

Assessment of Effective Organization For Highway Construction project: Case Study

Kalyani Ganesh Bendale¹, Dr. Pankaj. P. Bhangale²

² HOD, Dept of Civil Engineering

^{1,2} S.S.G.B. Collage of Engineering & Technology

Abstract- *This Project is intended to describe the various types of factors affecting the effectiveness of the organizational structures used in the different types of construction project. Thus the factors of organization affecting the effective working of project can be determined. These factors can be proposed for improvement for highway construction projects.*

To achieve the objectives of the study, the data of highway construction organizations are collected through questionnaire survey. Initially the main factors affecting the effectiveness of organization are determined. The factors are Size, Duration, Resource, Technology, Complexity, Internal Interdependency, External Interdependency, Customer base, Uncertainty, Importance. Then its sub factors under these main factors are determined. The score & weightage for the main factors calculated using the SMART method. Then ranking is to be given to all the factors. From that ranking importance of each factor is defined.

Thought all ten factors are responsible for the effectiveness of organization, some factors are critically responsible for working of organization. This intensity of these factors will get determined through this project. Thus, necessary recommendation will be given for the respective organizations. Thus this project can be helpful to improve the characteristics of organizations, which can be implemented in future, for major construction projects.

I. INTRODUCTION

The success of a project is greatly influenced by the organizational environment surrounding it. Many practitioners believe that organization of a major Construction project will have a significant impact on the successful completion of the project. The Project managers can enhance their overall chance of success by understanding how organizations affect projects. Organizational structure refers to the organizational and administrative patterns, such as the arrangement of departments and the division of labor, and distribution of authority. Thus organization structures have a great influence on the timeliness (schedule) & cost of project.

OVERVIEW OF ORGANISATIONAL STRUCTURES:

Organization can be defined as group of people who must coordinate their activities in order to meet organizational objective. The organization for construction project is temporary; Organizing for project management requires flexibility because of the uniqueness of each project. Some Important considerations for selection of organization are project scope and complexity, time schedule, geographic location, contract terms, financial arrangements, and so forth.

The organizational structure must facilitate the integration of company efforts to achieve project goals and objectives. This integration and coordination is especially important in the engineering and construction phases of large industrial type projects.

The basic types of organization structures include Functional, project Task force, Line & staff and Matrix organizational structures. Functional organizational structure is the simplest form of organization and used for only repetitive types of work. Notable success can be achieved in this type of organization only when design & constructions do not fully overlap. Each division is separate i.e. Separate designer, separate general contractor. In case of project task force organization, it is a self-sufficient organization. Line & staff organizations are used in military services.

1.2 SCOPE OF PROJECT:

This project will concentrate on studying the organizational structure of the different construction projects. The report from the investigations of case studies of highway construction projects aims further to improve the characteristics of organizations, which can be implement in the future major construction. In addition, comparison can be done between organizations of highway construction projects.

1.3 OBJECTIVES OF REPORT:

1. To study the concept of various types of organizations & their characteristics.
2. To study the different types of organization structures for highway construction.

3. To conduct the case study of organization structures for highway project.
4. To propose the suggestions for effective organization for highway project

1.4 METHODOLOGY:

1. Literature survey is to be conducted from previous research studies from various national and international journal research papers. This will help in understanding of basic terminologies and further research work.
2. It is proposed to carry out the study of various types of organizational structures used for highway construction projects.
3. It is also proposed to obtain the information of the two different organizational structures of highway construction projects, as a case study. Formation of the analysis report on the above study by identifying the factors of organizations affecting the success of project.
4. Based on the above work findings will be drawn and necessary recommendations will be given on organizational structures, factors of organizations affecting the schedule & cost of Projects, of both types of firms.

II. LITERATURE REVIEW

In this literature reviews the relevant literature on organizational structures related to construction projects, the concept of organization structures, and further discusses the problems associated with them. The Reviews of other authors help me to understand the topic easily.

