

# Enhancing Corporate Performance Management with Performatica Application

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**Abstract**—This paper presents the use of a software tool, called Performatica, to enhance Corporate Performance Management (CPM) in organizations. CPM has been recognized as having an important role to play in the effective management of organizations. However, a number of researchers have identified that developing IT support for CPM systems can be difficult. Organization s needs clear idea of the characteristics of CPM, and clear guidelines on how to bring IT support to effective CPM. This paper demonstrates the use of Performatica constructed based on the concept of evolutionary development, data quality, and data warehousing. The feasibility and effectiveness of Performatica was evaluated in two participatory case studies at large Thai companies.

**Index Terms**—corporate performance management, data quality, data warehousing, evolutionary development approach, Business Intelligent.

## I. INTRODUCTION

In recent years, increasing criticism has been leveled against the dominance of traditional financial reports from accounting systems to measure corporate performance [1] [2] [3]. Realizing the need for an alternative to traditional approaches to corporate performance management (CPM) to inform business decisions, Kaplan and Norton (1992) developed the concept of the balanced scorecard (BSC) which advocated a new approach to strategic management, performance measurement and control. It retained traditional financial measures but added customer, internal business process, and learning and growth perspectives [4]. Recently, the CPM concept has been widely adopted and extended across a large number of industries and organization types [5]. There are a large number of efforts to develop IT support for CPM in organizations. However, several researchers have identified that developing a CPM system can be difficult, with a low success rate [6] [7] [8].

This paper describes a research project to provide a software tool, called Performatica, to support effective CPM. This project adopted the concept of evolutionary development, data quality, and data warehousing, and

used two participatory case studies at Thai firms to demonstrate the feasibility and effectiveness of the proposed tool in practice. This tool will help practitioners to increase development reliability by providing principles that limit the range of system features and development activities to a more manageable set. The user acceptance of the CPM system developed using Performatica at the client organization is evaluated using an extended Technology Acceptance Model (TAM) proposed by Davis (1989) [9].

## II. ISSUES IN CPM SYSTEM DEVELOPMENT

A review of the literature on the development of CPM systems highlights four issues. The first issue is the poor data quality of CPM system data sources. A large number of corporations have problems with data quality within their operational systems [6] [8], which are used to provide CPM systems with their source data. As a result, poor data quality in operational systems can lead to data quality issues in the CPM system. This, in turn, may have a negative effect on the overall organization performance and may event lead to CPM system failure.

The second is that a dispersed IT infrastructure providing data to a CPM system can result in a number of problems, such as a lack of data integrity between reports from different systems, difficulties in providing a single integrated view of the organization, and problematic data schemas better suited for operational data requirements, rather than management reporting [6] [8].

The third issue is the evolutionary nature of CPM systems. We propose that a CPM system is a special kind of decision support systems (DSS) (Keen, 1980). A CPM system is not only a tool for strategy implementation and control, but also a strategic management system. Just as with other kinds of DSS usage, during the use of CPM systems, users gain a better understanding of their business, allowing them to identify different measures to better reflect their organization. This requires the ability to continuously define and redefine suitable performance measures and system functionalities [7].

The fourth issue is that the complexity of the CPM system design task makes the development of CPM systems even more problematic. This complexity not

only involves the selection and definition of a practical and appropriate set of measures, but also the integration of measures with the rest of the organization and the market place [7]. Lohman et al (2004) also point out that the development of CPM systems should be understood as a coordination effort in order to develop a coherent set of shared and clearly defined performance metrics. This requires a large number of people with experience and knowledge collaborating and guiding the organization through the CPM process [6].

### III. OVERVIEW OF PERFORMATICA

According to the selection of an available CPM solutions presented in the previous section, Microsoft BI platform is adopted to develop a CPM software tool, called Performatica. This tool is a web-based application that provides easy access for business user via internet browsers. Moreover, Moody and Shanks (2003)'s data quality management framework is accommodated into this software tool to promote and ensure a good data quality of CPM systems to be developed [10]. Performatica also supports evolutionary development and multi-dimensional modeling along with data warehousing technique proposed by Kimball & Ross (2002), which are the kernel theories adopted in the design of Performatica. As mentioned earlier, Performatica is developed based on Microsoft BI Platform by using Microsoft ASP.NET 2.0 [11]. By using the Microsoft BI platform, Microsoft Integration Services is used to integrate data within the CPM source systems into the star-schema based data warehouse stored in Microsoft SQL Server Database Engine. This data warehouse is used as a data source to create OLAP cubes implemented by Microsoft Analysis Services. These cubes provide flexible data retrieval and manipulation for analysis reports, which are developed using Microsoft Reporting Services.

