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Optimum Organizational Structure for Construction Projects (Management Tool of Selecting Organization in Egyptian Construction Market)

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Abstract--The quantitative determination of the optimal organizational structure during the construction phase is the main objective of this study. This will be conducted through the identification of the main factors affecting organization selection in the Egyptian construction market through questionnaire survey. To evaluate various organizational structures and their coordination efficiencies, this study utilizes the analytical process to quantify the success of organizational structures and identify the optimal structure of organization. Through quantitative modeling of execution efficiency, an objective function for calculating the total success factor is used to determine the optimal organizational structure available to execute the project. This study demonstrates how the proposed model may be applied in the future for evaluating the efficiencies of various organizational structures.

Index Terms—Management Approach .Organization Selections.

I. INTRODUCTION

Organization can be defined as group of people who must coordinate their activities in order to meet organizational objectives. The coordination function requires strong communications and a clear understanding of the relationships and interdependencies among people. Organizational structures are dictated by such factors as technology and its rate of change, complexity, resource availability, products and/or services, competition, and decision-making requirements. The reader must keep in mind that there is no such thing as a good or bad organizational structure; there are only appropriate or inappropriate ones.

Harvey & Levine (2002) mentions that there are three classic organizational structures available for dealing with projects these are the basic types of organizations:

A. The Functional Organization:

It is the traditional organization for performing ongoing work. Its focus is on operational discipline. It is best for routine work and the maintenance of standards.

B. The Project Organization:

It was designed for isolated kind of work with a strong focus on the project.

C. The Matrix Organization:

The limitations of both the classic functional organization and the pure project organization, it is understandable that a new type of organization would emerge. The matrix organization, which gained popularity in the 1970s, offers the best of both worlds solution but not without problems.

D. The Composite Organization:

It is an organization may be created for special project team to handle a critical project. Until now, there has been no quantitative modeling used for the evaluation of a project's communication efficiency under different organizational structures in the Egyptian construction market. Moreover the selection of the suitable organization structure for various types and scales of projects in the Egyptian construction market. [3] The quantitative determination of the optimal organizational structure during the construction phase is the main objective of this study. This will be conducted through the identification of the main factors affecting organization selection in the Egyptian construction market. Previous studies were taken in consideration especially in Middle East and in similar countries to compare it with the Egyptian construction market. Through a questionnaire surveyed to identify the most important factors affecting organization selection in Egypt in different levels of managing projects. Questionnaire survey will be carried out to get experts' opinions about the important factors affecting the choice of the organizational structure in the Egyptian construction market. To judge the results of survey. Some data about editors must be taken in considerations such as experts' experiences or positions in the construction management



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skeleton. Therefore classifying the editors is a must for clear vision. The realistic results must be taken from the biggest number and various editors and then analyzed. Selected factors affecting the choice of organizational structure in the construction market in this study will be mentioned using PARITO formula, To find the most selected factor those are affecting organizational structure choice. For testing the results of questionnaire (effect of selected factors) on real projects from various types and size. Data of real projects will be using a form asking about the most selected factors. To examine the real effect of it on projects, Data analysis will be taken in to find relations between factors and the right selection of organization type and its success. Trying to get formula of selection tacking all selected factors into consideration. Testing this formula on real projects will be taken in for at least four projects to insure its effectiveness.

II. SCOPE OF STUDY

This study focuses on the identification of the optimal organizational structure for the project during the construction taking into consideration the opinion of all levels of Egyptian construction management (starting from junior engineers to management professors and high leveled managers). Therefore indicating the major factors affecting the organization selection in Egypt. To investigate the effect of identified factors on the organizational structure of projects, actual field data regarding on selected organizational structure of construction projects were collected. Such data include the conditions of that best describe the previously identified factors. Having a management tool for selecting the successful organization in the Egyptian construction market is the scope of this study.

III. ORGANIZATION SELECTION FACTORS

A literature review was carried out to identify 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.



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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. [1],[2], [4],[5]...[20]

A. Surveyed Samples:

As the Egyptian market is the region of study, samples of the questionnaire must represent the whole management structure of construction industry in Egypt fifty three engineers : Designers, Planners, Project management office engineers (PMO),Consultants, Project managers and Construction engineers with experience ranged from two to forty years the surveyed experts can be classified according to job titles as followed :

- Construction professors (designer, planner, consultant) (1)
- Senior consultant engineers (2)
- Junior consultant engineers (4)
- Project managers (8)
- Senior planners (6)
- Junior planners (11)
- Senior construction engineers (10)
- Junior construction engineers (11)

B. Analysis of resultant of Questionnaire:

Data collected to get the ranking of factor are descendingly arranged using PARITO form which gives a formula for ranking the surveyed factors

- Importance factor = (no. of surveyed sample) X (highest factors effect)
- Importance index = collected score/ Importance factor %
- Selected factors = 20% of no. of factors
- In this study there are 51 surveyed experts (after eliminating 2 non serious data)
- Importance factor = 51(surveyed sample) X 5 (highest factors effect) = 255
- Importance index = collected score/ 255 %
- Then arranging factors by percentage of importance.
- 20% of factors = 43 factor X 20% = 8.6 taken it 10 factors.

Table (1) shows calculations of factors' ranking. Then the first ten factors affecting the selection of organizational structure in the Egyptian projects were as followed:

- I. Project size (budget).
- II. Project manager authority should be commensurate with responsibility.
- III. Effective project manager's personality.
- IV. Managers experience in simultaneous projects.



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- V. Information from simultaneous projects.
- VI. Project length (time).
- VII. Complexity of the project (type).
- VIII. Size of the project in relation to other work in-house (percentage).
- IX. Assigning authority.
- X. Experience with project management organization.

IV. PROJECTS DATA COLLECTION

To investigate the effect of the previously identified factors on the selection of a suitable organizational structure of projects, Actual field data regarding on the selected organizational structure of a sample of construction projects were collected. Such data include the conditions of the previously identified factors. It also includes some information that describe the project and its Performance. The sample of projects includes forty four projects, executed by four of the major construction companies in Egypt.

A. *The used form tried to tack project features to present the ten selected factors:*

- Project budget to present project size factor.
- Project length designed Project length factor.
- Project length actually to present time success of project.
- Project actual and estimated cost to present cost success of project.
- Project type to present complexity of project factor.
- Managers' experience & Managers experience in similar projects.
- Opinion in manager's personality(taken as an opinion if it is good, v good or fair giving fair 10 degrees, good 20 degrees and v. good 30 degrees)
- Effect of taking similar project in consideration (taken as an opinion if it is good, v good or fair giving fair 10 degrees good 20 degrees v. good 30 degrees).
- Percentage of project size to mother company.
- Degree of assigning authority (taken as an opinion if it is good, v. good or fair giving fair 10 degrees good 20 degrees v. good 30 degrees).
- How long did the planning manager of mother company work by management concept.

