METHOD FOR DRAWING UP A ROAD MAP THAT CONSIDERS THE SYNERGY EFFECT AND RISK FOR IT INVESTMENT

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Abstract: IT governance lacks a comprehensive vision of investment in two or more projects. It is necessary to decide the priority levels that maximize the effects under constrained conditions. It is a complex problem, because while sometimes a greater effect can be obtained by introducing two or more measures at the same time, other times the effect of two measures introduced at the same time might not be significant. Although there is a synergy effect when two or more measures are introduced, no method for drawing up an investment-decision road map has considered that effect. Therefore, we developed one. What a decision-maker must think about when considering the introduction of two or more measures, can be visualized by drawing up a comprehensive road map that satisfies constraint conditions, such as the effectiveness of the measure, budget, time, staff size, order of introduction, and the synergy effect. Road map users can easily reach a consensus because the map, by taking into account the constraint conditions and the investment decision-making process, helps them logically explain the order in which the measures should be introduced.

1 INTRODUCTION

Managers must account for all the investments made in a competitive business environment that rapidly changes, and it is becoming increasingly important that they carefully evaluate IT investments before making them. For instance, in a recent global study of 659 CEOs conducted by the London School of Economics, only 25% expressed satisfaction with the performance of their IT investments. Most IT projects exceed their budgets and do not perform as well as expected. For example, a survey of 8000 IT projects has revealed that only 16.2% of them meet their goals on time and within budget. In addition, after considering the risks of development delays and budget overruns, managers need to think about assigning IT measures a priority level that maximizes its effect, while keeping its costs within the budget. Since IT measures must be considered in light of the prevailing business challenges, all the while taking into account the various constraint conditions, there is a pressing need to develop a method for determining the priority of measures.

When there are two or more measures to be introduced, the importance of each must be decided, the constraint conditions considered, and the most important measure introduced first. This paper explains how to make a schedule chart (called a "road map") showing the order for introducing each measure. A manager constructs this road map by first using the Analytic Hierarchy Process (AHP) to intuitively determine the importance of each measure. These determinations are based on subjective evaluations, and in this paper a measure's degree of importance is called its business challenge level, in the sense of its impact on business management. The manager then calculates the order of introduction while taking into account the constraint conditions. This can be done by using the Program Evaluation and Review Technique (PERT) . The portfolio management software, ProSight, provides a tool that manages the project execution time and budget by ordering the introduction of measures according to their importance. However, a

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greater effect might be obtained by introducing two or more measures at the same time. On the other hand, the effect of two measures might not be significant even if they are introduced at the same time. That is, there is a synergy effect when two or more measures are introduced. What's more, while some measures need to be introduced and others do not, there has been no method for drawing up a road map that takes these factors into account.

We propose a method for drawing up a road map supporting managers. A manager's investment priority levels can be visualized by drawing up a comprehensive road map that satisfies the constraint conditions. Road map users can reach a consensus because they can logically explain the order of introducing measures by considering the constraint conditions without neglecting the investment decision–making process.

2 DEFINING THE PROBLEM

When two or more measures are introduced, a qualitative effect of their introduction is converted into a quantitative numerical value. After the constraint conditions are considered, the effects are maximized by introducing the measure for which this value is highest first. Each item of constraint conditions is explained below, and the outline of the constraint condition is shown in Figures 1 and 2.

(a) Total budget:

This item is the amount of the investment budget for each fiscal year.

(b) Total staff:

The amount of human resources (number of people) available for an investment for each fiscal year.

(c) Planning period:

The period of time that the plan targets.

(d) Business challenge level:

The level of degree to which a measure contributes to the management of each measure.

(e) Introduction period:

The period of time (specified in months) allotted for the introduction of each measure.

(f) Time that measure can be introduced:

The length of time (months) during which each measure can be developed is set.

(g) Introduction necessity:

This item specifies whether or not each measure must be introduced.

(h) Introduction order:

The order in which the measures are introduced.

(i) Exclusive measure:

This item is set when only one of two or more measures can be introduced.

(j) Synergy effect:

Either a bigger effect is obtained by introducing two or more measures at the same time or, oppositely, the effect of two measures might be insignificant even if they are introduced at the same time. This effect is shown by the size of the change in the business challenge level.

(k) Introduction budget:

The amount of each item's budget.

(l) Introduction staff:

The amount of human resources (number of people) for each measure.

In discussing the management strategy, the accuracy of the estimate in the budget and the introduction period of measures are rough, and there is a large uncertainty about the future. When an uncertainty exists, the risk condition is set.

