Using Strategy Mapping and Cause-and-Effect Relationship for Measuring ITSP Implementation

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Summary
The Information Technology Strategic Planning (ITSP) was developed to lead and reflect the organizational achievement and future aspiration. The plan basically includes the information technology (IT) goals and strategies for the next few years. The intention was to justify IT contributions towards the efficiency, effectiveness and competitiveness. The plan may comprise of associated IT projects to achieve the planning strategies. Previous study has concluded that most of the plans are usually hard to manage due to various projects involved. Therefore, many performance measurement models and frameworks have been investigated and exploited to address the problem. Measuring ITSP implementation is important to justify the achievement of the planned projects. The focus of this paper is describing the application of the strategy mapping and cause-and-effect relationship approach on measuring the achievement of the strategies and projects involved in the ITSP. This paper also report on the testing results of the related approach on the real case study to identify its applicability and measurability.

Key words:
ITSP Implementation, Strategy Mapping, Cause-and-effect Relationship, Project Achievement.

1. Introduction

The strategic planning for IT basically outlined the objectives, strategies and outcome of their plan in certain range of years. The plan can be in brief explanation or may include details of the plan implementation, the expected outcome and projects involved. Besides the plan, its implementation is another issue on justifying plan and more specific the projects achievement.

Evaluating the accomplishment of the project could assist on (i) reviewing the progress of the activities, (ii) using methods on measuring the results and accountability, and (iii) offering continuous improvement of the performance target. The measurement is important to know the efficiency and effectiveness of the IT [1]. The focus of this paper is to report the findings from the research study on applying the strategy mapping and cause-and-effect relationship approach to measure the project achievement of the ITSP implementation.

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The next section of this paper discusses on the literature background. Third section explains on the proposed framework including the usage of the strategy mapping template and cause-and-effect relationship approach. Then the fourth section describes the case study, the results and lesson learned. The final section concludes the paper and provides suggestion for future research.

2. Literature Background

In the last 20 years has witnessed a revolution in performance measurement. One of the perspectives under study is measuring the performance of ITSP implementation. The organization has indicated their strategies to be achieved within the ITSP. However, the problems arises when they fails to align the strategies with the performance measures [2] [3]. Therefore, it is difficult to obtain the actual results for measuring the performance and achievement of the effort been allocated [4] [5]. One of the related issues that need to be considered is the performance measures used for measuring the performance and how to ensure that all the strategies is achieved.

The valid performance measurement assist the organization effectively describe and implement strategy, assessing managerial effectiveness, guiding employee behavior, and provide basis for rewards [6]. Hence, various frameworks were found from the literature on measuring the performance.

Literature studies on describing project success are identified in various perspectives. Wateridge [7] reported from the literature study of the key criteria of IT project success as to have a clear agreement at early stage of project, and reviewed performance during the project progress. Besides the project manager, perspectives on time, budget and user criteria, the user perceptions of success and failure also need to be satisfied.

Nguyen [3] highlighted issues on an effective management the software development projects by applying the mapping of the development process. The process is simplified into four phases: project definition (feasibility);

requirements; design; and implementation. The used of goal-directed indicators and keys involves the mapping between the development process and decision-making of the organization. The goal-directed indicators and keys were included to justify the effectiveness of the management to the software development projects.

Turner and Müller [8] have discussed the literature review of the manager's leadership style as a success factor on projects are related to the project mission, top management support, schedule and plans, client consultation, personnel, technical tasks, client acceptance, monitoring and feedback, communication and troubleshooting.

Project Management Performance Assessment (PMPA) model was proposed by Bryde [9]. The model included six criteria for assessing project management performance: leadership; staff; policy and strategy; partnership and resources; project life cycle management processes; and key performance indicator. The PMPA model categorized the performance criteria into 'enabling' criteria and 'result' criteria. The measurements of the project management performance also considering the project life cycle, however the mapping of the strategy importance to the specific measurements is not included.

Other dimensions of project success based on the literature studies by Chan and Chan [2] was summarized as a consolidated framework. Those factors was based on the literature study conducted may be helpful to measure the performance of the project either project on progress or completed.