B. *Classification of the surveyed project:*

1. Surveyed project type

To describe projects, first they must be classified according to types and it was as followed: Marin work (ports-shore protection-intakes) fourteen projects, sanitary sys. (Pipe lines- sludge h. - pumping h.) fourteen projects, Building (bridges-repairing existing buildings) eight projects, Residential (high-rise – privet – peaches) three projects, Roads (asphalt – concrete - curbs)two projects and Industry (electric generators station) one project

2. Surveyed project size:

One of the main factors having the highest ranking is the size of project presented by project budget which can be classified as:

- Small projects which its budget is less than 10 EGP millions.
- Medium projects which is from 10 – 50 EGP millions.
- Large projects which from 50 – 200 EGP millions.
- Extra large projects which is more than 200 EGP millions.

3. Surveyed project lengths:

Project length is one of the main factors affecting the choice of organization in the Egyptian market (as Egyptian engineers said in the questioner).Projects can be classified as:

- Very short projects whose length less than 12 months.
- Short projects: whose length between 12 - 18 months.



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- Medium projects: which length between 19-24 months.
- Long projects: which length between 25 - 30 months.
- Extra longer projects: which length more 30 months.

4. Surveyed project managers' experience in similar projects:

Managers' experience in similar projects is one of the 10 selected factors can be presented as:

- Very short experience which length 5-7 years.
- Short experience: 7-10 years.
- Medium experience: 11- 20 years.
- Long experience: 21 - 30 years.

5. Surveyed project planning managers' (Mother company) experience:

Planning managers' experience in taking similar projects in consideration can be presented as:

- Very short experience which length 5-7 years,
- Short experience:7-10 years,
- Medium experience: 11- 20 years,
- Long experience: 21 - 30 years.

6. Percentage between project budget and mother company's:

Percentage between project budget and the total budget of projects in the mother company was selected as one of the 10 selected factors it can be presented as:

- Very small percentage between 1-5 %.
- Small percentage between 6-10%.
- Medium percentage 11-20%.
- High percentage 21-50 %.
- Very high percentage between 51-100%.
- It was noticed from the previous data:
- Percentage between project budget in comparison to company's budget reflects that companies are large scaled.
- Surveyed project sizes are small and medium. [It is good for study to judge small and medium projects which are difficult to select its organization].
- Project managers' experiences in similar projects are medium and long which reflect the trend of managers' choice.
- Planning managers' (Mother company) experience most projects are short and medium as the management concept is nearly executed in Egyptian construction market
- Project lengths are short and medium [which is good for study to judge short and medium projects which are difficult to select its organization].

V. DATA ANALYSIS

1. Success factor:

To judge the selection of organizational structure if it was right or wrong selected data must be analyzed to see this type of organization under these conditions (time , cost, type of project, managers' experience, planning managers' experience) was succeeded or not . Project success can be divided into: project cost success (PCS) and project time success (PTS).

To measure cost success of projects as quantitative value it was calculated as a percentage, 100 % means the equality of project cost designed and project cost actual. If the actual cost is less than the designed cost, this is will be a success and it will be more than 100%. The proposed formula will be:

$$P C S = \{ 100 - (PC \text{ actual} - PC \text{ designed}) / PC \text{ designed} * 100 \}$$

Where Project cost (P C) & Project Cost Success (P C S).



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To measure time success of projects as quantitative value it was calculated as a percentage, 100 % means the equality of project length designed and project length actual. If the actual length is less than the designed length this is a success and it will be more than 100%, then the proposed formula will be:

$$P T S = \{ 100 - (PL \text{ actual} - PL \text{ designed}) / PL \text{ designed} * 100 \}$$

Where Project length (P L) & Project Time Success (P T S). Assuming the equality of time and cost weights the total success is the average of two kinds of success P T S, P C S will be named project success P S

$$P S = (P T S + P C S) / 2$$

Assuming the project be successful if PS is over 90% or if PCS over 95 % (assumption due to surveyed samples of project managers) by using that assumption there is 6 unsuccessful projects and 36 successful ones.

Table (2) presents the calculations of P C S & P T S & P S for selected projects.

2. Classification of organizational structure types (fundamentals of classification):

To get a relation between organizational type and factors affecting the choice of projects, it should be classified then there must be a base of classification then the main types of organizations and its features must be clear in planning managers' opinions.

Functional organization (F):

- Functional manager
- Project Management Office (PMO) central at Mother Company.
- Industrial Safety central at mother company
- Human Resources (HR) central at mother Company.
- Finance and Sales Central at Mother Company.
- All reports of employs to functional manger at Mother Company.

The projectzed organization (P):

- Project manager.
- PMO of the entire project.
- Industrial safety in project.
- HR in project.
- Finance and sales in project.
- All reports of employs to the project manager.

The matrix organization (M):

- Project manager.
- PMO of the entire project but give reports to project manager and the central PMO of the company.
- Industrial safety in project give reports to project manager and the central to the company
- HR in project give reports to project manager and the central to the company
- Finance and sales in project give reports to project manager and the central to the company

The composite organization(C):

- Project manager.
- PMO of the entire project or another projects but give reports to project managers and the central PMO of the company.
- Industrial safety in project or in more than project gives reports to project manager and the central to the company.
- HR in project or in more than project gives reports to project manager and the central to the company.
- Finance and sales in project or in more than project give reports to project manager and the central to the company.



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On these fundamentals projects can be classified as followed : three projects pure functional(F), seven projects as pure projected(P), one project as matrix(M), fifteen projects composite of projected and matrix (CPM) and eighteen as composite between functional and matrix (CFM). Fig (1) shows project calcification.

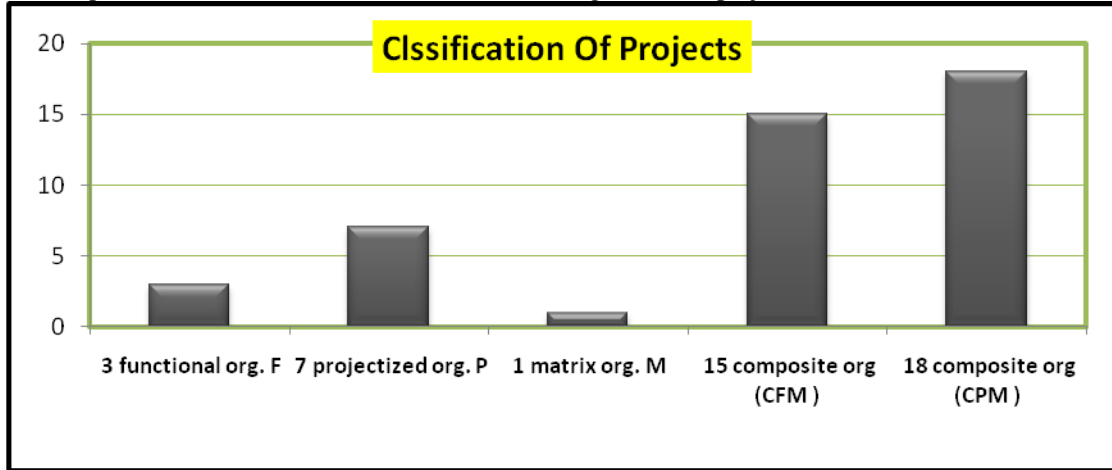


Fig (1) Project Calcification

A. Relations between factors and organization type:

To get a quantitative formula to choose the optimal organization of projects in Egyptian market the successful projects, its classification and data collected of planning managers' choice will be the judging base.