Microsoft BI Platform provides flexibility for add-ins to be developed and integrated into its platform. To resolve the above limitations, an add-in can be developed in a form of a web-based application to accommodate the Moody and Shanks (2003)'s framework into the Microsoft BI Platform. This add-in does not only direct support the use of Moody and Shanks (2003)'s framework, but also provides easy access for business users with a simple user interface. As a result, the Microsoft BI Platform along with the development of an add-in that accommodates Moody and Shanks (2003)'s

framework is adopted as a CPM tool to support effective CPM in this project [10].

Another reason of using Microsoft BI Platform to develop a software tool to support effective CPM involves the experience of the researcher in Microsoft's products development. As the background of the researcher that has worked as a system engineer, he has an experience in software development using Microsoft products for several years. With this experience, the Microsoft BI platform is considered to be the most appropriate. The experience is technically beneficial in conducting the development case studies in order to evaluate the effectiveness and efficiency of the proposed CPM development method. Moreover, the researcher lacks of experience in using and developing the other three CPM solutions. With a limited budget of the research, hiring external consultant to develop CPM systems using the other solutions is difficult. This is regarded as another reason for using the Microsoft BI Platform to develop a software tool that supports effective CPM.

Moreover, a wide variety of software products have been developed based on Microsoft windows technology. Many applications are supported by the later products of Microsoft. This makes Microsoft's products compatible with existing applications within organizations. Moreover, computer users around the world are familiar with Microsoft user interface such as the layout of title bars and menu to click to perform actions. This advantage makes later products of Microsoft including the Microsoft BI platform become easier to use because of the similar interface. Many organizations are familiar and may have in-house skills with using Microsoft's products. With these advantages, this can make the Microsoft BI platform can fit easily into the organizations.

Performatica is a CPM tool that does not only promote and ensure the good data quality of CPM systems, but also can be used as an interface that delivers CPM information to it users in a graphical format such as gauges and chart. Performatica also helps to link analysis reports developed using the Microsoft Reporting Services into each KPI context. This is particularly helpful in order to provide information support for CPM system users. Figure 1 presents Performatica's system architecture developed using Microsoft BI Platform.

