

Research on the Degradation of Project Complexity Based on Organization Optimizing

Qinghua He^a, Lan Luo^b and Shufang Mao^c

School of Economics and Management, Tongji University, Shanghai, 200092, China

^aheqinghua@263.net, ^bmengling2391@163.com, ^cmsfys@yahoo.cn

Keywords: Project Complexity, Organization Optimizing, Shanghai World Expo Project

Abstract. Project complexity management which plays a key role in achieving the success of the complex project management has been an important part of project management. Taking world expo AB area project as an example, this paper analyzed the degradation of project complexity based on organization optimizing by using the ProjectSim software, besides we examined the changes of the workload caused by the implicit work such as the rework, coordination and waiting process. Thus we can have a further study on the reducing of project complexity and know what it consist of in the microcosmic view, and it will provide us with some reference and significance of how to optimize the complex project synthetically.

Introduction

In recent years, the amount of the large projects is increasing, the scale is huger and the complexity is more obvious^{[1][2]}. Compared with small projects, the complex project is more difficult to predict the results, and varies from time to time^[3]. What's more, the project managers are difficult to succeed in control of the whole executing progress of project^[4], which leads to a series of serious consequences that makes the objective to be uncontrolled, such as the overinvestment and schedule slippage^{[5][6][7]}. As a result, project complexity management becomes a significant part of project management and it is a key to achieve the final objective.

This article takes world expo AB area project as an example to do research project complexity, analyze the degradation of project complexity based on organization optimizing in two aspects: the structure and the factors of organization^[8]. Under the influence of the interaction of the micro factors in the model, ProjectSim can calculate the proportion of the implicit workload to dominant workload caused by implicit work such as the rework, coordination and waiting process. Thus the complexity of world expo AB area project can be calculated in this way: the project complexity = the implicit workload / the dominant workload. And the implicit workload = reworking workload + coordinating workload + waiting workload. Therefore the complexity of world expo AB area project can be showed in such a objective way^{[9][10]}.

Analysis on the complexity of the organization factors (members)

The amount of the organization factors (members). The amount of the organization factors itself plays little important role in the project complexity. However, the difficulty in communicating and coordinating during the process caused by the gender difference between members is an important reason of project complexity; simultaneously the increasing of the number of members will also lead to increase levels of organization and management amplitude. Therefore, the amount of the organization factors (members) is one of the important factors which affect the project complexity.

The complexity of the organization factors (members). The leader capability: It affects the project complexity by making a difference in the coordination workload in the whole project. Namely, the stronger the leader capability is, the more smoothly members communicate with each other, and then dependence between tasks has less influence on the project complexity.

The technical capability: It can help reduce the technical dependence between members if a member can finish the work on his own as long as he has the required technical ability, thus it will help reduce the rework workload and coordination workload.

The capability of coordination: In order to fulfill the goal, members are supposed to communicate with each other when they are stuck in their own work, thus the capability of coordination can affect the rework workload, coordination workload and waiting workload.

The working experience: To some extent, the working experience reflects the members' coordinating skills and productive ability. It is one of the important factors that affect the project complexity.

The working background: To some extent, the working background reflects the education degree of members and their competence in previous jobs. So, it is one of the important factors that affect the project complexity.

The complexity of the dependence between members (structure)

- **Centralization:** It is used to describe the concentration degree of the right and decision in organization. In general, if the project mission is executed in order, which means the project complexity will reduce, the degree of centralization is relatively high, the upper echelons of the organization usually make decisions; But if project mission is executed concurrently, which means the project complexity will increase, the degree of centralization is relatively low. In this model, the project manager should give up the right to let the whole team make decisions independently by themselves.
- **Normalization:** It is used to describe the utilization degree of rules and procedures of organization behavior. In general, if the project mission is executed in order, which means the project complexity will reduce, the normalization is relatively high, the mission can be executed under the rules and procedures. When it comes to the model that the project mission is executed concurrently, which means the project complexity will increase, the normalization is relatively low. In this model, team members make decisions independently with less restrains.
- **Matrix form:** It is used to describe the degree of connectedness between organizations. In the project organization with high matrix form, members pay more attention to the informal information exchange and not the formal meeting to exchange information; But in the project organization with low matrix form, members often used to attend the meeting in the form of official information exchange.

Analyses on the Degradation of Project Complexity Based on Organization Optimizing

Analysis on the Degradation of Project Complexity Based on Organization Structure Optimizing. Organization structure consists of centralization, normalization and matrix form. By simulating through ProjectSim software, the study compares different change of the rework workload, coordination workload and waiting workload in different conditions. Thus it can explain the process how the organization structure optimizing degrade the complexity. The related data are shown as the following Table 1-3.