Relation between project size and organizational structure type:

Project size was the first factor affecting the choice of organizational structure in the Egyptian market. Fig (2) shows project size and organizational structure type.

- The functional organization was 14 - 50 million, the projectized organization 18- 500 million, matrix 126 million, composite CFM 14-200 million and composite CPM 19-300 million.
- It can be noticed that planners and engineers prefer projectized type for big budgets of projects but when it is specific projects (sanitary systems) they prefer functional or composite functional and matrix organization.

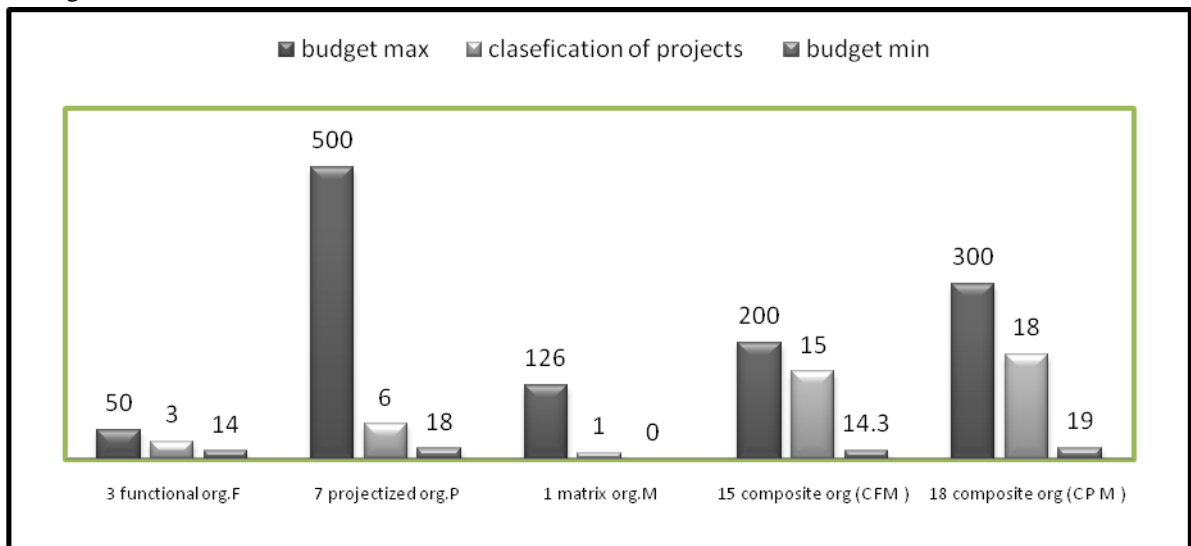


Fig (2) Project Size and Org. Structure Type

Relation between project type and Organizational structure type:

Project type was one of the first factors affecting the choice of organizational structure in the Egyptian market. It was noticed that:

- The projectized organization, marine work 4, roads 1, industrial 1, residential 1.



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- It can be noticed that planning managers and engineers prefer projectzed type for marine work projects
- The functional type, roads 1, residential 1, sanitary system project 1.
- The matrix type marine work project 1.
- It can be noticed that planning managers and engineers prefer functional type for specific projects: (sanitary systems, roads, residential as it is a repeated projects). They prefer matrix organization for small marine work also as it is repeated and can be related to other small marine work project.
- The composite type (project and matrix), 8 marine work, 3 building, 3sanitary system, 2 residential.
- It can be noticed that planning managers and engineers prefer the composite between matrix, project zed type for marine work projects and the traditional building.
- The composite type (functional and matrix) ,9 sanitary system, , 4 building, , 1 roads. 1 marine work.
- It is noticed that planning managers and engineers prefer composite functional and matrix organization when it is specific projects (sanitary systems, and traditional buildings).

3) Relation between project organizational structure and percentage of project budget to Mother Company's work budget:

- Project organizational structure and percentage of project budget to Mother Company's work budget: functional (0.5% to 5%), projectzed (3% to 100%), matrix (0% to 30%), CFM (0.3% to 30%) and CPM (1% to 25%)
- It is noticed that planning managers and engineers prefer composite functional and composite projectzed organization or projectzed when it is high percentage in relation to mother company work budget.

4) Relation between project organizational structure and project length

- Project organizational structure and percentage of project budget to Mother Company's work budget: functional (0.5% to 5%), project zed (3% to 100%), matrix (0% to 30%), CFM (0.3% to 30%) and CPM (1% to 25%)
- It is noticed that planners and engineers prefer composite functional and composite project zed organization or project zed when it is high percentage

VI. CHOICE OF ORGANIZATION TYPE IN EGYPTIAN PLANNING MANAGERS' OPINION

As it obvious there is no clear relations between organization type and project characteristics such size, length, type and percentage to mother company's. The study will focus on Egyptian planners' choice in successful projects getting their vision as a base of choice specially after selecting a suitable experienced planner and a project manager having experience in similar projects.

Some notices can be clearly noticed:

- Special types of projects with big budget are selected projectzed such marine work. Some types such sanitary systems, roads and residential buildings are selected functional (due to the repeated work).
- The smallest the size of project in special projects the highest probability of selecting the composite type (project& matrix) such marine work as the special sectors can be shared with other similar projects (HR- PMO-finance - safety).
- For other special projects such as sanitary systems and traditional buildings they prefer to select the composite (functional & matrix).
- The smallest the length of project the highest probability for selecting project type and functional type.
- The highest percentage to mother company budget the highest the trend to composite types.

1. Effect of selected factors on success of organization:

Trying to have a quantitative method of selecting organizational structure in the Egyptian market the ten factors must be related to project success PS and project type selection, projects will be classified to: F Functional organization, P the Project Organization, M the Matrix Organization, the Composite Organization:



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CFM The Composite Organization between F& M

CPM The Composite Organization between P& M

1. Effect of project size:

The budget of selected projects varied from 3.5 million to 500 EGP million. Fig (3) presents the relation between project size (as groups) and success factor.

- It is noticed that there is not an obvious relation between project size and project success.