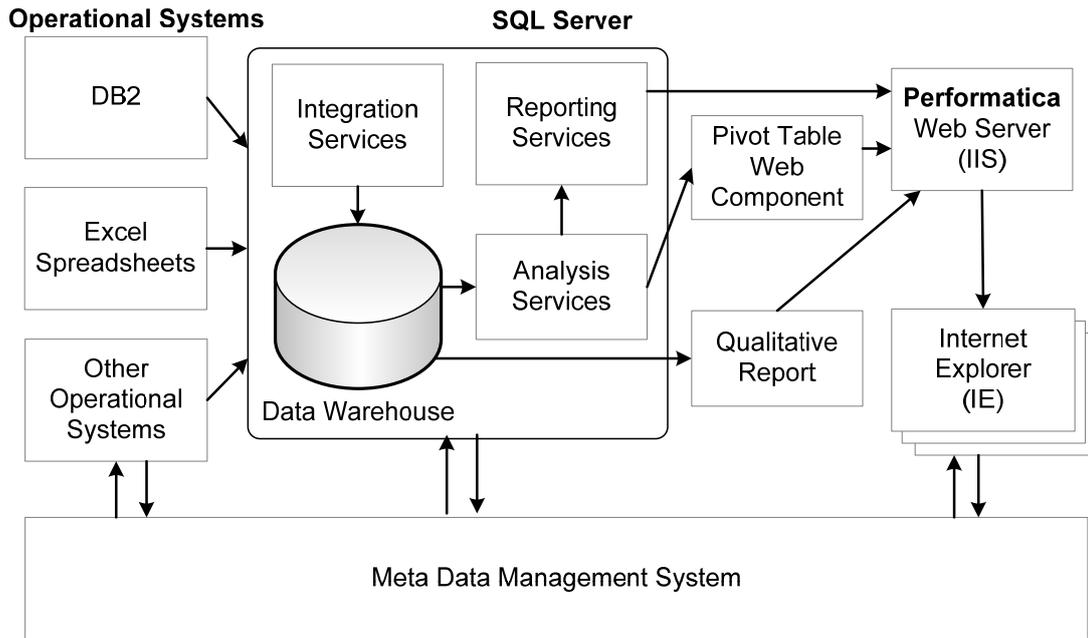


Figure 1 Performatica System Architecture

Based on the figure above, the overall process of sourcing data through to delivery of CPM information to the end user is governed by Moody & Shanks' (2003) data quality framework developed as tool for meta-data management in Performatica. In Performatica, each analysis report is linked to one or more key performance indicators (KPIs) [10]. These KPIs are displayed using graphical views such as gauges and charts. CPM system users can access this application through a standard web browser. Performatica enables an evolutionary development approach proposed by Keen (1980) by managing system components in a modular fashion, reducing complexity for developers as they receive user feedback and undergo another development cycle [12]. The tool is a developer-oriented application that helps to promote data quality and allows meta-data to be available both to developers as they work within Performatica, as well as to end users of the resulting CPM system. Developers can use the tool to create and maintain all meta-data within the CPM system, including database schemas, comments and data transformation rules. Data quality is a critical factor for the success of any CPM system, and the tool helps by providing visualisation of data definitions for each data source, destinations, error handling procedures, and validation rules involved in the data extraction processes, as well as a graphical presentation of Moody & Shanks' (2003) data quality framework. This includes the current values and statuses of each component of the framework gathered from the user's feedback. The function can help the developers to evaluate and identify issues for improving the data quality in the CPM system.

Operational source system meta-data including source schemas and copybooks can facilitate the extraction process. Staging metadata can help to guide the transformation and loading processing, including staging file and target table layouts, transformation and

cleansing rules, conformed dimension and fact definitions, aggregation definitions, and ETL transmission schedules and run-log results. This also includes the customer programming code in the data staging area. The data access tool meta-data finally can identify business names and definitions for the presentation area's tables and columns as well as constraint filters, specifications of application template, access and usage statistics, and other user documentation. Much like the resources of a library, the objective is to corral, catalogue integrate and then leverage these unrelated varieties of meta-data. Therefore, developing an overall meta-data plan including the purchase or implementation of a repository to keep track of all the meta-data is required [11]. Some screenshots of Performatica are included (see Figure 2 to Figure 4) as follows:



Figure 2 Personalized Dashboards

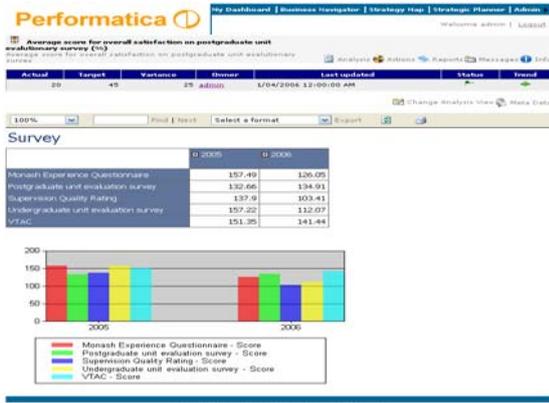


Figure 3 KPI Analyses

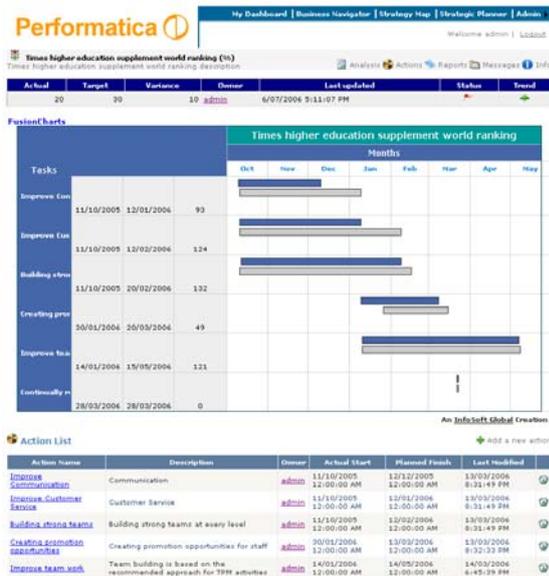


Figure 4 Collaboration Report

#### IV. EVALUATION OF PERFORMATICA

##### A. The Client Organization

ByteComp Group Company Limited is one of Thailand's leading information and communication technology companies, providing services to customers in industry and government. They provide solutions designed to meet customer's specific challenges enabling them to profit from the advanced use of technology. An interview with the person responsible for creating final KPI reports indicates the existing CPM process to be time consuming and requiring much effort. This person creates final reports but first must contact and follow up with division managers asking them to submit their departments' KPI reports. These divisional contain a summary level of performance data only in a standard

