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Identifying program critical success factors in construction industry

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A B S T R A C T

In project management literature, the concept of program is a group of related projects managed in a coordinated way to obtain benefits not available from managing them individually. This paper attempts to identify program critical success factors focusing on Iran's construction industry so that the level of relative importance of various factors could be determined for key stakeholders. Furthermore, since a program includes a set of projects, another objective of this study is to find out whether the projects of program are accomplished, successfully or not. Therefore, to run this study, first literature of topic based on research keywords is reviewed. Then a conceptual model including all the aspects of program success factors is presented. Next, critical success factors are quantitatively analyzed by performing an empirical investigation on active organizations and firms of Iran's construction industry. The study employs questionnaire and performs interview surveys with construction program professionals and experts. Finally, the critical success factors of program are sorted according to their ranks. The results show that program-related factors maintain the highest effects on program success followed by organization-related and project-related issues.

1. Introduction

During the past years, extensive attempts have been taken to reach an agreement on many project management fields and the issue of "success" has attracted special attention. Concerning project success, several valuable studies have been conducted, which mostly focus on two dimensions of success, namely success criteria, the measures by which success or failure of a project or business will be judged, and success factors, those inputs to the management system that lead directly or indirectly to the success of the project or business (Cooke-Davies, 2002). However, success criteria and factors of program and large projects relating in benefits have not been fully investigated yet and

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there is not sufficient research about them (Arbabi et al., 2010). In terms of project management scientists' perspectives, program and project are basically different. Based on program definition and its position in organization, it is necessary to consider various levels of an organization such as project, program, and portfolio in terms of various points. Table 1 depicts the difference between these levels in terms of success (PMI, 2008).

Table 1
Difference between Project, Program and Portfolio in terms of Success

	Projects	Programs	Portfolios
Success	Success is measured by product and project quality, timelines, budget compliance, and degree of customer satisfaction.	Success is measured by the degree to which the program satisfies the needs and benefits for which it was undertaken.	Success is measured in terms of aggregate performance of portfolio components.

Moreover, most works on critical success factors (CSF) for construction projects are context-specific and the implications are limited to the countries where such studies have been conducted. It implies that more studies should be conducted in other countries to learn more about the nature and the structure of the local construction industry, scale of construction projects, procurement strategies, maturity of the concerned organizations, and local cultural values and norms (Toor et al., 2008). To the best of authors' knowledge, there is virtually no study on these issues in Iran. Therefore, the primary objective of this paper is to depict the program CSF aspects as a conceptual model and then by conducting empirical research and investigating the CSF of each aspect in mentioned context (construction), the study determines program critical success factors in Iran construction industry.

1.1. Construction industry

Construction industry as one of the most important project-oriented industries and having some unique features encompasses a variety of programs and their implementation plays essential role in countries' development. Construction is of the most prominent industries in all countries especially developing ones such as Iran in executing their national long-term and strategic programs. In recent years, the construction industry of Iran has been thriving due to an increase in national and international investment to the extent that it became of the largest in the Middle East region. Construction is also an appropriate context and choice in order to investigate the subject of Program Success because it may involve a variety of cases with different scales and functions. However, constructions projects and programs in Iran generally suffer from problems of performance failures, cost wastage, schedule delays, etc., which emphasizes on this study. Ashley et al. (1987) and Chan et al. (2004) present some of the characteristics of construction industry as follows,

- Involvement of many parties in delivering one product,
- Innovation and technology transfer is slow,
- Traditionally, design, construction, and maintenance are undertaken by different parties,
- The products are long lasting and require routine maintenance,
- Difficult to deliver a product, involves huge amount of information processing, disputes, ambiguities, therefore requires thorough management,
- Construction products are always initiated by clients, opposite to most of the industries,

It is also strongly influenced by political, environmental and social changes in Iran.

1.2. Program

Programs have been defined in some different ways; a long-term undertaking that includes two or more projects, which require close cooperation (Archibald, 2003) or a framework for grouping existing projects or defining new projects, and for focusing all the activities required to achieve a set of major benefits (Ferns, 1991; Pellegrinelli,1997).

Programs also have been considered as large complex projects (Graham, 2000) or a set of projects and actions purposefully grouped to complete a transformation process and, thereby, realize strategic benefits (Miia & Paivi, 2007). Program cannot be considered just as a scale-up of single projects (Lycett et al., 2004). A program is a temporary, flexible organization created to coordinate, direct and oversee the implementation of a set of related projects and activities in order to deliver outcomes and benefits related to the organization's strategic objectives (MSP, 2011). To have consensus on Program concept, in this paper the definition presented by Project Management Institute (PMI) has been taken into consideration. Program is a group of related projects managed in a coordinated way to obtain benefits and control not available from managing them individually (PMI, 2008). It is also very important to differentiate program from two other organizational levels, Project and portfolio, and their interactions.