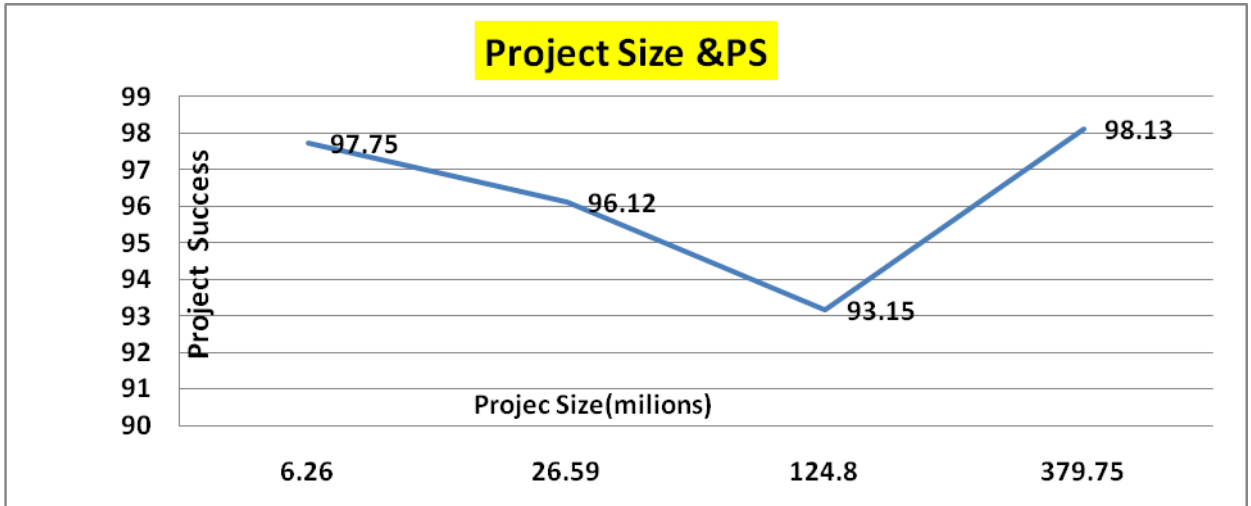


Fig (3) Relation between Project Size and PS

3. Effect of project managers' experience in similar projects:

In the selected samples managers' experience in similar projects varies from 7 to 35 years to have a relation it was divided into groups Fig (4) presents the relation between project managers' experience in similar projects (as groups) and success factor

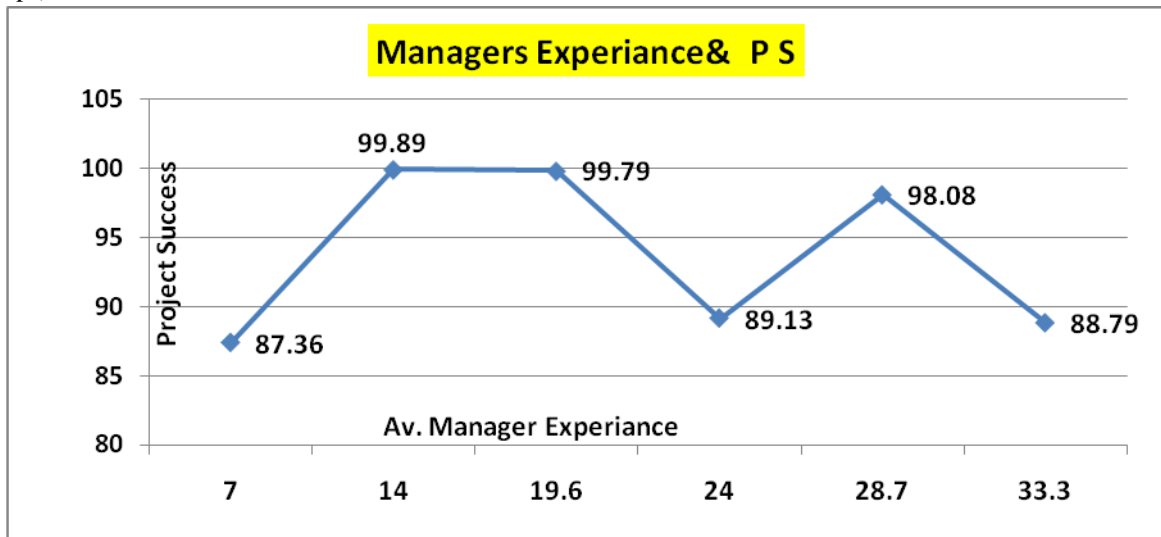


Fig (4) Project Size and Success Factor

- It is noticed that there is not an obvious relation between manager's experience in similar projects and project success.

4. Effect of experience in project management:

In the selected samples planning managers' experience in selecting organization of projects varies from 5 to 25 years to have a relation divided into groups , Fig(5) presents the relation between project planning managers' experience (as groups) and success factor PS



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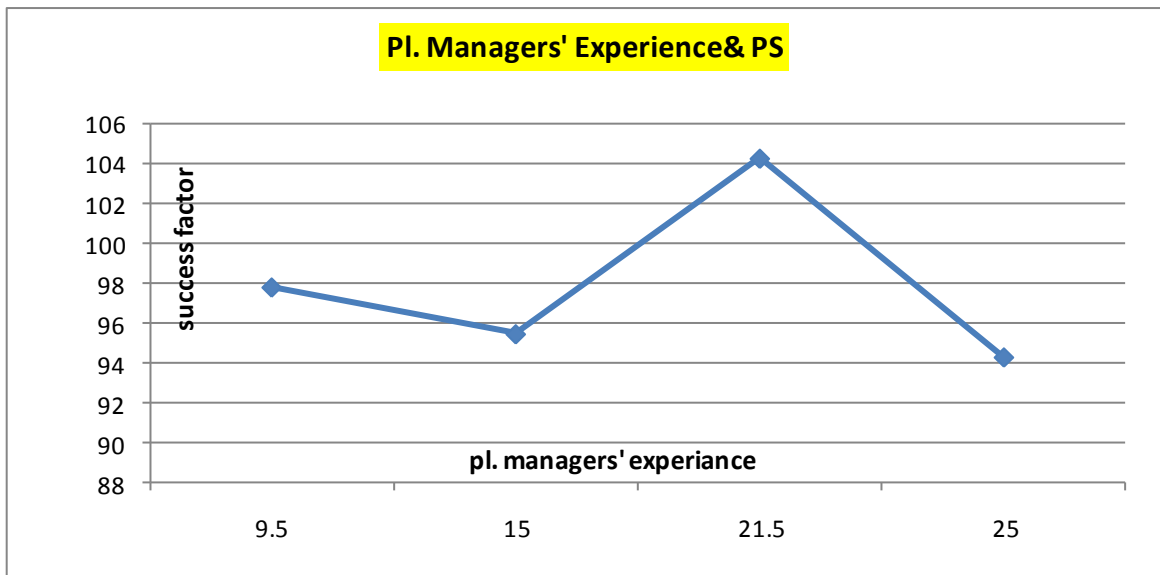


Fig (5) Planning Managers' and Success Factor

- It is noticed that there is not an obvious relation between planning managers' experience and project success.

5. Effect of project length:

In selected samples project lengths varies from 10 to 60 months. To have a relation with PS it was divided into groups and drawn the relation between average PS and average project lengths. Fig (6) presents the relation between project length (as groups) and success factor

- It is noticed that there is not an obvious relation between project length and project success.