NakHyeok Choi et al. (2017): This study analyses efficiency and effectiveness of highway management at the state level in the United States. This study was systemically designed to test the relationship by controlling the states' political factors, fiscal capacity, median voter, and economic conditions. Data envelopment and principal component analysis with panel data covering 11-year time waves were used to measure both efficiency and effectiveness. The results of the fixed effects model and the spatial autoregressive panel model show a statistically strong relationship between efficiency and effectiveness which are respectively measured by two analysis approaches.

A.B. Raiden et al. (2004): In this paper the characteristics of the construction industry present an extremely challenging context for elective human resource management (HRM). The dynamic project-based nature of the

industry results in extreme fluctuations in organizations workloads and requires teams to form, develop and disband relatively quickly. Thus, the importance of efficient management of employee resourcing activities cannot be understated. This paper reports on the findings of research which explored employee resourcing practices within large UK construction firms. The results suggest that managers currently attempt to carry out some strategic planning with regards to employee resourcing, but that this does not necessarily translate into elective operational practice which simultaneously takes account of organizational, project and individual employee needs. A new approach for more elective employee resourcing decision-making, based on encouraging the involvement of the employees in the deployment process, is put forward as a management tool which informs elective team formation and deployment. However, this will require the acceptance of both decision support technology and of employee input into what is currently a tacit, management oriented decision process.

David Arditi et al. (2017): This Author said that the delay is one of the most common problems in the construction industry. This study aims to explore the relationship between a construction company's organizational culture and delay. A questionnaire survey was administered to construction companies located in the U.S. and India in order to collect data on their organizational culture and the amount of delay that they experienced in their projects. The results of this study show that construction organizations in the U.S. are dominated by "clan" culture whereas those in India are dominated by "market" culture. The study also shows that the percentage of delay relative to project duration is lower in the U.S. compared to India. Despite the fact that delays are caused by a multitude of reasons often mentioned in the literature, statistical analysis indicates that there is also a significant relationship between organizational culture and the magnitude of delays. This relationship could be useful for a construction company in cultivating an organizational culture that is expected to reduce project delay. It could also be of benefit to international contractors relative to their expectations vis-a-vis time performance in projects undertaken in different countries.

Solomon Kwarteng Forkuoh et al. (2012): This research work seeks to establish the relationship and correlation between family set up (structure), line of authority, and chain of command in traditional family set ups and family business set ups (structure) in Ghana, and finally compared with that of non-family business, and suggest the best for smooth running and managing of family businesses in Ghana. In pursuance of this research work, fifty traditional families in Ghana were selected from the Ashanti Region of Ghana who is mostly matrilineal, and fifty families were also selected from the Eastern region of Ghana who is mostly patrilineal. A total of

thirty (30) family businesses were selected eighteen (18) from the Ashanti region and twelve from the Eastern Region (12) of Ghana for interview. A total of twenty-five non-family businesses were also selected for the interview in Ashanti and Eastern Regions of Ghana respectively. A study on the chain of command in families, family businesses, and non-family businesses as well as the organograms of businesses, were made and final recommendations were also made to the authorities concern. It was established that family structure, chain of command and role play in family has influenced family businesses negatively, even though there are some positive impacts. The research also revealed that, most family businesses surveyed have the same organizational structure as that of their families, the family heads as chief executive officer, and grandchildren at the bottom of the organogram.

Vrushali Chaudhari et al. (2015): This Paper is intended to describe the various types of factors affecting the effectiveness of the organizational structures used in the different types of construction project. Thus the factors of organization affecting the effective working of project can be determined. These factors can be proposed for improvement for both private as well as for Public project. The ten main factors & their sub factor are determined through literature review. Thought all ten factors are responsible for the effectiveness of organization; some factors are critically responsible for working of organization. These factors will go to determine through this paper. Thus, necessary recommendation will be given for the respective organizations. Thus this paper can be helpful to improve the characteristics of organizations, which can be implemented in future, for major construction projects.