format; this makes for difficulty in tracking down errors, or to understand how the numbers are compiled. Then BSC reports are composed for quarterly executive meetings. This is time consuming and often involves human errors. As more and more data are available, these reports are also difficult for data analysis such as comparisons and trends. The company has a big document shelf for report storage which leads to retrieval problems, especially for historical KPI information, which takes a very long time to complete when asked for. Based on these requirements, the two organizations decided to engage the researcher to develop new CPM systems for them.

##### B. Theoretical Model

Technology Acceptance Model (TAM) is a conceptual model, which comprises the set of factors that influence IS use; it theorizes that perceived usefulness and perceived ease of use are the major antecedents that facilitate intention of users to use the system [13]. Perceived usefulness (U) is individual belief that using the system will enhance his/her work performance. Perceived ease of use (EOU) can be defined as individual belief that using the systems will be free of effort [14]. According to the experiment conducted by Davis et al (1989), it can be concluded that U, which can be influenced by EOU, together have a greater association with actual system use than EOU [9]. External Variables, such as tasks, user characteristics, political policy and organizational factors, are parameters that affect both U and EOU [15]. U and EOU can influence Attitude Towards (AT). Behavioral Intention to use (I), defined as personal intention, can be influenced by both AT and U. Finally; I can be used to determine the actual use of the system [16]. In this study, the TAM model has been extended to investigate the acceptance and actual use of a CPM system by examining its users' attitudes towards behavioral intention to use; this might be influenced by three major factors – perceived usefulness, perceived ease of use and social influence. The theoretical model used combines aspects of Theory of Reasoned Action (TRA) proposed by Fishbein and Ajzen (1975) with aspects of TAM in a complementary manner (see Figure 5) [17]. The model involves the social factors from TRA, appending them to TAM with the intention that the figure of determination of CPM system adoption be fulfilled. In the case of ByteComp, There were a total of 15 participants interviewed. Most participants in the review were executives and senior managers from major departments and had extensive experience in using computer systems.

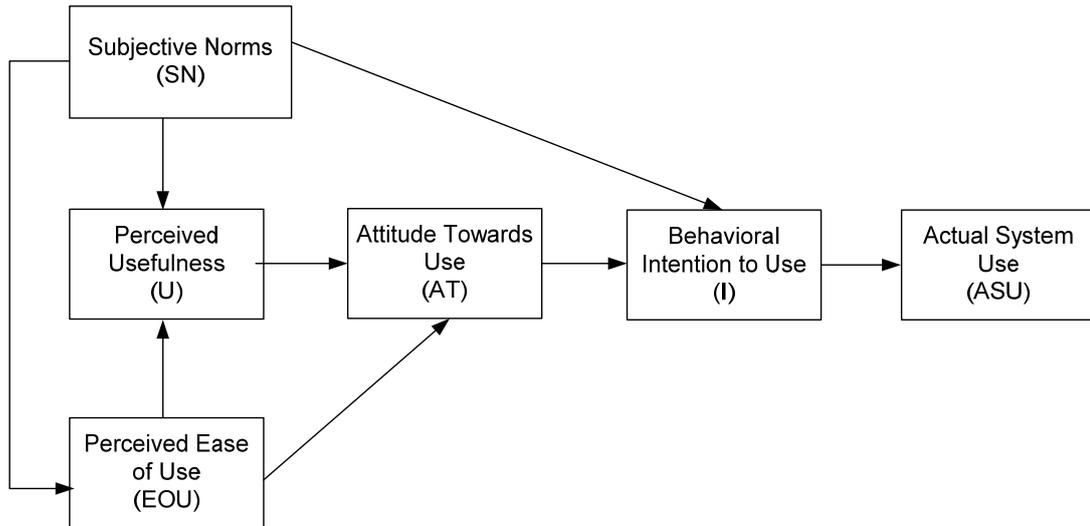


Figure 5 The Extended TAM

### C. Evaluation Design

The evaluation of Performatica involved conducting confidential interviews to investigate the success/user acceptance of the resulting CPM system. The unit of analysis of this phase is user's perceptions of the developed CPM system. An Extend TAM was used as a framework for the interview questions. Users' perceptions regarding the CPM systems developed using Performatica were canvassed. The interviews were conducted around the end of the development project and were varied in time based on the availability and willingness of each participant. Each interview was audio taped with the participant's permission for later transcribing and analysis. A draft transcript was sent to each participant by email for final approval. Participants were able to modify or delete any data that they did not wish to be recorded. An understanding of the CPM systems development method in terms of their effectiveness and feasibility was interpreted from the content and statistical analysis of the interview data obtained. The client organization and participants' identities have been masked.