Project is defined as a temporary endeavor undertaken to create a unique product, service or result. Projects focus on achieving their individual requirements. A program is comprised of multiple related projects initiated during the program's life cycle. The program manager coordinates efforts between projects but does not directly manage the individual projects. Programs concentrate on achieving the benefits aligned with the portfolio and, subsequently, organizational objectives.

A portfolio is a collection of components (i.e., projects, programs, portfolios, and other work such as maintenance and related ongoing operations), which are grouped together to facilitate the effective management of that work in order to meet strategic business objectives. The projects or programs of the portfolio may not necessarily be interdependent or directly related. Portfolio management focuses on assuring that programs and projects are selected, prioritized, and staffed with respect to their alignment with organizational strategies.

Programs are comprised of various components. Most of these components are the separate projects within the program, but another component is the management effort and infrastructure needed to manage the program. Thus, programs may include elements of related work (e.g. managing the program itself) outside the scope of the discrete projects in a program. It is helpful to have a deeper insight about above definition to create a success model for program. Actually, in forming model, we scrutinized the standard of program management and other related sources to acquire success route in the aspect of program based on the mentioned perception, "Program itself". The result was 25 Critical Success factors listed in Table 5.

1.3.Critical Success Factors

There is no doubt that all the parties and stakeholders of a program or project are interested in the success of a program. In other words, success is a climax for them. The concept of success factors is usually credited to Daniel (Daniel, 1961) who introduced it in association with the management information crisis (Fortune & White, 2006). Rubin and Seeling (1967) first introduced the concept of project success factors in 1967 and Rockart (1982) used the terminology critical success factors (CSFs) for the first time (Toor, 2008):

". . . the limited number of areas in which results, if they are satisfactory, will ensure successful competitive performance for the organization . . . . . the few key areas where _things must go right_ for the business to flourish. . . . areas of activity that should receive constant and careful attention from management.. . . the areas in which good performance is necessary to ensure attainment of [organizational] goals".

Researches and studies have indicated that most findings and conclusions summarized in a project level and the Project Success has been studied in many industries like Construction as well. Since projects are the components of Program, it is useful to review the studies carried out in project level.

Table 2 summarizes the initial studies on project success factor under the title of organizational areas used in Westerveld model (Westerveld, 2003). Critical concern must be paid into attention, the difference between CSF and Success Criteria (SC). Belassi and Tukel (1996) asserted that a good research in this area should observe two features.1) Distinction between CSF and SC.2) Distinction between CSF under the control of project manager and CSF outside the control of project manager. De Wit (1988) and other writers distinguished between project success (measured against the overall objectives of the project) and project management success (measured against the widespread and traditional measures of performance against cost, time and quality) (Ahadzie et al., 2008; Baccarini, 1993; Cooke-Davies, 2002).

Table 2
Summary of initial research on critical success factors for projects

Areas(CSF for projects)	Morris & Hough	Munns & Bjeirmi	Belassi & tunkel	Pinto & Slevin
Leadership and team	Human factors	Human parties	Use of managerial skills	• Personal recruitment • Trouble shooting
Policy and strategy	Project definition		Control and monitoring	
Stakeholder management	Politics and social factors	Relations with client Politics		• Client consultation • Communication • Power and Politics
Resources	Finance		• Use of technology • Preliminary estimates	
Contracting	Legal agreements	Legal agreements Contracting		
Project management	Scheduling design	• Project administration • Efficiency	Scheduling	Technical tasks
External factors	• Schedule urgency • Schedule duration	Objectives	• Factors related to project manger • Project team members • Factors related to the project • Factors related to the organization • Availability of resources • External environment	• Top management support • Characteristics of project manager • Environment events • Urgency

There are valuable researches in Construction area as well. Table 3 summarizes the initial studies on Construction project success factors. In general, in this paper it is possibly aimed to utilize all the dominant and related studies to extract Construction Project Success Factors. In the following, these factors form our third aspect of model (Project level) listed in Table 6 by employing the view of experts and Professionals.