Ehab E., et al. (2013): Author has identified the different factors, those are affecting organization selection. Forty three factors were prepared to be surveyed in the questionnaire. Selected factors to be surveyed: 1. Project size. 2. Project length. 3. Experience with project management organization. 4. Philosophy and visibility of upper level management. 5. Project location. 6. Available resources. 7. Unique aspects of the project. 8. Diversity of product lines. 9. Rate of change of the product lines. 10. Interdependencies among subunits. 11. Level of technology. 12. Presence of economies of scale. 13. Organizational size. 14. Clear location of responsibility. 15. Ease and accuracy of communication. 16. Effective cost control. 17. Ability to provide good technical supervision. 18. Flexibility of staffing. 19. Importance to the company. 20. Quick reaction capability to sudden changes in the project. 21. Complexity of the project. 22. Size of the project with relation to other work in-house. 23. Form desired by the owner. 24. Ability to provide a clear path for individual promotion. 25. Using familiar unit grouping. 26.

Requiring specific types of experience for designated positions. 27. Assigning authority. 28. Managers experience in simultaneous projects. 29. Information from simultaneous projects. 30. Effective project manager's personality. 31. Project manager authority should be commensurate with responsibility. 32. The choice of project management authority structure. 33. How high project manager reports in the overall company depends upon. 34. The trust of employees in managers. 35. Defining the objectives. 36. Selecting the size of each units and work groups. 37. Adding the planning and monitoring system. 38. Defining requirements of positions. 39. Cultural differences and environmental needs. 40. Governmental intervention in organizations (HR polices which employ less Skilled people) 41. Social acceptance of a particular technology. 42. Political and governmental factor. 43. Form desired and suitable for the consulting system.

III. ORGANIZATION SELECTION FACTORS

From literature review different important factors which can be affects to the effectiveness of organization structures are determined.

- a) Size,
- b) Duration,
- c) Resource,
- d) Technology,
- e) Complexity,
- f) Internal interdependency,
- g) External interdependency,
- h) Customer base,
- i) Uncertainty,
- j) Importance.

There are some sub factors under these main factors.

IV. DATACOLLECTION

The data is collected through the questioner based on the above mentioned main factors and its sub factors. The data is collected from various highway companies organization is as follows:-

- 1) Ayush Procon pvt ltd 391.35 to 422.700 km in the state of Maharashtra to be executed on hybrid annuity pattern under NHDP Phase IV Rs- 500cr.

In Ayush Procon Pvt Ltd the highway work is concrete and bituminous work. In these project work major bridges, minor bridges, railway over bridges and VUP and PUP are structures. This company is in Sakegaon, Jalgaon.

- 2) Gawar construction 391.35 to 360.00 km in the state of Maharashtra to be executed on hybrid annuity pattern under NHDP Phase IV Rs- 408.80cr.

In Gawar Construction Company, the highway work is concrete and bituminous works. In these project work minor bridge, VUP, PUP, and railway over bridge are structures. This company is in Deepnagar, Bhusawal.