### D. Result

This section presents the complex underlying belief structures of the users concerning the six constructs of the extended TAM as they pertain to Performatica. According to the interview results, the users of Performatica were at a high level of their organization. Most of them were executives and senior managers from major departments and had long-time IT experiences. Overall, users of Performatica had mainly positive perceptions of the system. Moreover, evaluation of the statistical results indicates Perceived Ease of Use to influence perceived usefulness. Users' perceptions of this technology's usefulness, together with ease of use have a significant effect on their attitude towards its use. Subjective Norms and user's Attitude Towards Use influence their Behavioral Intention to Use; and user's Behavioral Intention to Use affects the actual use of

Performatica. The following section presents an analysis of individual TAM variables and relationships among them are analyzed.

#### - Actual System Use

The result presented in the previous section showed that the Actual System Use of Performatica developed at ByteComp may vary by the functions that a particular user requires, which may range from once a day to once a month. The interview results present a positive response of the actual CPM system use variable. Performatica replaced manual paper-based KPI reporting, so enabling better information sharing and helping the organization to integrate data from several departments, an entirely new departure. A senior executive was supportive, stating, "We will use the system to analyze the performance of our department. The system can help us to report on the statistical performance for each department. This will make our reporting process to be of a common standard. It also helps us to make a query regarding KPIs more quickly and with less effort. The manager can now access information by using the system; there is no need to wait for the administrative staff to create a paper-based report. This uses much less effort and the information presented can be seen in a single pattern for each department. In addition, we can use this information for doing performance analysis, which helps us to improve our department business processes as well as creating an action plan for improving the KPI's status" (PD). Another executive user also supported, saying, "I will use it for making decisions. The system performs like a person that's responsible for integrating CPM data. So we will have more up-to-date information. In the past we consolidated this data from a large number of people. The system can help us link my KPIs with other KPIs from other departments. This will enable us to make decisions about adjusting our business strategies more effectively. The system can support us in doing this" (MG).

An executive user also provided positive feedback on Performatica claiming that the system can help in improving the CPM process of the organization. As the

executive pointed out, INDENT “In the past we did the CPM without software. However, we need this information for monitoring the results and their targets of our business performance. Performatica enables us to integrate the data from several departments quicker and use less effort, instead of asking the accounting department to create reports and submit them to me. So they can continue to work on their normal tasks but the executives can get the reports from the system at any time. The new system can help us with its flexibility so we can have the information that we want at the time we need it. We are also able to extend the capability of the system such as accessing it from home, which makes me manage my time better” (PD).

In addition to the CPM process improvement, Performatica also provided the ability for ByteComp to include a larger number of KPIs into their CPM. Thus Performatica can help the organization to manage better and reduce the time spent on gathering performance data. A comment from a senior executive user stated supportively, “Apart from the use of Performatica, I think we need to improve our list of KPIs. When we have a tool we can have more KPIs. In the past, we have been trying to keep the number minimized by selecting only important KPIs because we don't have any tool and it will be very complex and take time for the employees. This is to enable us to setup a reporting system that can report in a timely fashion. But if we have a tool, it can help us to see small parts of the organization that we didn't look at it before” (PD).

Another executive from the HR department also supported the use of Performatica, “This will be very beneficial for me especially in the certified staff report in the HR areas. The report will enable me to identify who received what certification in order to assign people to a particular project. It also includes the number of service calls made from the customers. It will help me to identify what projects currently have a problem and what suppliers provide low quality products” (PN). One of the staff believed that if the organization enforces the new policy better supportive of the CPM, system usage would be increased. This staff member opined, “Currently I still use my traditional way to access the data. However, in the future, I believe that I will move to this new system and I will use it heavily if the organization makes a policy to do so” (PM). Evidence of heavy Performatica use was provided by another user who claimed, “I will use the system to obtain information for adjusting marketing strategies. This is because there are a large number of KPIs that we use in our marketing departments which are involved with the corporate KPI, such as gross profit and revenue. The system tells us if we must adjust our strategy or what are the areas on which we should focus” (MS). Another heavy use of Performatica was evident by a comment from a user in the marketing area who asserted, “I use the system to see sales movements and status. I also use it for business plan adjustment. It consists of reports monitoring the business status, which helps us to plan for the current situation. The scale and gauges can also help us to monitor whether we are in a

safe status. If not, we can look at the details to see numbers that can help use to create action plans for improving our business status” (MG).