Initially, Balanced Scorecard (BSC) was introduced by Kaplan and Norton [10] [11] [12] as a measurement system that enables organizations to make clear their vision and strategy and interpret it into an action. Two measures were indicate in the BSC was the lead and lag indicators. Combination of both measures may produce a good BSC [12]. The lead and lag indicator are related as follows: (i) lag indicators related to the core outcomes of the common goals, that is the strategies developed and were similar across companies and industries and (ii) lead indicators is related to the performance drivers and are unique to the particular unit. The generic ITBSC allocates the question, mission and objectives of each perspective.

The shortcoming of the BSC has been note by the other authors that includes failure to recognize the importance of aspects such as human resources, supplier performance; and no specification of the dimensions of performance that determine success [13]; lead elements of the performance measures were presented but not fully developed [14]; primarily designed for senior managers to provide them with an overall view of performance and much work required to go on below the level of scorecard to provide aggregate measures [15]; the theoretical constructs do not explicitly specify which areas or factors must be considered under each of the perspectives; and inadequacy theoretical knowledge base to projects such as the project management focuses areas [16].

In recent years, the BSC has been applied to information technology in order to ensure that IT is fairly evaluated. Grembergen [17] illustrates the relationship between the business scorecard and IT Balanced Scorecard (ITBSC) which is becomes a linked set of measures to determine how business value is created through IT. The adoption of the ITBSC is still small in the academic study. The proposed idea by Grembergen [17] required further studies especially on indicating the operational and IT development performance for measuring the ITSP implementation.

Literature study on the ITSP implementation shows that measuring the performance may help to indicate and well managed the efforts and resources. Developing appropriate measures is important and will depend upon the activity to be measured. Performance measures are also intended to communicate to the organization, what is important or necessary for success, and should be developed by those responsible. The Key Performance Indicators (KPI) should be linked to strategies identified in the ITSP.

In this study the measurement of the project success refers to the perspectives of the IT infrastructure. The measurements of the KPI comprise of the five variables: hardware, software, people and skill, network and communication and procedure. The details of the study on the KPI formulation were documented separately.

3. The Proposed Performance Measurement Framework

The previous work of Fane [18], Ittner and Larcker [19], Crandall [4], Corrigan [20], Neely et al. [21], Parker [22] and Roberts [23] point out the importance to indicate the appropriate performance measures to quantify success. The performance measurement framework of Mc Gill [24], Markless and Streatfield [25], Mendonca et al. [26], and Kaplan and Norton [10] [11] [12] were the basis of the performance measurement architecture. As shown in Fig. 1, the proposed performance measurement of the ITSP implementation comprises of three main components. The components are as follows:

i. measurement modeling named as the Information technology key performance indicators (ITKPI) model,
   The model includes related measures on evaluating the project.
ii. performance evaluation as the Performance Analysis
   The analysis involves the performance evaluation process and calculation method.

iii. Performance Measurement Repository as part of the application tool.

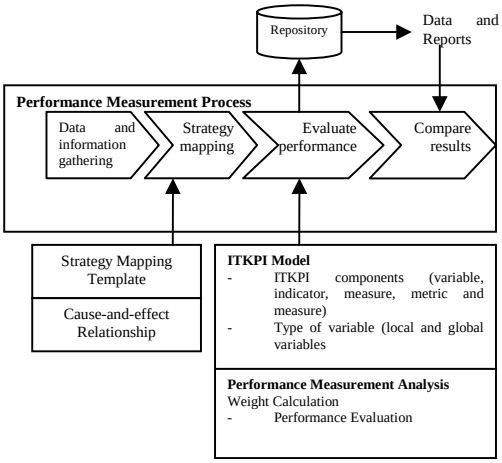

Fig. 1: PMF for ITSP Implementation

3.1 ITKPI Model

The ITKPI is separated into five types of variables: (i) software, (ii) hardware, (iii) people and skill, (iv) network and communication, and (v) procedure. The foundations of the proposed variable are based on the classification of the IT and IT infrastructure from the literature study.
Table 1 listed the indicators and metrics of each variable. All the ITKPI components may contributes to the measurement of the ITSP implementation. Therefore, ITKPI was adapted to the framework to assign the basis for the measurements.