Table 3
Summary of initial research on critical success factors for Construction projects

Chan et al.	Chua et al.	Nguyen et al.	Fortune & White	Yu et al.	Toor et al.
Project team commitment	Project characteristics	Comfort	Goals and objectives	Project-related factors	Comprehension
Contractor's competencies	Contractual	Competence	Performance	Human-related factors	Competence
Risk and liability assessment	Project participants	Commitment	Decision-maker(s)	Process-related factors	Commitment
Client's competencies	Interactive processes	Communication	Transformations	Input-related factors	Communication
End-users' needs			Communication	Output-related factors	
Constraints imposed by end users			Environment		
			Boundaries		
			Resources		
			Continuity		

2. Research Method

First, an extensive library research including the review of existing books, journals, papers, standards, models etc. were accomplished. This was carried out in valid and reliable sources in the field of project management, program management, critical success factors and success criteria of a project, program, organization, construction context, etc.

After realizing program success aspects, a conceptual model of program critical success factors was designed. Then a complete preliminary list of CSF for each aspect based on research studies was formed. This preliminary list was further refined by interviews with academic experts and practicing professionals in the Iran construction industry in a way that only those CSF of each aspect affects program success were finalized. The result was a list comprising 66 critical success factors, which formulated into questionnaire and distributed to program managers, construction project managers, scholars and academics involved in various Iran construction programs.

In order to fill in the questionnaires more precisely and give complementary explanations, questionnaires were answered in the presence of researcher. The 5-point Likert scale was adopted to determine the importance of each CSF. Finally, 30 completed questionnaires were obtained which yielded a response rate of over 95%.

Since this research is categorized in quantitative approach, the SPSS software was used to evaluate the questionnaires' results. Then the process of conducting scientific research including data collection, analysis and conclusion were followed to identify and rank the program critical success factors of Iran construction industry.

3. Results

3.1.Program success model

Based on the implications of program, a conceptual model for program critical success factors can be assumed which has been constituted of 3 aspects. Fig. 1 indicates the components of model.