A number of data preparer staff claimed that they will depend on Performatica heavily. This is evident by a comment of a user who gave the opinion, “I depend heavily on the new system to report my KPI, especially the sum of revenue. In the past, I was responsible for entering data, including the plan of each department, and revenue from accounting department to create paper reports. But when the new system is in place, it will be easy for me to enter the statistical data and the system generates the charts and reports” (MK). Another data preparer commented, “In the past, we used our old excel spreadsheet. Now we have this system to help us. So every employee in this company has access to it. So I don't need to create reports and send them off one by one. The executives can access these by themselves. Overall, I think it is good” (AC).

However, a small number of users emphasized the possibility of them continuing their CPM work, if Performatica became no longer available. One of the users commented, “I think it will be difficult, but we will survive as we used to once without the computerized system. However, if you ask me, this is an advance for us. If we're moving forward why do we have to move back? This is the answer” (PD). Another user believed that, if Performatica was no longer available, employees can still go back to their paper-based CPM reporting process; however, it might be difficult to do so. This user commented, “It is not that difficult. I think we can still go back to our old process. But it's difficult in some areas such as the financial area. In the past we have to ask the accounting department for a finance report, but this system enables us to see the financial data at any time we want. This is where the system makes the CPM process easier” (MG). This is consistent with another user who said, “I don't think it will be difficult. This is because in the past we had been using the manual system for many years. But when this tool came available it will be more convenient for us to follow up the work and let the executives view the information whenever they want” (MS).

Some users also pointed to negative factors that affected system usage. One of the users claimed, “The system has a limitation in that some data is not yet integrated into the system, so I make only a little use of it” (PM). This comment is also supported by another user, “If we have more data in the system, this will enable us to see the information in a greater number of areas, which make us want to use it more. But if the system only measures at the high level, this will be less beneficial” (PS). Another user also commented, “If I can add some more little details into the system, I believe this will be very useful. It needs a little more adjustment” (CE).

The users of Performatica also believed it should be continually improved by incorporating new emerging requirements into the system. A comment by a senior executive in the TOP department supports this view, claiming, “We need continuous improvement such as

reports that need some modification. Apart from using the system for KPI monitoring, we might adapt the system for other work as well. For example, now the project management manager is using the system for project management purpose” (PS). Another executive also suggested, “What we will do here next is we will make the data input more automatic. We will try to make our operational processes more computerized. We believe the employees should work on their regular computer tasks and the data can be integrated automatically to Performatica. This is what we need as a further development” (PD).

#### - Behavioral Intention to Use

Overall, the users recorded a high level of Behavioral Intention to Use Performatica with a positive response. A large number of users recorded their intention to use Performatica for the next 6 months. This is evident by an executive user who claimed, “We will definitely continue to use CPM. This is now a policy of the company. It is similar to when we introduced the concept of BSC into our company. At first the employees do not want to use it. But after a period of the time they got used to it and we can see the benefit. Although the employees don't see many benefits, the management does. In the same way, we need to insist the data entry person uploads the data at the time frequency specified. And the data must be correct” (PD).

The results of this case study show that Behavioral Intention to Use is an important variable that determines actual Performatica use. This may suggest that users are driven to accept Performatica principally based on their intention to use the technology or individual beliefs that using Performatica will enhance their performance. This finding is consistent with the result from prior studies using TAM, such as Davis (1989) and Taylor and Todd (2001), which found the mediated effect of user's intention to actually use an information system [9] [18].