Table 1 Variable and Indicators of ITKPI

Variable	Indicator
Software	- System quality
	- Usage and maintenance of applications/ tools
	- Project progress
Hardware	- Technology effectiveness
	- Selection and acquisition
Network and Communication	- Administration
	- Communication channel
	- Resources
People and Skill	- Personnel management
	- Communication skill
	- Customer satisfaction Training/skill development
Procedure	- Reporting
	- Policy of procurement
	- Change procedure
	- Standards and deliverables
	- Policy of management

Three important indicators may contribute to the software measurements, which are project progress, the application usage and its maintenance, and system quality. The purposes of measuring the software perspective are to indicate the criteria on (a) The contribution of the software or application used for allocating the project progress. Other software or application that was used for other software development; (b) the usage and maintenance perspectives of the system. The criteria on the system usage based on the physical size and functionality size. The system maintenance refers to the modification of its usage, technical and configuration support, and consultancy support; and (c) the system quality is measured based on its functionality support, efficiency, portability of combination, usability, dependability, reliability, and responsiveness of the system to the operational activities.
The hardware technology, usage and maintenance also may have an impact on the project achievement. The indicators for hardware measurement involve the technology effectiveness and hardware selection and acquisition. Hardware stability is measured based on the integration between different pieces of the hardware from various suppliers. This may influence the cost allocation either on the project costing or the operational activities. The availability of the hardware is also important to ensure that the project progress and services run smoothly. Selection of the qualified vendors may influence the capability to support project development and operational activities. The delivery of the requested hardware product also may gives impact to the project and operational activities.
The human related factor which includes the personnel management and customer satisfaction and skills are measured based on the training, skill development and communication skill. The personnel management are measured based on effort expanded for the project development and/or operational activities; the productivity; allocation of experience staff; the skills are matched with the task given; the changes of the team members or IT staff; level of staff motivation; level of team involvement and support; and support from the top management.
The measures used are mainly to indicate the contribution of the personnel management to the strategy achievement. The performance of the training and skill development are related to the reviews on the career paths created, training programs conducted, and recognition of achievements to the IT staff. For future improvement of the IT staff, the numbers of training courses and sessions are required for skill development. A clear career paths and job prospect reflects from the number of open positions and internal promotions created. This may gives motivation to the IT staff for career development.
Besides IT staff, customer or users are also included in measuring the project management and operational

performance. Customer satisfaction refers to the knowledge involvement, staff service and relation, and information product. The communication skill may also influence the performance based on the interactive conversation, presentations, and written correspondence. Network and communication measurements are related to the administration, resources and communication channel. The network reliability may influence the usage satisfaction and security of the data and information. The maintenance of networking is also important to ensure connectivity, reduces or minimizes the communication bottlenecks, and utilizes the network mechanism.

The resources of the network and communication measures is considering the capacity of the access points, utilizes the on-line analytical processing, and ability to transport and use application across multiple platforms. The delivery of network depends on the response time and delivery percentage of the information on-line. The coverage of the network and communication refers to the penetration in the remote areas, information sharing, access coverage, and utilizing the virtual network (if any). Others are related to the infrastructure of the resources provided which includes the type of information, user interfaces, and reusable software modules, utilize object oriented technology, and connectivity to other branch, remote or mobile offices.

Communication channel measurements are related to information rich environment, enhancement of knowledge and expertise and communication improved. The measures of the information rich environment are based on the publication of reports, information sharing, the documents created or revised, public information shared, and frequencies of website hits. The knowledge enhancement refers to the depth of the database request for information whereas the knowledge improvement is measured by the reports and information bulletins circulated. The communications in and within the organization is reflected by the number of users accessing information, recorded information request, number of documents assessable on-line, and messages frequencies using network facilities.

3.2 Performance Measurement Process

The proposed process of performance evaluation includes four main steps. The related processes are shown in Fig. 2. The evaluation process is a sequential approach and each process consists of several related activities. Each activity required the related input to ensure the outcome is generated. The detail explanations related to the performance measurement process was included in previous publication [27]. The following sub-section will explain the focus of this paper, the strategy mapping and cause-and-effect relationship concept applied.

3.3 Strategy Mapping

The strategy mapping and cause-and-effect relationship were applied to allocate the interrelationship between the strategies and variables. The representation of the mapping and the relationships are useful to:

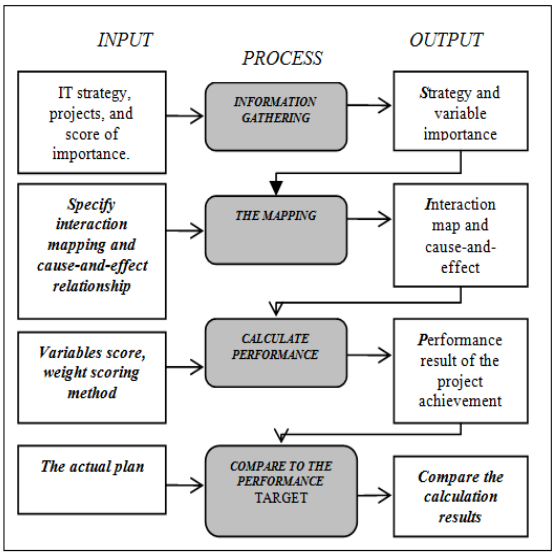

Fig. 2: Evaluation Process

i. capture the management team point of view on the related strategy, project involved and selected measures or metrics and
ii. better understanding of the interaction between the local and global indicators.

The template of strategy mapping is used to justify the relationship between the strategies and variables. The template was useful to represents the mapping of the management points of views. The completed template is then applied to the weight as the direct relationship of interaction (The weight of interaction giving double impact compared to the indirect relationship) and the indirect relationship of interaction as the weight of interaction is equal to one.

The template (Table 2) was applied to acquire a comprehensible interaction between the variables involved and to encompass a more detail of the related measurement from the organizations tactical point of view. Then the related category of measurement identified either for the project management or operational type. For this purpose, the research decides to choose the mapping concept to indicate the importance of each project to the strategy achievement.

The previous work of Kaplan and Norton [10] [11] [12], Warren [28], Kardaras and Karakostas [29], Irwin [30], and Kolkman et al. [31] have been reviewed to rationalize

the mapping concept and further illustrate the interrelationship of the variables. The mapping and cause-and-effect relationship are useful for a finer result of performance measurement.

Table 2: Strategy Mapping Template

Strategy	Project Management					Operational				
	S	H	P	N	Pr	S	H	P	N	Pr
S_1										
S_2										
S_3										
S_n										

Key: S = Software, H = Hardware, P = People and skill, N = Network and communication Pr = Procedure

3.4 The Cause-and-Effect Relationship

The variables are divided into two: the global variable and local variable. The local variables refer to the performance of the local variables influenced by the global variable. The global variables may affect the performance of the ITSP implementation on the procedures of the organization and management practice. The global variable will influence the overall performance of the variables.

The local variables are software, hardware, people and skill, and network and communication and the procedure is considered as global variable that include the organization's procedure, management policies and guidelines related to the ITSP.

The local variable is influenced by the procedure since the IT department or activities are part of the organization. Since most of the IT policies were established and bound by the agreements between the top management of the IT managers and other functional areas, so it is considered as the global variable. The difference between global and local variable is significant for the interaction mapping and cause-and-effect relationship of the proposed framework.

The general rules for working with the interaction mapping are as follows: (1) If a positive measures from A cause an increase effect in B the arrow from A to B carries a plus sign, (2) If a negative measures in A causes a decrease effect in B the arrow from A to B carries a minus sign.

The cause-and-effect relationship was applied to capture the view of the management team. The mapping contains three important features: (1) Some outcomes that are not driven by external forces, but depends on initiatives of the internal management itself, (2) The tendency of the management view on the performance of performance indicator is highlighted in the map, and (3) The measurement needs to include all the variables of the proposed ITKPI (Fig. 3).

4. Implementation

This section reports the results of the framework implementation on the case study. Concentration is given on the implementation of the related strategy mapping template and cause-and-effect relationship approach.

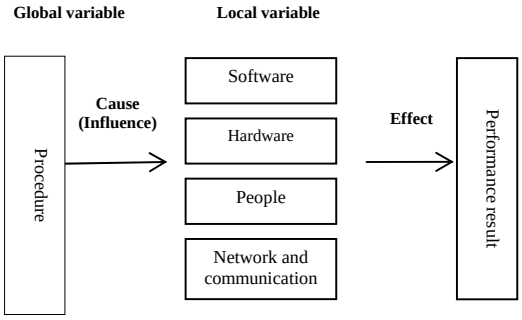

Fig. 3 Cause-and-Effect Relationships

4.1 Case Study

The selected organization is one of the Malaysian government agencies and has already implementing their ITSP. In this paper, for the purpose of confidentiality the organization named as Case X.

Case X focused their ITSP implementation on the national importance, electronic government, industry standards, information base organization, and customer satisfaction. The technique and approach applied to achieve the main focus was: a) Inter collaboration between department, unit and agency, b) Good working procedure, integrate and efficient, c) Produce product that satisfied the market, d) Fulfill the organization establishment, and e) Customer, staff and management friendly.