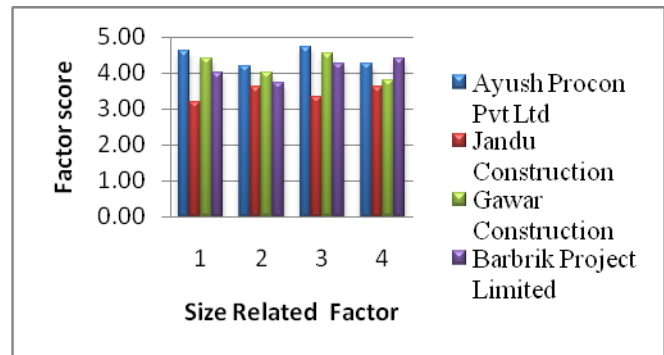
- 3) Jandu construction Improvement of NH-53 passing through Jalgaon City to four lane along with construction of VUPs & PUP in the State of Maharashtra on EPC Mode ERPOC, Tender Number (CPPP) NHAI/RO-NAG/2018-19/26, Estimated Project Cost 69.26 (Rs. Cr), Construction Period 1.5 (Yrs.), Executing Agency NHAI, Mode of Execution EPC (Lump Sum/Item Rate Contract)
- 4) Barbrik Project Ltd Consultancy services for Authority Engineer for Supervision of Rehabilitation and Up gradation of 2 lane Salaikurd - Tirora (Design Ch. Km. 44/000 to 87/000) (Ch. Km. 117/200 to 74/200) NH-753 in the state of Maharashtra on EPC Mode. RS-300cr period is 2 year. This work is concrete work (Rigid highway)

V. ANALYSIS OF DATA COLLECTED

The questionnaires are get filled according to the data collected from different organizations in detailed survey carried out during the project work. The SMART technique which means SIMPLE MULTIATTRIBUTE RATING TECHNIQUE is used to rank each key factor. Then the ranking is converted in to score and from these score the weight age of the each factor is found out. After finding out weightage of each main factor the important weightage of the each sub factor is found out. With the help of important factor the criticality of each sub factor is found out. The figures are based on the score off actors calculated through data analyzed.

A. Size Related Factors:

The effect of Size related factors on different organizations is as shown in graph-1

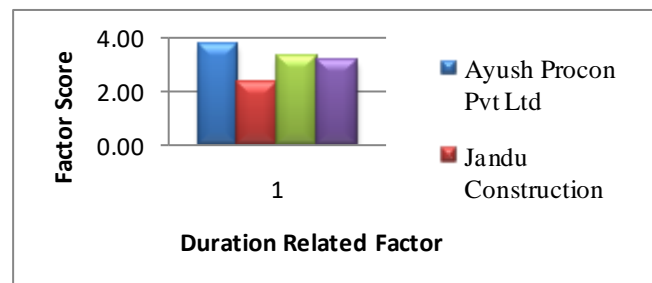


Graph-1 Comparison of selected organization for Size related factors.

The graph shows that the highway construction organizations has size related factor, Size of the project, selecting the size of each unit & work group has lowest score. Thus it is the critical factor for Jandu Construction company’s organizations.

B. Duration Related Factors:

The effect of Duration on different organizations is as shown in a graph -2

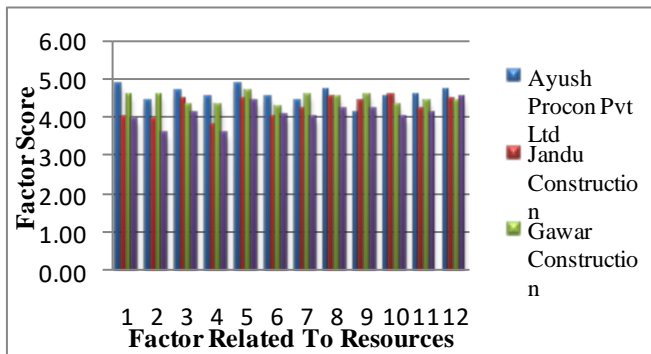


Graph-2 Comparison of selected organization for Duration related factors.

The graph shows that for Jandu Construction company organization Project duration has lowest score. Thus it is the critical factor for Jandu Construction company’s organizations.

C. Resource Related Factors:

The effect of Resource related factors on different organizations is as shown in a graph-3

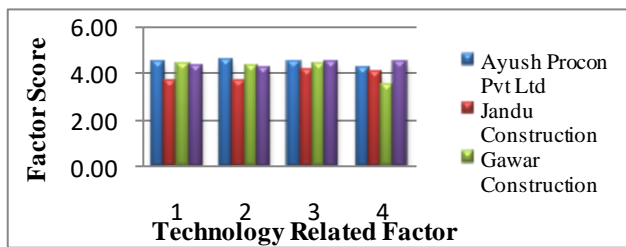


Graph-3 Comparison of selected organization for Resources related factors.