Based on the results, Behavioral Intention to Use Performatica is affected by two major factors: Subjective Norms and user's attitude towards using the technology. The results show a significant effect of Subjective Norms on user's Behavioral Intention to Use the technology. The results also show there to be a significant relationship existing between user's Attitude Towards Use and the user's Behavioral Intention to Use Performatica. Again, this finding is consistent with the findings of prior research conducted by Hsu and Lu (2004), who also found significant relationships on Subjective Norms and user's intention to use, and on the Attitude Towards Use and the user's Behavioral Intention to Use an information system [19]. Evidence supportive of the relationship between these variables is recorded by a user who claimed, “I think using the CPM system is a good idea. Personally I think it is a good system; but it also depends on other people. Everybody must use it and collaborate by keeping the system up-to-date” (SPJ).

#### - Attitude towards Use

In general, the users of Performatica positively recorded that they liked the idea of using Performatica. Although some new emerging requirements were

requested by the user to be incorporated into the system, most users perceived that the functions provided by the current version of Performatica were good enough, satisfying the users. This is evident from an executive user who claimed, “I think we need to have more reports to better support our need. But from what I have seen I think it is at a level that satisfies me. I think it's mostly completed because as the system developed we have worked on the design together” (QMR).

The results report that both Perceived Ease of Use and Perceived Usefulness significantly influence the user's attitude towards using Performatica. Perceived Usefulness has a greater effect on Attitude Towards Use than Perceived Ease of Use. This may imply that a user's attitude to Performatica is primarily based on usefulness because of the functions that Performatica perform for them. The relationship between Perceived Ease of Use and Perceived Usefulness and Attitude Towards Use reported in this study is consistent with several prior investigations such as Chau (1996), Morris (1997) and Davis (1989), which also report a greater effect of Perceived Usefulness on attitude towards use [20] [21] [9].

An effect of Perceived Usefulness on user's attitude toward using Performatica is evident by a comment provided by an executive user who stated, “Yes I think using the system is a good idea. This is because it is like a daily or weekly self-diagnosis. When the data is fed in we can see and take action on what should be done to improve our business” (MG). This is also supported by another user who commented, “Yes I really like it. I like the concept of integration. If we're in the same company, we should have the same standard. We are an IT company. We developed systems for a large number of customers. So we should have internal system that is of a good standard and hi-tech, not just manual paper-based processes” (PS). Another user claimed, “I like using the system because it enables us to see a clearer picture of the organization and improve our performance. Also it will enable us to see the problems, which allow us to resolve them and improve our performance” (TOP). The user attitude toward use is also influenced by Perceived Ease of Use, which is consistent with a comment provided by a user who asserted, “I think using the system is a good idea. It is easy to use. It also provides analytic and visual functions to identify the status of KPIs” (SD1).

#### - Subjective Norms

Overall, users of Performatica perceived themselves to be influenced by their supervisors and colleagues; a matter represented. One of the possible reasons for this is that employees at ByteComp have a culture of performance measurement in place, which has them perceive their supervisors and colleagues to be highly influential. This is evident from the quantity of feedback provided by a large number of users who believe that CPM is a management tool, mutually agreed to be used as an indicator for measuring the result of their operations based on the direction of the corporate plan, and that the management will use it for self-diagnosis of organizational performance. Another user of

Performatica further explained, “I think everybody supports its use. In this company, we discussed it quite openly, and we think it is useful. Everybody agrees, seeing the benefits of using the system. I think at the management level they are all agreed except for the data entry people who think it increases their workload. But in the long run they will feel this becomes their regular job. For the management, they will surely understand the benefits and the system will help them to complete the job easily” (PD). A number of users stated that the use of Performatica is one of the company’s policies so they are forced to use it. They also believed that Performatica will help them to standardize the CPM process, making it more systematic. This is evident from a user who stated, “It has been in our common plan for a long time since we implemented the BSC. We want it to be more systematic” (PS).

Although Subjective Norms have a significant effect on the user’s Behavioral Intention to, there are no significant effects of Subjective Norms on both Perceived Ease of Use and Perceived Usefulness of Performatica. One of the possible reasons is that since supervisors and colleagues influence the intention of the users to use Performatica, they might not provide the users with immediate support to increase the ease of use and the usefulness of the system. This is evident for one of the users who stated, “It is a company policy that I must use Performatica, but I haven’t received support from my supervisors” (MK). Another user also complained, “My supervisor does not help me with the new system, but he forces me to use it” (PM). There were also a number of complaints about Performatica since its introduction of having increased the workload, especially for the data preparer staff. But they must use it because their supervisors asked them to. This can be seen as an influence from Subjective Norms to the Behavioral Intention to Use Performatica, but not Perceived Usefulness and Perceived Ease of Use.