Case X highlighted several factors within the plan implementation. The factors are: a) the human factor, b) human resources constraints, c) ICT staff appreciation, d) ICT environment, and e) business and technology changes strategy. The business development issues and strategies were listed based on the ranking of importance and the proposed indicators of the research of the Case X. However, the study on the ITSP documentation and discussions found that the realization of the ideas is still undiscovered by Case X. The priority based on the importance will be covered in detail within the performance measurement methodology of the proposed framework.

The initiative of the ITSP at Case X is getting much support from the top management. Performance

measurements at Case X concentrates on measuring progress related to five projects. Again for the purpose of confidentiality the projects named as A, B, C, D and E.

The existing methods on measuring performance at Case X involve the project milestone. The projects performance was measured based on the existing project activities outlined by the project manager and organization's committee. The time based is one of the important factors to indicate the project progress.

However, the proposed framework may apply dissimilar approach with different measures on justifying the performance of ITSP implementation. The application of the proposed framework is hoped that the results produced from the analysis will improve the evaluation of the performance measurement on the ITSP implementation at the organization.

The existing performance measure includes the combination of performance index on the organization and community. The internal effectiveness based on the Case X's project. The project successfulness based on the target and milestone of each project is achieved. The standard operating procedure (SOP) is developed based on the working process.

The ITSP implementation of Case X involves the intention of achieving the ten strategies listed in Table 3. Each strategy statement either related to the project management or operational activities.

4.2 The Result

Case X used the performance measures to view the overall project progress such as the budgeting, project scheduling and milestone, and allocation of the team members. However, the measurement of the overall project performance for the ITSP implementation was not enclosed by the organization. The performance evaluation was made within the project management. There are no such measurement been done for the operational activities. The mapping of the strategy and related variables of Case X is shown in Table 3.

Table 3: Strategy Mapping and Related Variables

Strategy	Project Management					Operational				
	S	H	P	N	Pr	S	H	P	N	Pr
S_1										X
S_2					X					
S_3						X	X	X	X	
S_4								X		X
S_5										X
S_6			X					X	X	
S_7					X				X	
S_8										X
S_9										X
S_10										X

Key: S = Software, H = Hardware, P = People and skill, N = Network and communication Pr = Procedure

The ITKPI model and evaluation process are considered as a new approach on evaluating the project achievement for Case X. This may offer preference for the case to put into practice in the future. The project performances are between 3.3 and 3.38 out of 5. This performance score are considered average since all the project is still in progress. Table 3 shows the performance of the project involved.

Table 3: Project Performance

Project	Project Performance
A	3.30
B	3.35
C	3.31
D	3.32
E	3.38

The proposed performance variables may provides a new view of measurement for the organization on evaluating the project achievement. The proposed ITKPI gives an additional alternative for indicating the project performance. The perspectives of the ITKPI also were able to identify the limitation of the IT infrastructure and can be used as the measurement for future improvement.

To further evaluate the performance of the project involved, performance score should be given to each project involved. The calculation considers the strategy mapping and cause-and-effect relationship between local and global variable.

The results of the project performances are between 3.3 and 3.38. The results of the project performance are presented in Table 4. The contributions of the local variables are given equally for each project on the hardware and network (and communication). The procedure also contributes equally for all the projects involved. However, software and people (and skill) contribute differently to each project.

Table 4: Cause-and-Effect Relationships for Project Performance

Project	Local Variable				TOTAL	AVG	Global variable	
	S	H	N	P			Pr	Project Performance
A	2.77	3.60	3.67	3.25	13.29	3.32	3.29	3.30
B	3.08	3.60	3.67	3.31	13.66	3.41	3.29	3.35
C	2.85	3.60	3.67	3.25	13.36	3.34	3.29	3.31
D	2.92	3.60	3.67	3.25	13.44	3.36	3.29	3.32
E	3.46	3.60	3.67	3.19	13.92	3.48	3.29	3.38

Project performance can also be viewed by analyzing the contributions of each variable. The lowest performance contributed by the software which is between 2.77 to 3.46. People and skill is given in a variety score of contributions that are between 3.19 and 3.25. The contribution of the

hardware and network and communication is equal to all the projects. The results are consistent with the overall project performance.