The graph shows that Flexibility of staffing & using familiar unit grouping are the critical factor related to Resources for Highway construction organizations, Jandu construction and Barbrik project Ltd has lowest score.

D. Technology Related Factors:

The effect of Technology related factors on different organizations is as shown in a Graph -4.

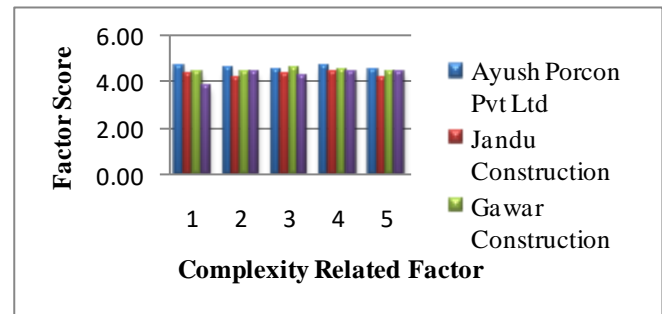


Graph-4 Comparison of selected organization for Technology related factors.

The graph shows that, the level of Technology and the social acceptance of a particular technology have lowest score. Thus it is the critical factor related to Technology for Jandu construction and Gawar Construction.

E. Complexity Related Factors:

The effect of complexity related factors on different organizations is as shown in a Graph -5

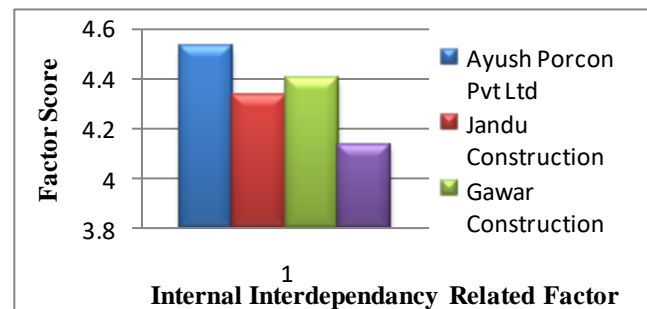


Graph-5 Comparison of selected organization for Complexity related factors

The figure shows that for Barbrik Project Ltd & Jandu Construction Company, complexity of project has lowest score. Thus it is the critical factor for Highway construction organizations.

F. Internal Dependency Related Factors:

The effect of internal dependency related factors on different organizations is as shown in a Graph -6.

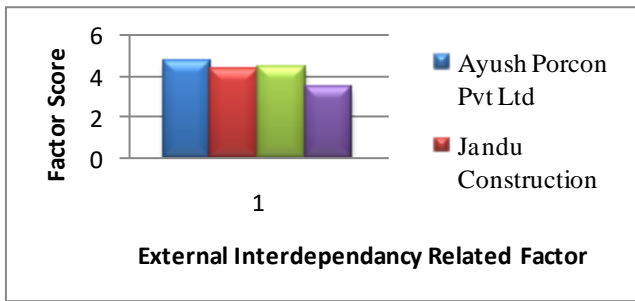


Graph-6 Comparison of selected organization for Internal Interdependency related factors.

Above Chart showing the comparison of Internal Interdependency Factor in terms of Interdependencies among subunits between four Highway constructions Organization. The score of Ayush Porcon Pvt Ltd for Internal Interdependency is 4.53 & for Jandu Construction Company, the score is 4.33, and also for Gawar Construction Company, the score is 4.40 and the Barbrik Project Ltd, the score is 4.13. Though Barbrik Project Ltd has lowest score than the other company's; Internal Interdependency is Critical factor for Barbrik Project Ltd.