(m) Risk of introduction period:

This is the fluctuation range of the estimated introduction period (e).

(n) Risk of introduction budget:

This is the fluctuation range of the estimated introduction budget (k).

(o) Risk of introduction staff:

This is the fluctuation range of the estimated introduction staff (l).

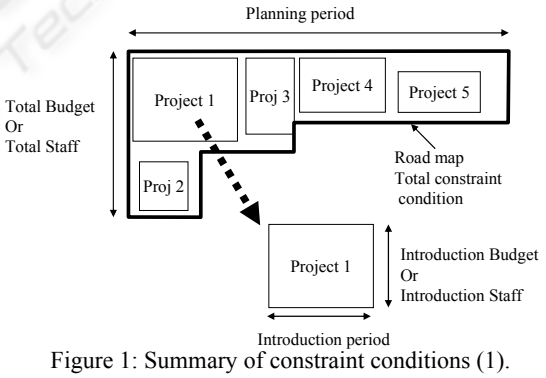

Figure 1: Summary of constraint conditions (1).

	Project 1	Project 2	Project 3	Project 4
Project 1		1 × 2		
Project 2	1 × 2		2 → 3	
Project 3		2 → 3		+5
Project 4			+5	

→ : introduction order constraint condition
× : Exclusive measure constraint condition
+ : Up Impact
- : Down Impact

Figure 2: Summary of constraint conditions (2).

3 METHOD OF DRAWING UP A ROAD MAP.

3.1 Flow of Drawing Up a Road Map

The procedure we propose for drawing up a road map is shown as follows:

(1) Setting of the business challenge level and constraint conditions:

The business challenge level is set to each of two or more measures. Moreover, a variety of constraint conditions are set.

(2) Drawing up a road map:

A road map that takes into consideration the set constraint conditions is drawn up.

(3) Showing the road map:

The drawn up road map is presented to the decision maker. When the decision maker feels odd about the road map, or there are contradictions or incompleteness with the conditions set forth in step (1), it returns to step (1) and a variety of constraint conditions are set again.

A consensus building of the parties concerned is possible by the repetition correction of the road map.

3.2 Drawing up a Road Map that Considers the Synergy Effect

The way in which the road map is drawn up is based on how the business challenge level and constraint conditions specified in Section 2 are set. Concretely, under the constraint conditions of the entire road map frame in Figure 1 (budget limits, number of staff, and the time), the frame of each measure is arranged in the order of the business challenge levels, with an eye on the introduction order and the synergy effect. The solution is calculated in such a way that maximizes the evaluation value of the road map as a whole. When we consider the frame of each measure to be composed of two axes, like those shown in Figure 1, we have the following two kinds of frames:

(1) Two-axes frame (time and budget axes).

(2) Two-axes frame (time and staff axes).

When drawing up the road map, we need to build the constraint conditions of the entire road map into each of these two kinds of frames, for each measure.

It is impossible to calculate the evaluation value of the whole road map for all cases because the computational complexity is expected to be O(n!) when the number of measures is n. Therefore, we propose a method for drawing up a road map by dividing its calculation into two steps, one calculating the initial solution and the other calculating an optimisation solution. To maximize the overall effect of the road map, the initial solution of the road map is calculated as one in which the measures are sequentially introduced in descending order of business challenge level and then rearranged to satisfy the conditions of the constraining introduction order.

Now that the introduction priority of the measures has been determined, the introduction time of the measure is determined in a way satisfying the order of the introduction priority. The earliest time is the introduction time of the measure that satisfies the conditions constraining the total investment (total budget, total staff, and planning period) and the time that the measure can be introduced. The total budget at a pertinent period is decreased by the amount of the introduction budget, and the entire staff at a pertinent period is decreased by the amount of introduction staff. A measure is not introduced when there is no introduction time that satisfies the constraint conditions. The introduction time for each measure can be determined by repeating the above steps for all measures. When the introduction time of a certain measure is decided, however, the exclusive measure of it is not introduced. The procedure described above provides an initial road map.

Next, the road map is corrected to consider the synergy effect. An example of this correction procedure is shown in Figure 3.