Table 1 Simulative Data about the Relationship between the Organization Centralization and Project Complexity

| Organization Centralization | Time of Simulation | The Implicit Workload | | | | Project Complexity |
|-----------------------------|--------------------|-----------------------|--------------|---------|----------|--------------------|
| | | Rework | Coordination | Waiting | Total | |
| High | 823.5d | 22836.5 | 53409.1 | 32759.3 | 109004.9 | 0.757 |
| Medium | 800.2d | 17798.7 | 51273.0 | 21061.4 | 90133.1 | 0.626 |
| Low | 760.0d | 11010.7 | 45092.5 | 7409.0 | 63512.2 | 0.441 |

Table 2 Simulative Data about the Relationship between the Organization Normalization and Project Complexity

| Organization Normalization | Time of Simulation | The Implicit Workload | | | | Project Complexity |
|----------------------------|--------------------|-----------------------|--------------|---------|----------|--------------------|
| | | Rework | Coordination | Waiting | Total | |
| High | 769.0d | 11376.9 | 20234.5 | 9823.7 | 41435.1 | 0.288 |
| Medium | 800.2d | 17798.7 | 51273.0 | 21061.4 | 90133.1 | 0.626 |
| Low | 1039.6d | 36360.0 | 101252.2 | 25033.3 | 162645.5 | 1.129 |

Table 3 Simulative Data about the Relationship between the Degree of Organization Matrix form and Project Complexity

| Degree of Organization Matrix form | Time of Simulation | The Implicit Workload | | | | Project Complexity |
|------------------------------------|--------------------|-----------------------|--------------|---------|---------|--------------------|
| | | Rework | Coordination | Waiting | Total | |
| High | 808.4d | 18103.2 | 44276.4 | 10524.7 | 72904.3 | 0.506 |
| Medium | 800.2d | 17798.7 | 51273.0 | 21061.4 | 90133.1 | 0.626 |
| Low | 815.1d | 16630.2 | 47875.4 | 22880.9 | 97386.5 | 0.676 |

- **Analysis on the Degradation of Project Complexity Based on Organization Centralization.**
As it is shown in the table 1, with the reduction of the degree of the project centralization, the implicit workload reduce drastically, as a result, the project complexity reduce. Besides the waiting workload has the most drastic reduction among the implicit workload while the rework workload and coordination workload have much less reduction. This can illustrate that the waiting workload will increase if the degree of the centralization becomes higher, and then it has a direct influence on the limit time of the project and its complexity.
- **Analysis on the Degradation of Project Complexity Based on Organization Normalization.**
As it is shown in the table 2, with the increase of the degree of the organization normalization, the rework workload, coordination workload and waiting workload become less, especially the coordination workload and implicit workload significantly. The coordination workload reduces by over half every time when the degree of the normalization increase and the implicit workload reduce nearly half. Therefore the project normalization can be the key measure that helps reduce the coordination workload and the implicit workload.
- **Analysis on the Degradation of Project Complexity Based on Organization Matrix Form.**
As it is shown in the Table 3, with the increase of the degree of the organization matrix form, the implicit workload becomes less. But it has less influence on the project complexity when compared with the centralization and normalization. With the increase of the organization matrix form, the rework workload increases within a narrow range while the waiting workload decrease within a narrow range. But the coordination workload becomes uncertain.

Analysis on the Degradation of Project Complexity Based on Organization Members Optimizing. Organization factors consist of team experience, functional mistakes, working experience. By simulating the project through ProjectSim software, the study compares different workload change of the rework, coordination and waiting in different conditions. Thus it can explain the process how the organization factors optimizing degrade the complexity. The data are shown as the following Table 4-6.

Table 4 Simulative Data about the Relationship between Team Experience and Project Complexity

| Team Experience | Time of Simulation | The Implicit Workload | | | | Project Complexity |
|-----------------|--------------------|-----------------------|--------------|---------|----------|--------------------|
| | | Rework | Coordination | Waiting | Total | |
| High | 784.5d | 17186.9 | 35834.6 | 18549.6 | 71571.1 | 0.497 |
| Medium | 800.2d | 17798.7 | 51273.0 | 21061.4 | 90133.1 | 0.626 |
| Low | 834.4d | 19222.1 | 72966.0 | 21160.0 | 113348.1 | 0.787 |

Table 5 Simulative Data about the Relationship between Functional Mistakes and Project Complexity

| Functional Mistakes | Time of Simulation | The Implicit Workload | | | | Project Complexity |
|---------------------|--------------------|-----------------------|--------------|---------|----------|--------------------|
| | | Rework | Coordination | Waiting | Total | |
| 0.0 | 751.2d | 6058.2 | 30515.7 | 1354.0 | 37927.9 | 0.263 |
| 0.1 | 800.2d | 17798.7 | 51273.0 | 21061.4 | 90133.1 | 0.626 |
| 0.2 | 840.4d | 27006.8 | 55351.8 | 38372.1 | 120730.7 | 0.838 |