G. External Dependency Related Factors:

The effect of External dependency related factors on different organizations is as shown in a Graph-7.

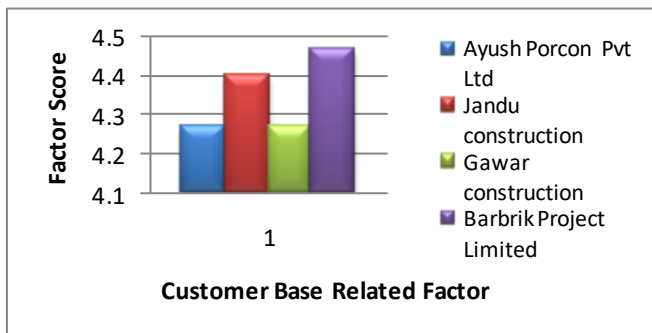


Graph-7 Comparison of selected organization for External Interdependency related factors.

Above Chart showing the comparison of External Interdependency Factor in terms of Interdependencies among subunits between four Highway Construction Organizations. The score of Ayush Porcon Pvt Ltd, Interdependencies among sub units is 4.67 & for Jandu Construction the score is 4.33, and also the score for Gawar Construction Company has 4.47. Whereas the Barbrik Project Pvt has 3.47. Thus Barbrik Project Ltd has lowest score than the other construction company. So, the factor of External Interdependency Factor in terms of Interdependencies among subunits is Critical for Barbrik Project Ltd.

H. Customer Base Related Factors:

The effect of External dependency related factors on different organizations is as shown in a Graph -8.

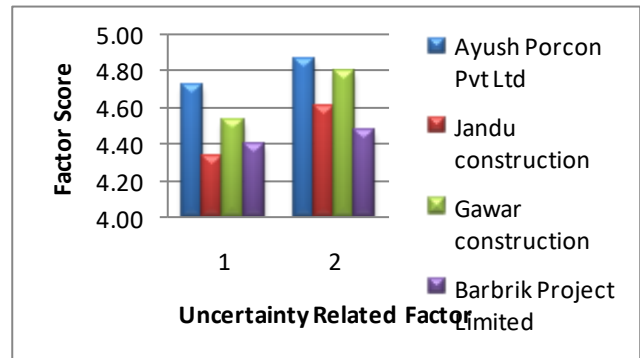


Graph-8 Comparison of selected organization for Customer Base related factors.

Above Chart showing the comparison of Customer base Factor in terms of Form desired by the owner between four Highway constructions Organization. For Ayush Porcon Pvt Ltd and Gawar Construction Company have same score is 4.27.and whereas the Jandu construction has the score is 4.40 and Barbrik Project Ltd has score is 4.47.Thus Customer base is critical factor for both Ayush Porcon Pvt Ltd and Gawar Construction Company.

I. Uncertainty Related Factors:

The effect of Uncertainty related factors on different organizations is as shown in a Graph-9.

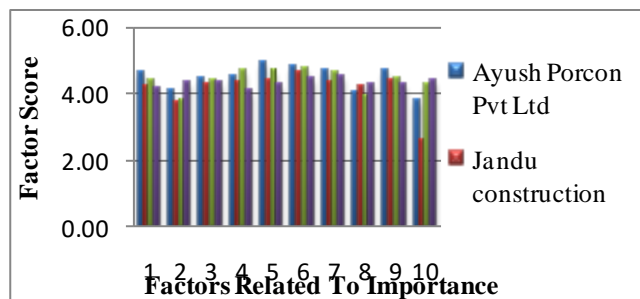


Graph-9 Comparison of selected organization for Uncertainty related factors

Above Chart showing the comparison of different sub factor related to Uncertainty Factor, between four Highway Construction Organization. It is found that the Rate of change of the product lines have Lowest score 4.33 for Jandu construction. In case of Quick reaction capability to sudden changes in the project having the Lowest score 4.47 for Barbrik Project Ltd. Thus the Jandu construction and Barbrik Project Ltd is the critical factor related to Uncertainty for Highway construction Organization.