4.3 Lesson Learned

The strategy mapping and cause-and-effect relationship may provide a better understanding to justify achievement of the implementation effort. The strategy mapping template was proposed to further encompass the tactical point of view. Besides that, the variable interaction mapping represents the influence of the performance variables to another. Furthermore, in this study, the evaluation on the project performance is specified by allocating the measurement based on the relationship between the strategies and projects involved.
Research concludes that the strategy mapping template is applicable and measurable when implemented in the real case. However, for the complex organization the calculation method may face problems when involving many projects. Using an application tool may help to manage larger data. Hence, the performance calculation process will be much easier to complete.

5. Conclusion and Future Research

The problems occurring to ITSP implementation is becoming more obvious these days. The failure of the ITSP implementation is associated with the expended resources, cost involved, time consuming with unforeseen benefits, identify the appropriate performance indicator and assigning performance based on schedule. The challenge is to indicate the ITSP performance on the implementation that had been conducted.
The failure of the ITSP establishment and implementation can be reduced by using the performance measurement framework. Literature agreed that implementation of the ITSP is essential but difficult to achieve and succeed. Various factors and constraint has been highlighted and stressed out. However, the researcher decides to focus on KPI and provides the methodologies on measuring performance and an attempt to propose a framework on measuring the performance of the ITSP implementation.
The study discovers that several recommendations can be highlighted to further improve the performance measurement framework of this research. Based on the research experiences on the case studies, performance results can contribute to the modification, improvement effort and generate a better implementation of the ITSP in the future. The following are recommendation of performance measurement and implementation of the framework.

i. Research into Applicability of the PMF to Other Enterprise Situation

Different types of organization may provide a better foundation based on the nature of business and requirements of the system and projects involved. The research can be extended to a different type of business or specifically for the same nature of business of the organization.
An implementation of the framework on a more complex case should be conducted to allocate other differences. This may contributes towards the research effort to obtain a better formulation and method when facing with a larger performance data for measuring the ITSP achievement. In a complex case which involves many projects and strategies the required performance data for the performance evaluation also become larger. In this situation, research requires more time to obtain sufficient data to measure the performance and produce the results. Hence, the performance calculation method is necessary to be reviewed. However, in this research the framework implementation main aim is to justify the applicability of the proposed framework achieved so the implementation on the case study is considered sufficient.
Strategy mapping and cause-and-effect relationship should be conducted by those people who have the ability to outline the related mapping of the organization. This means that the basic knowledge of the mapping technique is required in order to produce a better representation. The strategy mapping is then employed to indicate the relationship between variables and performance calculation. The calculation results may wrongly evaluate if the mapping is interpreted and presented dissimilarly.

ii. Develop Feedback Mechanism for the PMF

In this research the framework is applied to an organization with on-going ITSP implementation. In other words, the selected case study is measured based on the current performance from a certain implementation schedule of ITSP. Thus, it is suggested that comparing the performance result obtained with the time-based of the organizational targeted performance should be made. The framework should be applied continuously for a better performance evaluation. Moreover, with a comprehensive implementation on the case study, better result can be accomplished.
Measurement alone is not good enough. The result of the proposed and agreed measures can be improved by informing and gathering feedback from others. The management strategy map (Fig. 4) illustrates the research

recommendation on communication perspective between top and lower management within the proposed framework. The feedbacks are required to gain an agreement of the results obtained.

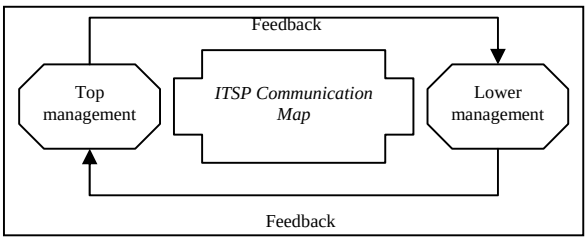

Fig. 4 Management Strategy Map

The management strategy map is significant for the following reason: (1) to communicate the findings with the subordinate. Share the findings with subordinate to identify the response and gain the acceptance level. The relevancy of the variables can be accumulated and will help to update the existing indicator for future measurements; (2) Response from both level of management can be joined together and it can contribute towards the ITSP communication strategy map. It is clear that the company strategic planning is formally proposed and developed by top management of the organization. However, bottom-up communication channel is also important. The communication channel was named feedback; (3) Update the existing indicators to improve performance evaluation. Potential indicator and metric of the variables can be extended in the future based on the organizational requirements.

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