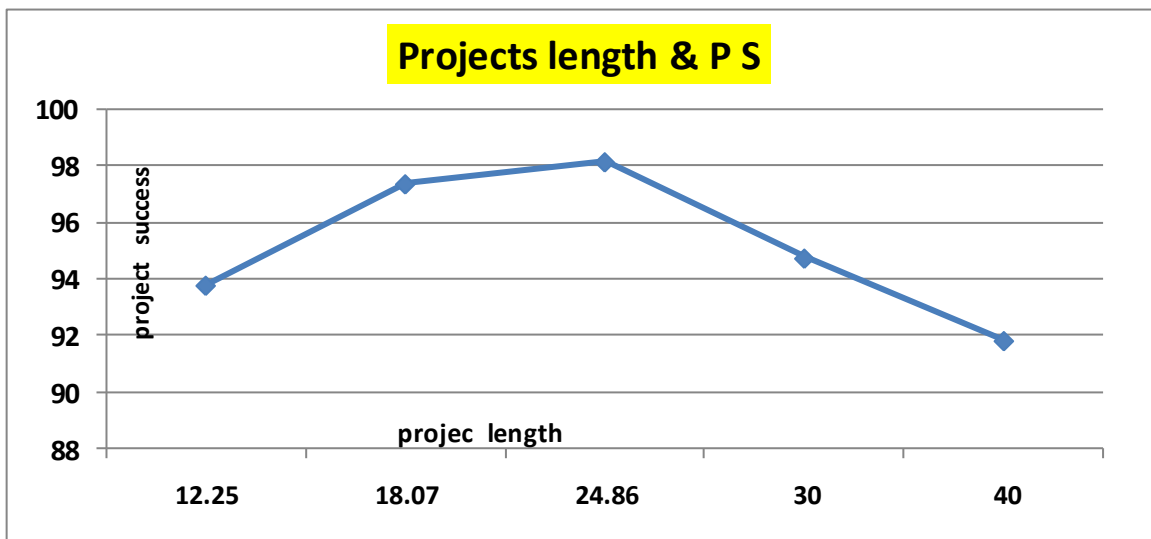


Fig (6) Project Length and Success Factor

6. Effect of project size to Company's budget:

In selected samples percentage of project budget to mother company's hall yearly budget varies from 0.3 to 100% to have a relation with PS it was divided into groups Fig (7) presents the relation between percentage (as groups) and success factor PS.

- It is noticed that there is not an obvious relation between percentage to mother company work budget and project success.



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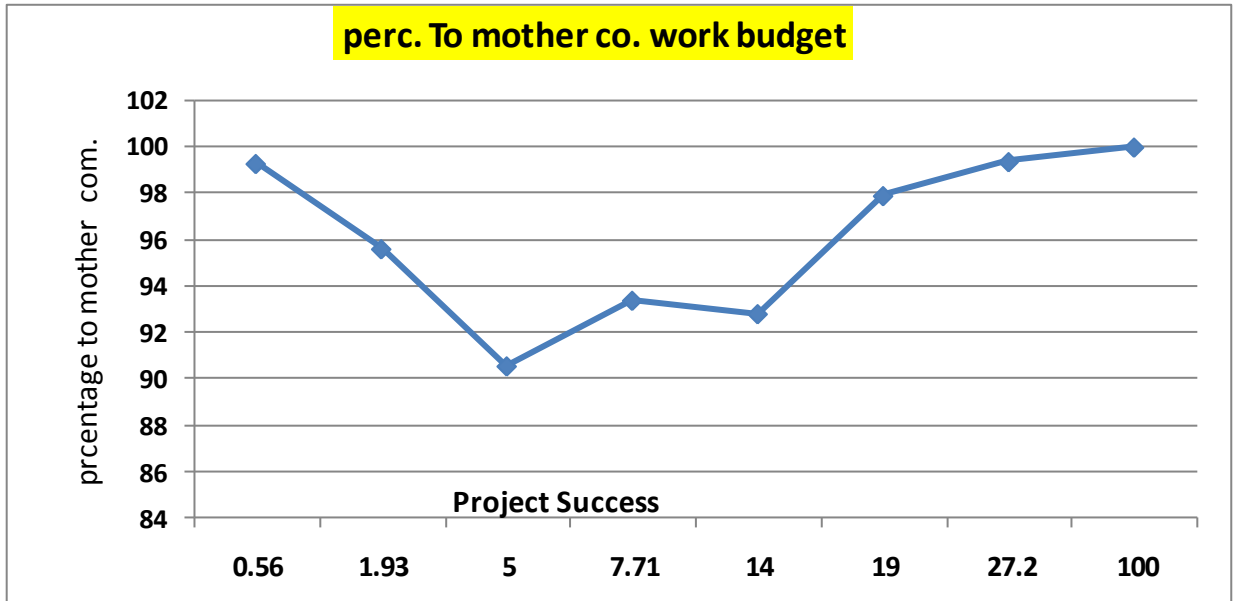


Fig (7) Percentage to Mother Company and PS

7. Manager's personality effect:

Manager's personality was one of the ten factors. Data supplier's opinions was taken, if it is fair (10 degrees) or good (20 degrees) or v.good (30 degrees) and made it into groups. Fig (8) presents relation between manager's personality ranking and success factor.

- It is noticed that there is not an obvious relation between managers' personality and project success.