J. Importance Related Factors:

The effect of Importance related factors on different organizations is as shown in a Graph-10.



Graph-10 Comparison of selected organization for Importance related factors

Above Chart showing the comparison of different sub factor related to Importance Factor, between four highway constructions Organization. It is found that the Political and governmental factor has lowest score 3.80 for Ayush Porcon Pvt Ltd and also lowest score 2.60 for Jandu construction. Philosophy and visibility of upper level management has lowest score is 3.80 for Gawar construction. Whereas

Presence of economies of scale has lowest score is 4.07 for Barbrik Project Ltd. Thus is the Political and governmental factor and Philosophy and visibility of upper level management and Presence of economies of scale is critical factor related to Importance for Highway Construction Organization.

VI. CONCLUSIONS & DISCUSSIONS

The factors which can affect the organizational structure of construction industry were identified based on the literature review. A total ten possible factors that were felt to have an effect on organization structure of construction companies are determined. These main factors are size, Duration, Resource, Technology, complexity, Internal Interdependency, External Interdependency, Customer base, Uncertainty, Importance. Similarly the sub factors of these main factors were determined. Data collection is done from four different sizes highway construction company organizations related to these factors by taking personal interviews of different construction professionals to fill the questioner. The discussion of this overall project is done in short as follows.

1. Now, various construction projects are becoming much more complex and difficult. The project team is facing unequal changes. The study of factors affecting the Organizational structure are considered to be a means to improve effectiveness of organization structures, which will results in smooth working of construction projects. The purpose of this study is to systematically investigate the factor which can be improving the effectiveness of organizational structures. This study will helpful to identify which factor influence the project success.
2. The literature review shows that there was an extensive study on Organization Structure at international level. The literature has studied the various organizational aspects like, Authority structures, Management Levels within the organization, Organizational environment, various decision making models and Design of Organization Structures and various factors affecting the working of Organization.
3. Depending upon how responsibility & authority in any enterprise can be distributed, the organizational structure can be classified in to Four types 1) Line Organization, 2) Line & staff Organization 3) Functional Organization 4) Project Task Force & Matrix Organization. Line organization is simplest form of organization & can be maintain discipline within the organization. Line and staff organization produce most efficient utilization of human & physical resource, so quality of product is better. In functional organization, efficiency of individual increases due to limited number of specialist activities.so this is most suitable for research concerns. Project task force include high adaptability and the high understanding of the overall task and can foster an excellent team spirit if proper leadership is provided. The Matrix organization has highest overall management & administrative cost.
4. The analysis is done for various factors related to Size, Duration,Resource, Technology, Complexity, Internal Interdependency, External Interdependency, Customer base, Uncertainty, Importance. Then critical factors for each types of organization were found.
5. In Ayush Procon Pvt Ltd, The choice of project management authority structure, Form desired by the owner these two factors having minimum ranking, so they are less critical factors for the Ayush Procon Pvt Ltd. Similarly the Project size, Level of Technology & Social acceptance of particular technology and the trust of employees in managers these four factors having highest ranking in the ranking table so does not need to give important to them as compare to the above mention.
6. In Jandu Construction Company, Project size, Selecting the size of each units and work, Organizational size, Size of the project with relation to other work in-house, Cultural differences and environmental needs, Level of technology, Effective project manager's personality, Diversity of product lines, Political and governmental factor are most critical factors and The trust of employees in managers, Project location, Adding the planning and monitoringsystem are less critical factor.
7. Gawar Construction Company, Social acceptance of particular technology, the ability to provide a clear path for individual promotion, governmental intervention in organizations, level of technology, unique aspects of the project and complexity of the project are Moderately critical factors by ranking and Project size, Organizational size, Size of the project with relation to other work in house, Project length, Project manager authority should be commensurate with responsibility, The choice of project management authority structure, Interdependencies among subunits and Form desired by the owner are the less critical factors.
8. Barbrik Project Ltd, Flexibility of staffing, Ability to provide a clear path for individual promotion, Using familiar unit grouping, Requiring specific types of