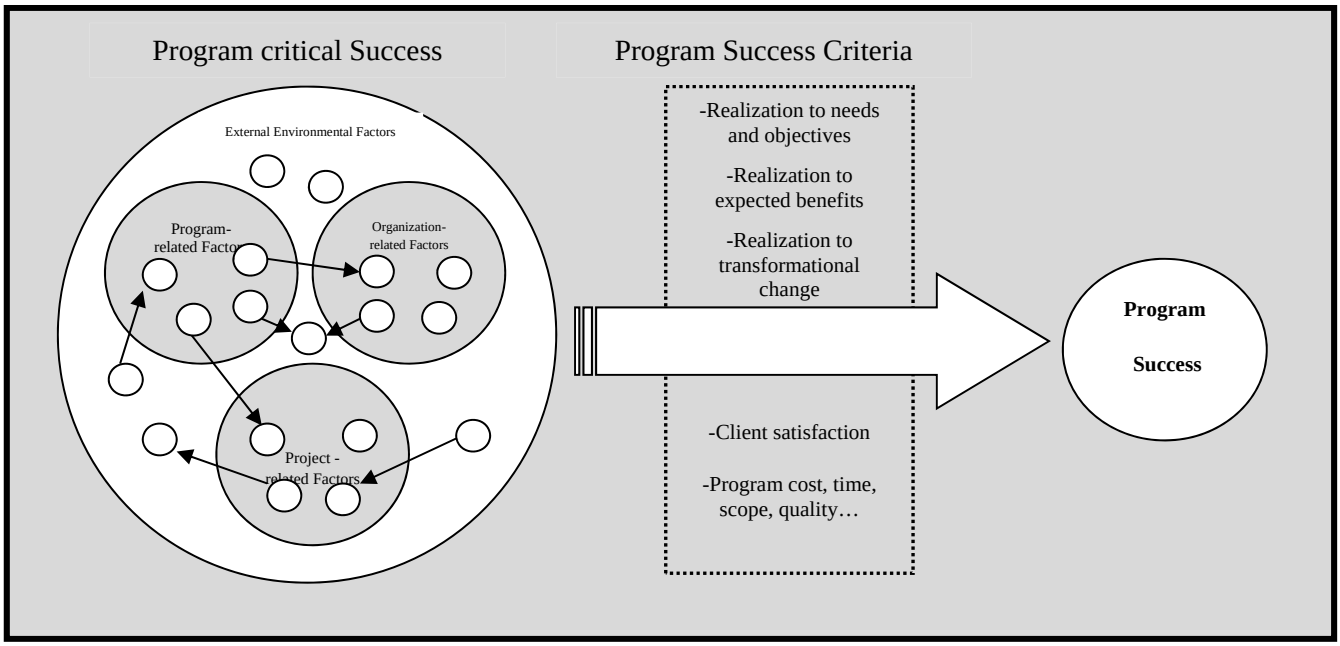

Fig. 1. Conceptual Model for Program Success

First aspect concerns those CSF existing in organizational levels, which may influence programs success. These factors are mostly strategic and highly leveled and refer to organizational factors such as well-defined organization structure and culture, clear goals and objectives, top management supporting, etc., which provide bases to have successful programs. In this paper, they are called "Organization-related factors". Among many factors relating organization success in construction areas, by conducting face to face interview with experts and professionals, at last 17 factors were finalized and distributed to respondents in a form of questionnaire. These factors are listed in Table 4.

Table 4
Organization-related factors

CSF	Description of CSF
1	Right resource allocation to programs' projects
2	Support from senior management
3	Positive organizational Culture/structure
4	Good communication and managing relationships
5	Clearly written lines of responsibility
6	Clear Strategy(vision, mission)
7	Clear and realistic goals
8	Secure employment in staffs and members
9	Right delegation of authority and responsibility
10	Sufficient resource allocation
11	Conducting regular evaluations of program and projects
12	A realistic view on the possibilities and limitations of industry
13	Complete feasibility studies
14	Right Project financing
15	Right Projects delivery system
16	Right Projects parties and adequate communication among them
17	Strategic alignment of project goals with adopted technology

The second aspect is called "Program- related" factors. These factors have been defined in program level per se and include general factors such as program management, program key stakeholders, Program benefits, requirements, needs, etc. As mentioned in section 1-2, these factors have been extracted from namely references of program management mainly from standard of program management published by PMI. They are listed in Table 5 including 25 critical success factors.

Table 5
Program-related factors

CSF	Description of CSF
18	Clear and realistic goals, deliverables, benefits of program
19	Effective change management
20	Right risk management
21	Effective Stakeholders management
22	Using from Projects results in program
23	Right cost estimates of program
24	Right schedule estimates of program
25	Proper allocation of Program budget to projects
26	Proper allocation of Program time to projects
27	Effective program cost management
28	Effective program time management
29	Effective program quality management
30	Strategic alignment of Program goals with organization strategy
31	Control disputes and conflicts by having good communication
32	Coordinated performance of operational units
33	Knowledge on the exact information needs of top management
34	Using proven tools, techniques and processes in program management
35	Competent program manager
36	Having high relations between key benefits of program
37	Focused and coordinated management to achieve strategic objectives
38	considering mutual dependencies of components by program manager
39	Strong and integrated Program management office
40	Continuous financial support based on authorized budget
41	Strong business case/charter for program
42	Aligning and directing program components benefits toward strategic benefits

The third part refers to operational levels of an organization and can have a major role in final succession of programs. They are called "Project- related" factors. These factors have been defined in

each project scope and the activities occur among projects. As noted in section 1-3 after using experts' views, they were finalized in Table 6 with 24 critical success factors.

Table 6
Project-related factors

CSF	Description of CSF
43	Clear and realistic goals of each project aligning strategic objectives
44	Strong/detailed plan kept up to date
45	Client involvement in each project
46	Skilled/suitably qualified/sufficient staff/team
47	Competent and experienced project managers
48	Strong business case/charter /sound basis for projects
49	Effective resource management in each project
50	Using proper and related technology for construction work in each project
51	Proper execution of each project based on predetermined schedule plan
52	Proper execution of each project based on predetermined cost plan
53	Proper execution of each project based on predetermined quality plan
54	Proper budget estimate for each project
55	Proper time estimate for each project
56	Right performance of all parties involved in project
57	Appropriate education and training of project team
58	Clear and detailed written contract for each project
59	Awarding bids to the right designers/contractors…
60	Learning from previous successful experiences
61	Client acceptance of plans
62	Clear prioritization of each project goals
63	Proven methodology of project management
64	Proper dispute resolution clauses incorporated in the contract
65	Adequate WBS linked with OBS(organization breakdown structure)
66	Developing positive friendly relationships with team and stakeholders

It is necessary to be noted that another forth aspect can be regarded in this model under the title of "External environment" factors. These factors are outside the control of managers and may be reflected as proper risk management, stakeholder management, and complete feasibility studies in this model. The sources of most 66 factors are derived from the main studies listed in the references.