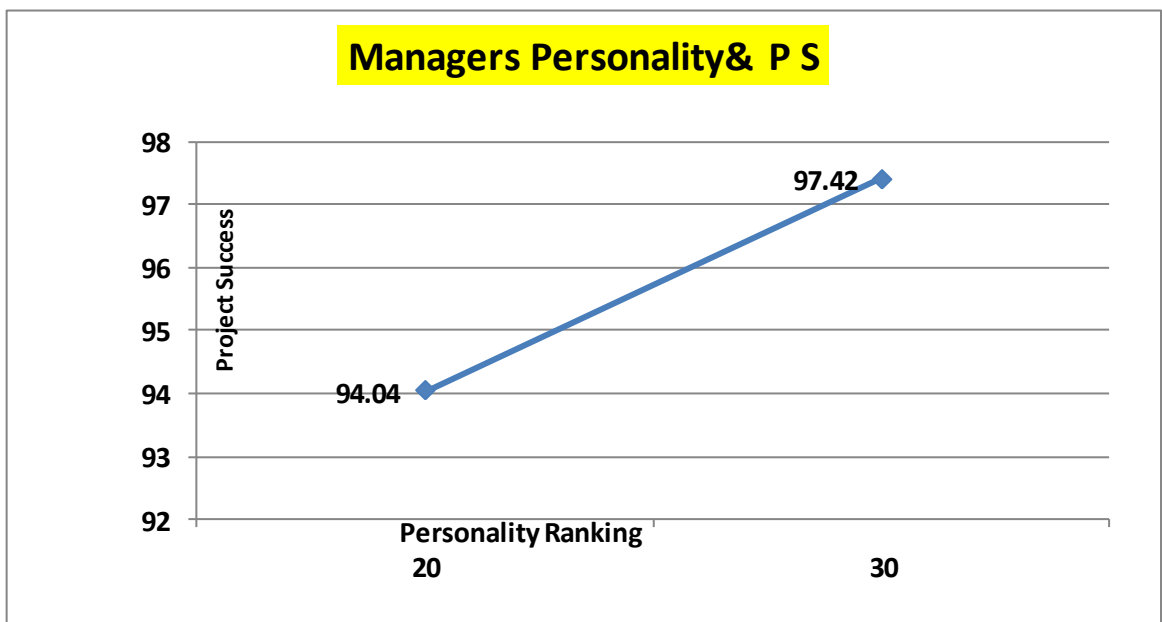


Fig (8) Managers Personality Ranking and PS

8. Distribution of authority:

Distribution of authority was one of the 10 factors data supplier's opinion is it fair or good or v.good and gives it a weight and made it into groups, Fig (9) presents relation between distribution of authority & P S.

- It is noticed that there is not an obvious relation between distribution of authority in projects and project success but may be direct proportion.



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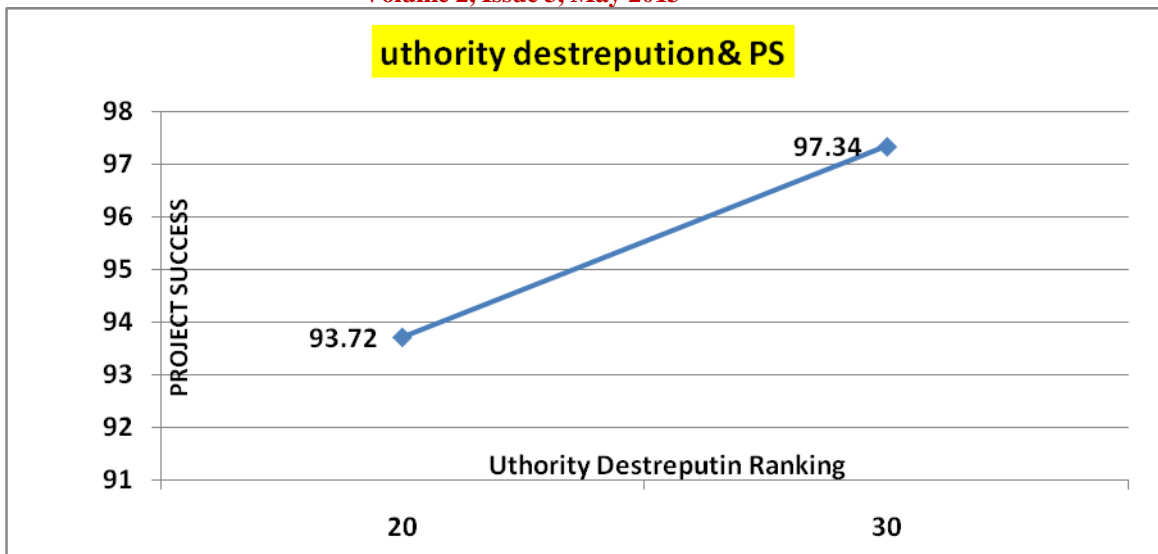


Fig (9) Distribution of Authority & P S

VII. RULES OF ORGANIZATIONAL STRUCTURE CHOICE

From all what was studied in this study a quantitative formula is very hard to be considered the base of organizational structure choice, As all relations is not clear to give the way to chose or to judge the organization if it is a successful one or not. So the rule is how to choose the organizational structure on Egyptian planning managers' way especially in successful projects, taking the ten factors in consideration. The ten factors affecting organizational structure can be divided into: Selectable factors and non selectable ones Which appears in manager's choice and planning manager's choice, as followed:

1. Managers choice will cover three of the ten factors:
 - Effective project manager's personality.
 - Managers experience in similar projects.
 - Project manager authority commensurate with responsibility.
2. Planning manager of the mother company choice will cover three of the ten factors:
 - Experience with project management organization.
 - Assigning authority on project team.
 - Using information from simultaneous projects.

The rest four of the ten factors (the quantitative factors) will be presented as questions to follow the Egyptian experts' choice.

- Project size (budget).
- Project length (time).
- Complexity of the project (type).
- Size of the project in relation to other work in-house (percentage).

Table (3) presents the four questions the choice tool including questions to be asked and the answers indicates a probability of organization selection, the most selected probability is the best organization in Egyptian experts opinion in this project.

VIII. TESTING THE VALIDITY OF THE PROPOSED TOOL

The proposed tool or Table (3) for organization selection must be tested to see the validity of it in the Egyptian construction market, Using 4 projects' data as case study for testing the proposed tool.

- **Project 1 :**
Project data:



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- Name of project: Edku naval port - Contractor: Arab Contractors Othman Ahmad Othman

1. Type of work: Marin work 2. Project budget: 182 millions EGP

3. Project length: 33 months 4. Percentage to mother company's work: 10%

Organization classification (dew to previous fundamentals): CPM (composite projectzed and matrix)

Using table (3) and project data to answer the questions

1. Marin work P or CPM or M 2. Long Project (Length) P or CPM

3. Large project budget P or CPM or M 4. Percentage to mother com CFM or CPM

Resultant: 4 CPM (in every selection) so it can be selected, 3 P, 2 M can be second and third choice.

Tool choice CPM And that was the company's selection

• **Project 2 :**

Project data:

Name of project: Marssi coastal village Contractor: Arab Contractors Othman Ahmad Othman

1. Type of work: buildings 2. Project budget: 500 EGP millions

3. Project length: 24 months 4. Percentage to mother company's work: 30%

Organization classification: P projectized using table (3) and project data to answer the questions

1. Buildings CPM or CF M 2. Medium length CPM or CFM or M

3. Extra large project budget CPM or P or CFM 4. Percentage to mother com. CPM or P or CFM

The resultant: 4 CPM in every selection so it can be selected and also 4 CFM can be selected as second selection,

2 P also can be selected Tool Choice CPM And that was not the company's selection

Due to planning managers or manager opinion or owners roles it was the third selection of six probabilities.

• **Project 3 :**

Project data:

Name of project: Abo Kire Intake of Electric Station Contractor

Contractor: Arab Contractors Othman Ahmad Othman

1. Type of work: Marin Work 2. Project budget: 452.3 EGP Millions

3. Project length: 35 Months 4. Percentage to mother company's work: 7%

Organization classification:

Using table (3) and project data to answer the questions

1. Marin work M or P or CPM 2. Long Project Length p or CPM

3. Extra Large Project Budgets P or CFM or CPM 4. Percentage to mother com. P or F or CFM

The resultant: 4 P projectized 3 CPM, 2CFM. Tool selection is P And that was the company's selection

Project 4:

Project data:

Name of project: Sanitary Station of Khorshed Contractor: Arab Contractors Othman Ahmad Othman

1. Type of work: Sanitary System 2. Project budget: 21 EGP millions

3. Project length: 24 months 4. Percentage to mother company's work: 2.5%

Organization classification: F Using table (3) and project data to answer the questions

1. Sanitary system F or CFM 2. Medium length CP M or CFM or M

3. Percentage to mother com. P or F 4. Medium Budget M or CFM or CPM

The resultant: 3 CFM & 2 CPM & 2 F all semi equal then the choice due to planners and managers experience.