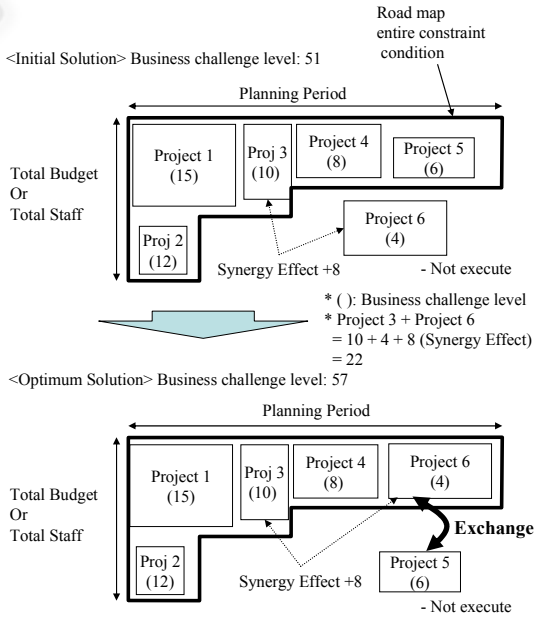

Figure 3: Correction of road map considering synergy effect.

A measure with a high business challenge level is selected from among the measures that have a positive synergy effect and are not on the road map, and that measure is inserted. At the same time, measures are pulled out in increasing order of their business challenge levels until all the constraint conditions are satisfied. Conversely, when the road map contains measures with a mutually negative synergy effect in the road map, one measure is excluded in the road map and in its space a measure that is not on the map and has a high business challenge level is inserted. When the synergy effect is considered, those measures are actually replaced when the business challenge level of the entire road map is high before the measure is replaced.

3.3 Risk

It is necessary to take into consideration uncertainties (risk) in the future with resources and/or time constraint conditions. For instance, a development delay or an over-budget of a measure can happen. To take such risks into consideration, the expected value and fluctuation range are set for items that have uncertainties. Road maps with room according to an uncertain size of each measure are drawn up, because it is preferable not to influence the entire road map, even if the development of the measure is delayed. The value in which the expected value is added to the fluctuation range is set as the value of the constraint condition, and the road map is drawn up.

4 VERIFICATION

This section explains how simpler fictitious constraint condition data than actual problem data was used to evaluate the proposed method. The result of applying the proposed method to the data described in the preceding paragraph is shown in Fig. 4, and the road map drawn up without considering the synergy effect is shown in Fig. 5.

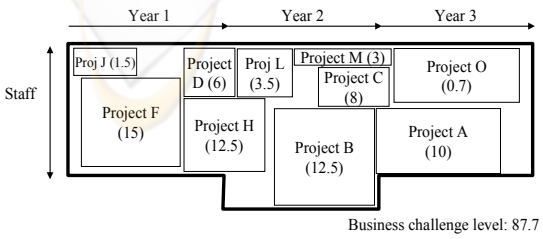

Figure 4: Road map.

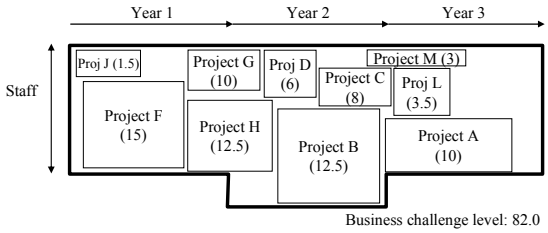

Figure 5: Road map (not considering synergy effect).

Figure 4 shows that the road map without contradictions and taking into consideration a variety of constraint conditions, such as the introduction order, can be drawn up. On the other hand, both measures G and H are introduced in Figure 5, where the synergy effect is not considered, but the synergy effect is set to a minus, and the introduction is not significant. On the other hand, measure G is not introduced in Fig. 4, where the synergy effect is considered, and a road map that is actually suitable can be drawn up. In addition, the business challenge level in Figure 4 is 87.7, while that of Fig. 5 is 82.0. This shows that a road map with a large effect can be drawn up.

5 CONCLUSION

In this paper we proposed a method for drawing up a road map supporting the investment decision-making required when the introduction of two or more measures after taking into account the constraint conditions. We also confirmed the effectiveness of the proposed method. In addition, the tool that executed the proposal method was made, and was applied to actual user data.

REFERENCES

Compass Group., 1999. International IT Survey Census. Rotterdam, The Netherlands. Compass Publishing BV.

The Standish Group., 1995. Chaos Report.

Saaty, T. L., 1980. The Analytic Hierarchy Process. McGraw-Hill.

Washington, D.C., 1961. PERT: Program Evaluation and Review Technique, Handbook, NPC-101.

ProSight, http://www.prosight.com