experience for designated positions, Effective project manager's personality, The organization has proper assigning authority, Project manager authority should be commensurate with responsibility, The choice of project management authority structure, The trust of employees in managers, Defining requirements of positions are most critical factors and the Selecting the size of each units and work groups, Project length, Project manager authority should be commensurate with responsibility, The choice of project management authority structure, Defining requirements of positions, Governmental intervention in organizations, Form desired and suitable for the consulting system and Interdependencies among subunits are less critical factors.

So, Finally It can be concluded that for better optimization of the organization various factors are responsible but some factors are critical. In the present study the Technology, Complexity and Importance, these main factors are found to be critical for Highway construction organizations.

REFERENCES

- [1] NakHyeok Choi and Kyujin Jung, "Measuring Efficiency and Effectiveness of Highway Management in Sustainability," *Sustainability* 2017, 9, 1347.
- [2] Ani B. Raiden, Andrew R.J. Dainty, Richard H. Neale, "Current barriers and possible solutions to effective project team formation and deployment within a large construction organization", *International Journal of Project Management* 22 (2004) 309–316.
- [3] David Arditi, Shruti Nayak, Atilla Damci "Effect of organizational culture on delay in construction", *International Journal of Project Management* 35 (2017) 136 – 147.
- [4] Solomon Kwarteng Forkuoh, Abraham Osei, "Adopting best organizational structure for effective Management and control of family businesses in Ghana," *International Journal of Advanced Research in Management and Social Sciences*, ISSN: 2278-6236 Vol. 1 | No. 3 | September 2012.
- [5] Vrushali Chaudhari, Prof. P. B. Bhangale, "Effective Organizational Structure for Construction Industry: Case Study," Volume IV, Issue VII, July 2015.
- [6] Xueying Wu, Wenyi Zhao and Tianshan Ma, *Improving the Impact of Green Construction Management on the Quality of Highway Engineering Projects*.
- [7] Arnold M. Rurskin and Eugen W., "Organization Factor in project management", *journal of construction engineering and management*, ASCE, Vol.2, Mar., 1986.
- [8] Tenah Kawaku A., "Management level as defined and applied with in a construction organization by some US contractors and Engineers", *Project Management*, Butterworth & Co, Vol.4, Nov., 1986, pp. 195-203.
- [9] Ehab E., Hossam H., Waleed M., "Optimum Organization Structure for construction projects (Management tool of selecting Organization in Egyptian Construction Market)", *International journal of Engineering Science and Innovative Technology (IJESIT)* Vol.2, Issue 3, May 2013, pp.411-431.
- [10] Thomas R., Keating J. M, and Bludorn A. C., "Authority structures for construction project Management," *Journal of construction Engineering and Management*, ASCE. Vol.109, No.4, Dec., 1983, pp. 406-422.
- [11] Riza Yosia Sunindij, "Improving safety among small organizations in the construction industry: key barriers and improvement strategies," *Procedia Engineering* 125 (2015) 109 – 116.
- [12] Mulla Aneesa.I, Dr. A.K.Gupta, Prof. D.B.Desai, "Supply Chain Management: Effective Tool in Construction Industry," *International Journal of Novel Research in Engineering and Science*, Vol. 2, Issue 1, pp.: (35-40), Month: March 2015.
- [13] Dušan Bobera, "Project Management Organization," *Management Information Systems*, Vol. 3 (2008), No. 1, pp. 003-009.
- [14] Francisco J. Forteza, Jose M. Carretero-Gómez, Albert Sesé, "Effects of organizational complexity and resources on construction site risk," *Journal of Safety research* 62 (2017) 185–198.