Tool selection is CFM and that was not the company's selection

Due to planning managers or manager opinion or owners roles it was the third selection of six probabilities.

- Through case studies the tool was succeeded in 50% of projects as the first selection was typical and 50% was the third selection, the tool based on the four questions. The other six factors of selection



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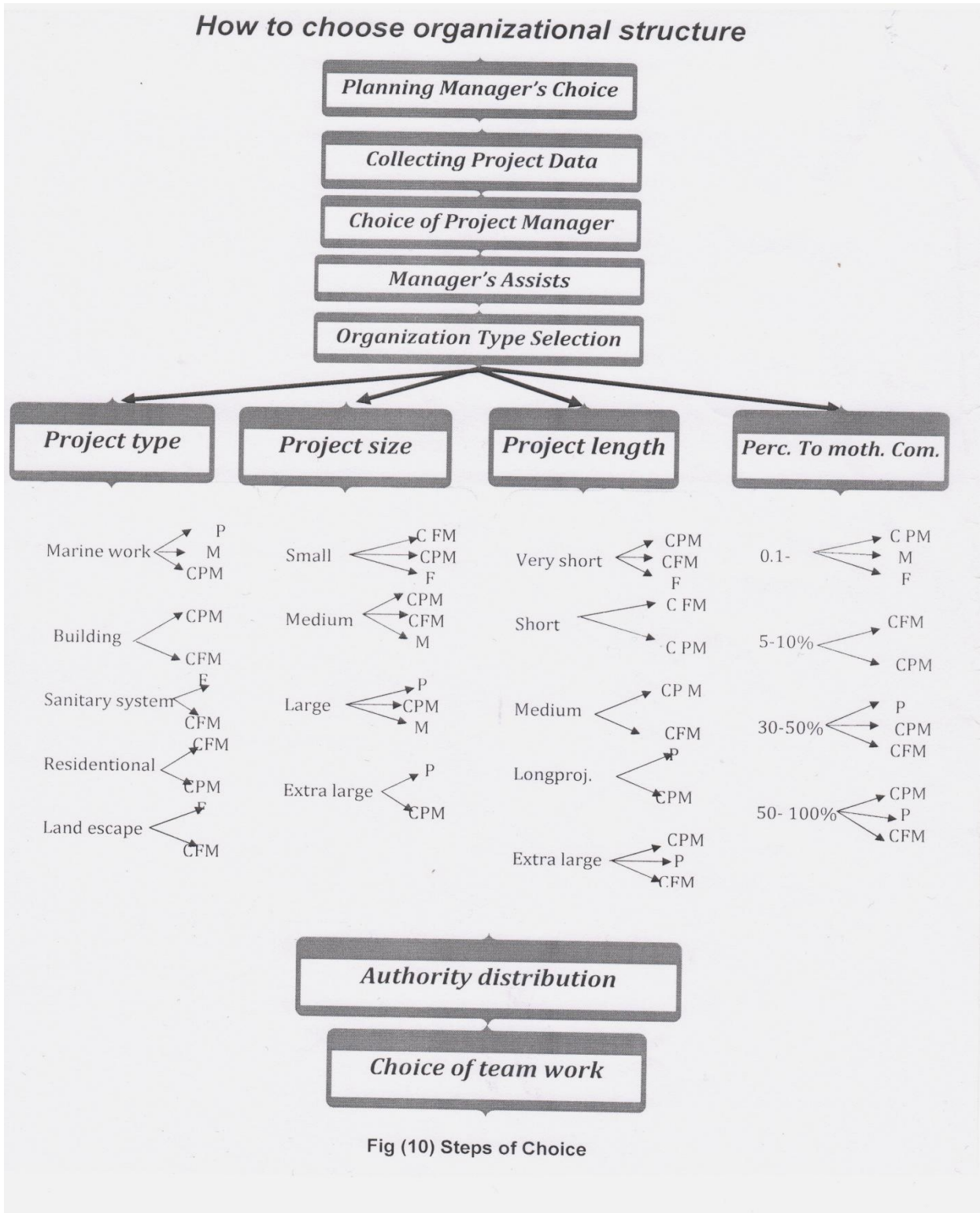
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can be added in a proposed flow chart to add project manager's experience and also the planning manager's experience and their assists to the selection. Fig (10) Present steps of selection.

IX. SUMMARY





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The uniqueness of the Egyptian construction market, as developing country and the narrow execution of management concepts in medium and small scaled project will add complexity to find the optimum organizational structure in all the Egyptian projects. The identification of the main factors affecting organization selection and the degree of its influence on project, will be conducted through a literature review from all over the world especially in similar developing countries like Turkey, Iran, Thailand will give a base of selection for a questionnaire survey. The question-naira survey will identify the most important factors affecting organization selection in Egypt in construction experts' opinion. This study focuses on factors relations with the optimal organizational structure for the project during the construction taking through studying 44 projects executed by four extra large construction companies working in Egyptian market: Arab Contractors Othman Ahmad Othman, Archirodon Construction Over Seas Co. S.A., China Harbor Engineering Company Ltd, Hassan Allam Construction Company Ltd.

A quantitative model was not easy to be established through this study as the relation between factors affecting the choice of organization type and projects data (organization selection) was not clear. Moreover, a suggested quantitative model for organization selection has been provided. The validity of the proposed model had been tested on four projects and it was essential to provide a flow chart showing the steps of selection to be on Egyptian planners' way.

X. CONCLUSION

The experience of both planners and managers is the main factors affecting the selection of suitable organizational structure as it is presented in 60% of factors selected by Egyptian experts. The study could not find a quantitative formula for selecting organizational structure but through data collected it could deliver a management tool that will be guide of Egyptian construction companies to find the right selection of organization types which suitable for execution in Egypt by the Egyptian managers and planners. The flow chart delivered through this study give the way for decision maker to select suitable organization. It was obvious that the most preferred organization in Egypt the combined organization either between matrix and functional or between matrix and project zed projects.

XI. RECOMMENDATIONS

- Organization type in all scales of projects must be well selected before starting execution.
- During construction phase selected manager and planner must re adjust the organizational relations to have smooth execution according to their experience.
- The best is to choose the suitable planner then the suitable manager then the suitable organization type and lastly the project team.
- The proposed tool and flow chart will add to the easy choice of organization type in Egyptian construction market.