3.2 Data analysis and Discussion

After collecting all the questionnaires from respondents, their data were entered in SPSS software to be statistically analyzed. Table 7 shows the result and related statistical concepts. The factors have been sorted by their scores and listed from the highest importance to the lowest. The reliability of research is also provided in which regarding 66 factors addressed, Cronbach's Alpha was reached 0.958. The important point here is that all the investigated factors are critical for program success, but due to studied context and the perception of respondents, the listed factors were concluded for program critical success in Iran construction industry. The result represents that Support from top and senior management of program and project managers, proper cost estimates of program, Clear and realistic goals of each project, Clear and realistic goals, deliverables, benefits of program, Effective program cost management and proper schedule estimates of program have been realized as critical success factors from the viewpoint of Iran construction practitioners and experts. Another significant point deducted from results is that the most critical success factors relate to program aspect. Organization-related and then project-related factors have less factors among top list. It is obvious that from 10 highest critical success factors determined, 7 factors are program-related, 2 factors are organization-related and only one factor is project-related. Also concerning 10 factors acquired minimum scores, 3 factors are organization-related and 7 factors concern related projects aspect. After sorting the factors based on their mean score (highest) and then standard deviation score (lowest), in order to validate the results, we statistically analyzed the results by using a one-way ANOVA test. It can be assured that the findings of the sample can be generalized to the whole population. Therefore, using 5% significance level, the construction program CSF's are ranked based on the experts' opinion. In this regard, seven CSF's are of the most importance and there is not a meaningful difference between them according to ANOVA analysis. They can be considered as top CSF's. These CSF's are as follows:

1- Support from senior management
2- Clear and realistic goals, deliverables, benefits of program
3- Clear and realistic goals of each project aligning strategic objectives
4- Right cost estimates of program
5- Effective program cost management
6- Aligning and directing program components benefits toward strategic benefits
7- Right schedule estimates of program