Table 6 Simulative Data about the Relationship between Working Experience and Project Complexity

| Working Experience | Time of Simulation | The Implicit Workload | | | | Project Complexity |
|--------------------|--------------------|-----------------------|--------------|---------|---------|--------------------|
| | | Rework | Coordination | Waiting | Total | |
| High | 793.4d | 17939.7 | 47174.0 | 15812.6 | 80926.3 | 0.562 |
| Medium | 800.2d | 17798.7 | 51273.0 | 21061.4 | 90133.1 | 0.626 |
| Low | 974.9d | 18627.3 | 53318.8 | 23036.4 | 94982.5 | 0.659 |

- **Analysis on the Degradation of Project Complexity Based on Team Experience.** As it is shown in the table 4, the team experience has a great influence on the degradation. With the increase of the team experience, the coordination workload become much less while the rework workload and waiting workload decrease with a relatively smaller range.
- **Analysis on the Degradation of Project Complexity Based on Functional Mistakes.** As it is shown in the table 5, with the reduction of the functional mistakes, the implicit workload reduces drastically, especially the coordination workload and the waiting workload. When the functional mistakes become 0, the waiting workload is down to neatly none. And this illustrates those functional mistakes of project members are one of the key reason to the waiting process.
- **Analysis on the Degradation of Project Complexity Based on working experience.** Working experience varies from person to person. For the sack of convenience in analysis, the study takes the Section A of world expo AB area project as an example, where the position backlog is much more serious. It analyses how the working experience affect on the project complexity. Since there is only one position that has been adjusted, the project complexity varies within a small range. But as it is shown in the table 6, with the increase of the working experience, the implicit workload becomes less. So does the project complexity. With the increase of the working experience, the coordination workload and waiting workload becomes less.

Discussion and Conclusion

Different factors can have different effects on the project complexity. Generally logical configuration of organization structure and members can definitely help reduce the project complexity. To the contrary, the illogical configuration can increase the project complexity.

Generally, organization structure has more influence on the project complexity than organization members. This can be shown in two aspects: the degree of centralization and normalization of project organization. But organization matrix form has much less influence though it is also one of

the factors that affect the complexity. Organization members affect the complexity through the missions. Though single member has limit influence on the complexity, it can have a strong and direct influence when there is an interaction between different members. Functional mistake is the most important factor that affects the reworking workload and project complexity among these factors. Thus it is supposed to avoid functional mistakes to the greatest extent in real situations. Besides team experience and working experience can affect the complexity directly. So it is supposed to select members who have more team experience and working experience when the project team is in the initial configuration.

Analysis on the Degradation of the Reworking Workload Based on Organization Optimizing. Functional mistakes and working experience of members have a great influence on the reworking workload. Thus the reworking workload can be reduced by optimizing these two factors. As a result, the project complexity can be reduced greatly. The reworking workload depends on the demand complexity that the mission itself has. It is the rework that makes the mission complexity has more influence on the project complexity. And all these are the objective reasons to the necessary of rework. It can reduce the influence of rework externally and subjectively in two ways: reducing the functional mistakes and increasing the working experience.

Analysis on the Degradation of the Coordination Workload Based on organization optimizing. Both the normalization of organization structure and team experience have an important influence on the coordination workload. It can reduce the coordination workload between members by making the whole project standardized. Besides in terms of team experience, if the member of the project has high experience of cooperation, the coordination workload can reduce to a great extent.

Analysis on the Degradation of the Waiting Workload Based on Organization Optimizing. Waiting process is a form of wasting resource badly. There is no wonder that the limit time and cost for the project will reduce if the waiting workload reduce to the least. Objectively, it is because the former mission failed to be finished in time that the relative positions have to be kept waiting in the later mission. As it has been analyzed above, the waiting workload can reduce to a great extent if the project reduces the backlog of the relative positions. What's more, it can reduce the waiting workload to a great extent in other ways: centralization and normalization of the organization structure. And reducing the functional mistakes is another way.

Acknowledgements

This work was financially supported by the national natural science funds (70972071) and Humanities and Social Science Found of Ministry of Education (09YJAZH067).

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Advanced Building Materials and Sustainable Architecture

10.4028/www.scientific.net/AMM.174-177

Research on the Degradation of Project Complexity Based on Organization Optimizing

10.4028/www.scientific.net/AMM.174-177.2876