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APPENDIX

Table(1 a) Ranking Factors factors affecting organizational structure in Egypt								
	factor	1	2	3	4	5	Σ	IM. IN%
1	Project size	4	3	3	9	34	225	88.24
2	Project length	1	5	12	19	16	203	79.61
3	Experience with project management organization	7	2	7	17	20	200	78.43
4	Philosophy and visibility of upper level management	2	8	7	24	12	195	76.47
5	Project location	6	11	16	9	11	167	65.49
6	Available resources	4	7	10	14	18	194	76.08
7	Unique aspects of the project	2	5	19	12	15	192	75.29
8	Diversity of product lines	3	9	15	11	15	185	72.55
9	Rate of change of the product lines	1	11	23	13	5	169	66.27
10	Interdependencies among subunits	3	9	17	15	9	177	69.41
11	Level of technology	1	9	15	13	15	191	74.90
12	Presence of economies of scale	4	6	17	13	13	184	72.16
13	Organizational size	6	9	3	16	19	192	75.29
14	Clear location of responsibility	5	7	10	11	20	193	75.69
15	Ease and accuracy of communication	3	8	13	16	13	187	73.33
16	Effective cost control	4	8	13	21	7	178	69.80
17	Ability to provide good technical supervision	0	10	23	13	7	176	69.02
18	Flexibility of staffing	2	7	16	19	9	185	72.55
19	Importance to the company	4	10	11	16	12	181	70.98
20	Quick reaction capability to sudden changes in the project	5	5	11	17	15	191	74.90
21	Complexity of the project	0	5	13	21	14	203	79.61



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Table(1 b) Ranking Factors factors affecting organizational structure in Egypt								
22	Size of the project with relation to other work in-house	3	6	8	18	18	201	78.82
23	Form desired by the owner	4	7	11	14	17	192	75.29
24	Ability to provide a clear path for individual promotion	4	7	11	20	11	186	72.94
25	Using familiar unit grouping	4	8	17	15	9	176	69.02
26	Requiring specific types of experience for designated positions.	6	6	15	16	10	177	69.41
27	Assigning authority	1	8	9	18	17	201	78.82
28	Managers experience in simultaneous projects	1	6	7	18	21	211	82.75
29	Information from simultaneous projects	1	7	8	19	18	205	80.39
30	Effective project manager's personality	2	3	9	15	24	215	84.31
31	Project manager authority should be commensurate with responsibility.	1	2	8	19	23	220	86.27
32	The choice of project management authority structure	2	6	14	17	14	194	76.08
33	How high the project manager reports in the overall company depends upon	3	5	13	26	6	186	72.94
34	The trust of employees in managers	4	5	11	15	18	197	77.25
35	Defining the objectives	3	6	18	14	12	185	72.55
36	Selecting the size of each units and work groups	3	9	19	13	9	175	68.63
37	Adding the planning and monitoring system	1	7	14	19	12	193	75.69
38	Defining requirements of positions.	8	1	16	21	7	177	69.41
39	Cultural differences and environmental needs	5	11	14	16	7	168	65.88
40	Governmental intervention in organizations (HR polices which employ less skilled people)	8	11	14	9	11	163	63.92
41	Social acceptance of a particular technology.	4	13	22	11	3	155	60.78
42	Political and governmental factor	5	11	12	13	12	175	68.63
43	Form desired and suitable for the consulting system	3	6	18	13	13	186	72.94



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P. NO.	1	2	3	4	5	6	7	8	9	10	11
PL d	33	35	19	18	13	60	24	18	24	40	24
PL a	33	36	27	22	12	56	24	18	28	45	30
P T S	100	97.1	57.9	77.8	107.7	106.7	100	100	83.3	87.5	75
PC d	150	380	70	31	25	210	11	18	300	61	55
PC a	150	385	84	31	24	208	10	17	280	65	56
P C S	100	98.7	80	100	104	101	109.1	105.6	106.7	93.4	98.2
PS	100	97.9	68.9	88.9	105.9	103.	104.6	102.8	95	90.5	86.6
P. NO.	12	13	14	15	16	17	18	19	20	21	22
PL d	18	24	24	20	24	18	12	12	19	18	18
PL a	16	30	28	22	28	24	13	10	22	20	18
P T S	75	83.3	93.3	83.3	66.7	91.7	116.7	77.8	88.9	100	100
PC d	19.5	50	25	175	14	8	6	3	6	18	6
PC a	19	56	28	178	16	8.5	6	2.9	6	17.5	6
P C S	88	88	98.3	85.7	93.8	100	103.3	100	102.8	100	98.4
P S	81.5	85.7	95.8	84.5	80.3	95.9	110	88.9	95.9	100	99.2
P. NO.	23	24	25	26	27	28	29	30	31	32	33
PL d	18	24	24	30	36	36	28	28	12	24	32
PL a	18	28	24	32	36	36	28	28	11	28	30
P T S	83.3	100	93.3	100	100	100	100	108.3	83.3	106.3	83.3
PC d	3.15	7.6	17	26.5	140	140	80	80	2.5	17	61
PC a	3.2	8	17.5	27	140	140	80	80	2.5	18	60
P C S	94.7	97.1	98.1	100	100	100	100	100	100	94.1	101.6
P S	89	98.6	95.7	100	100	100	100	104.2	91.7	100.2	92.5
P. NO.	34	35	36	37	38	39	40	41	42	43	44
PL d	24	36	36	28	18	18	18	36	18	18	24
PL a	28	34	40	32	20	16	18	34	20	18	23
P T S	83.3	105.6	88.9	85.7	88.9	111.	100	105.6	88.9	100	104.2
PC d	5.6	15	22	12.6	5.6	3.8	3.3	9	2.7	3	17
PC a	5.8	14.8	23	13	5.6	3.7	3.4	8.5	2.7	3	16.5
P C S	96.4	101.3	95.5	96.8	100	103.	96.7	105.6	98.5	100	102.9
P S	89.9	103.5	92.2	91.3	94.5	107.	98.4	105.6	93.7	100	103.6



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Table 3 : Proposed Tool (Questions to be asked)

What is the project size?	Small	Medium		Large	Extra large
	CFM/CPM/F	CPM/CFM/F		P/CPM/M	P/CPM
What is the project type?	Marin work	Building	Sanitary sys	Residential	Roads
	M/P/CPM	CPM/CFM	F/CFM	CFM/CPM	F/CFM
What is the project Size with relation to other work in mother company?	0.1-5	5-9	10-30	30-50	50-100
	CPM/CFM/F	CPM/CFM	CFM/CPM/P	M/CPM/CFM	P/CPM
What is the project length?	Very Short	Short	Medium	Long	Extra long
	CPM/CFM/F	CFM/CPM	CPM/P/CFM	P/CPM/CFM	CPM/ P/CFM

Where:

F Functional organization

P The Project Organization

M The Matrix Organization

C The Composite Organization:

CFM The Composite Organization between F & M

CPM The Composite Organization between P & M