Table 7
Critical Success Factors Ranking

CSF	Rank	Description of CSF	Sum	M	SD	Aspect
CSF2	1	Support from senior management	138	5	0.724	Organization
CSF23	2	Right cost estimates of program	138	5	0.885	Program
CSF18	3	Clear and realistic goals, deliverables, benefits of program	137	5	0.774	Program
CSF43	4	Clear and realistic goals of each project aligning strategic objectives	137	5	0.774	Projects
CSF27	5	Effective program cost management	136	5	0.819	Program
CSF24	6	Right schedule estimates of program	135	5	0.731	Program
CSF15	7	Right Projects delivery system	135	5	0.931	Organization
CSF42	8	Aligning and directing program components benefits toward strategic benefits	133	5	0.774	Program
CSF30	9	Strategic alignment of Program goals with organization strategy	133	5	1.006	Program
CSF40	10	Continuous financial support based on authorized budget	133	5	1.104	Program
CSF28	11	Effective program time management	131	4.5	0.809	Program
CSF14	12	Right Project financing	130	5	0.802	Organization
CSF38	13	considering mutual dependencies of components by program manager	129	4	0.702	Program
CSF1	14	Right resource allocation to programs' projects	129	4	0.75	Organization
CSF37	15	Focused and coordinated management to achieve strategic objectives	129	5	1.055	Program
CSF13	16	Complete feasibility studies	126	4	0.925	Organization
CSF35	17	Competent program manager	125	4	0.747	Program
CSF44	18	Strong/detailed plan kept up to date for each project	125	4	0.834	Projects
CSF49	19	Effective resource management in each project	124	4	0.681	Projects
CSF19	20	Effective change management	123	4	0.803	Program
CSF25	21	Proper allocation of Program budget to projects	123	4	0.845	Program
CSF54	22	Proper budget estimate for each project	123	4	0.809	Projects
CSF33	23	Knowledge on the exact information needs of top management	121	4	0.928	Program
CSF16	24	Right Projects parties and adequate communication among them	121	4	0.695	Organization
CSF10	25	Sufficient resource allocation	120	4	0.743	Organization
CSF36	26	Having high relations between key benefits of program	120	4	1.083	Program
CSF21	27	Effective Stakeholders management	120	4	0.669	Program
CSF29	28	Effective program quality management	119	4	0.89	Program
CSF41	29	Strong business case/charter for program	119	4	0.785	Program
CSF48	30	Strong business case/charter /sound basis for projects	118	4	0.828	Projects
CSF20	31	Right risk management	118	4	0.571	Program
CSF32	32	Coordinated performance of operational units	116	4	0.9	Program
CSF526	33	Proper allocation of Program time to projects	116	4	0.937	Program
CSF39	34	Strong and integrated Program management office	116	4	0.95	Program
CSF52	35	Proper execution of each project based on predetermined cost plan	115	4	1.117	Projects
CSF11	36	Conducting regular evaluations of program and projects	115	4	1.064	Organization
CSF55	37	Proper time estimate for each project	114	4	0.858	Projects
CSF47	38	Competent and experienced project managers	113	4	1.104	Projects
CSF56	39	Right performance of all parties involved in project	113	4	0.952	Projects
CSF51	40	Proper execution of each project based on predetermined schedule plan	111	4	1.022	Projects
CSF6	41	Clear Strategy(vision, mission)	111	4	1.119	Organization
CSF62	42	Clear prioritization of each project goals	111	4	0.802	Projects
CSF31	43	Control disputes and conflicts by having good communication	110	4	1.028	Program
CSF34	44	Using proven tools, techniques and processes in program management	110	4	0.765	Program
CSF7	45	Clear and realistic goals	109	4	1.066	Organization
CSF22	46	Using from Projects results in program	109	4	0.817	Program
CSF59	47	Awarding bids to the right designers/contractors…	107	3	0.971	Projects
CSF5	48	Clearly written lines of responsibility	107	4	0.73	Organization
CSF3	49	Positive organizational Culture/structure	106	4	1.042	Organization
CSF46	50	Skilled/suitably qualified/sufficient staff/team	106	3	1.008	Projects
CSF58	51	Clear and detailed written contract for each project	104	3	1.224	Projects
CSF4	52	Good communication and managing relationships	104	3.5	0.898	Organization
CSF9	53	Right delegation of authority and responsibility	103	4	0.971	Organization
CSF60	54	Learning from previous successful experiences	103	3	0.615	Projects
CSF53	55	Proper execution of each project based on predetermined quality plan	101	3	1.155	Projects
CSF64	56	Proper dispute resolution clauses incorporated in the contract	100	3	0.915	Projects
CSF66	57	Developing positive friendly relationships with team and stakeholders	99	3	1.081	Projects
CSF12	58	A realistic view on the possibilities and limitations of industry	98	3	0.997	Organization
CSF63	59	Proven methodology of project management	96	3	1.126	Projects
CSF45	60	Client involvement in each project	96	3	0.96	Projects
CSF65	61	Adequate WBS linked with OBS(organization breakdown structure)	93	3	0.999	Projects
CSF8	62	Secure employment in staffs and members	89	3	1.098	Organization
CSF50	63	Using proper and related technology for construction work in each project	87	3	1.094	Projects
CSF57	64	Appropriate education and training of project team	87	3	1.185	Projects
CSF17	65	Strategic alignment of project goals with adopted technology	85	3	0.986	Organization
CSF61	66	Client acceptance of plans	78	2	1.003	Projects

On the other hand, based on the ANOVA results, seven other CSF's are of the least importance. These CSF's have the same statistical significance and are as follows:

1- Client acceptance of plans
2- Appropriate education and training of project team
3- Secure employment in staffs and members
4- Using proper and related technology for construction work in each project
5- Strategic alignment of project goals with adopted technology
6- Proven methodology of project management
7- Adequate WBS linked with OBS(organization breakdown structure)

Table 7 shows the critical success factors ranking just based on the highest mean score and their corresponding aspects. (the scores are rounded).

4. Conclusions

Success in (Construction) Programs is an intact challenging issue and depends on various aspects. This study has asserted that program success may include organization-related factors, program-related factors, project-related factors and factors associated with external environment.

This study reveals the top critical success factors of programs in Iranian construction industry. Although Support from senior management from organization-related factors ranked first by the view of expert respondents, analysis of this study shows that program-related factors have most CSF in Iran construction programs. Organization-related and projects-related are placed next. This issue can also provide a response to main question of study noted initially; critical success factors for projects are not necessarily the same as critical success factors for program but they may play a considerable role in program success. In other words, if all the projects of one program are successfully performed (measured by product and project quality, timelines, budget compliance, and degree of customer satisfaction), it will not be guaranteed to have successful program, because there are more aspects and factors which will affect it.

It is necessary to note that since this research was conducted in Iran's construction programs, findings should be interpreted in context of the Iran construction industry. Further researches can be felt in presenting program excellence model, which logically links success criteria and success factors and investigating inter-relationships between factors and may be suggested as future works.

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