Evidence that confirms the relationship between subjective norms and Behavioral Intention to Use Performatica is observed from feedback given by a Performatica user who states, “I think my supervisor wants me to use the system. If I use the system I will have a way to improve my business process. This will improve the status of the corporate KPI, which impacts everyone in the organization in terms of benefits (Bonuses). For example, if we can meet our sales target, everyone will be granted benefits. So, I think my boss likes me to use it” (PD). This is also supported by a comment from one of the users who avers, “I think they want me to use the system because this system is for setting measurable targets. Senior people assign my targets or people under me are assigned targets for them; both are involved in this process. For example, the president, who influences me, monitors whether the targets are met, because he will be measured by the executive board. For my staff, they will be followed up by me in terms of numbers. So if they need to monitor their status, they need to use this system to see the numbers” (MG).

#### - Perceived Usefulness

The users of Performatica generally perceived it to be useful. The interview results present a positive response of the Perceived Usefulness variable. This usefulness is evident from a comment made by a Performatica user who found a personal usefulness factor in his ability to access historical data, compare between multiple perspectives, and seeing forthcoming trends. This user was positive about its usefulness, being very happy to have this kind of system in place.

One of Performatica users provided evidence of Performatica’s usefulness, saying, “When we have the new system, it is easy. When we have the data we can upload it to the system. If they want to see the data, they don’t need to ask me to create a new report. They can just access to the system by themselves. It’s easy at this point. The system helps us to address the issue about any conflict with the paper-based version of the report as well as preventing work to be redone” (MK). Another user also supported, “I think it is very useful for my work. First, the system can keep history of information, so everyone can access the system at any time. They also can see the past information or current data. This can significantly reduce the number of documents needed and documents to be transferred. Moreover, I can see the information from other people without calling them and asking for the reports” (AC).

One of the respondents believed that Performatica helped the organization to deal with their dispersed IT infrastructure. The user claimed, “I think it is useful. We can see the complete picture of the organization and I think that’s particularly useful. In the past we don’t have integrated data storage for KPI. So everyone was working individually. But now, the system can help in consolidating the KPI data. So there will be no need for a person to be responsible for integrating this data, which also may produce errors during the consolidation process. By using a computerized system to integrate KPI data the risk of generating errors will be reduced” (PD). This is consistent with another comment from a user in the marketing department who claimed the benefit of Performatica in performance data integration was significant, “In the past, it took a very long time to consolidate data from accounting for doing calculations before the data is ready to be presented. In the past we planned to send a report on the 5th of each month, but in the actual situation we received the report around 20th. Now, I think it is quick and the work won’t be redundant when the accounting department enters the data it’s made available and ready for use” (AF).

The PM manager believed that Performatica can help to answer business questions related to corporate performance. This is evident by a comment, “I think the system is very useful. For example, if there are questions about business performance for this month or this quarter, we can use the system to answer these questions. It also can tell us about our department performance or other statistics including statuses of each project, such as how many projects are work-in-progress, how many projects those were fined or delivered late. This can tell us how

many projects are in use and identify their statuses. In part, our existing system can answer this question at a level, but with the new system we can click via the webpage and get an answer straight away. Also my boss can view this information at the same time and doesn't need to wait for me to report" (PS).

However, there was a comment from the accounting manager who perceived little benefit from Performatica. This user was of the opinion, "There are only few benefits for me. In the financial perspective, I can see the numbers before the data is shown in Performatica. However, for other perspectives it might be useful for overall management but I make little use of it. I may use it for training and skills for KPIs. I will use it but may be not regularly" (AF).

As mentioned earlier, the issue of complexity of the CPM design task was found in this case study. It is hoped that Performatica will help the organization to reduce this complexity. One of the users claimed, "I think the system is useful. In my perspective, each department that is involved in Performatica should discuss and create a strategy map that actually reflects the business. If it does not, each department will operate in the ways that do not support each other. Performatica can be used as a tool for leading the discussion, enabling us to see the whole CPM picture of the organization" (PD).

#### - Perceived Ease of Use

In general, users perceived Performatica as easy to use. This is evident from the comments by a user who simply claimed, "I think it is very easy to use. I can access the system using a web browser, with which I am familiar. I can just use a mouse to click to view the reports. This also includes charts that help to visualize the information" (MS). A large number of users provided positive feedback about incorporating the Excel Pivot Table function that enables the performing of interactive analysis on the performance data. This viewpoint was emphasized by an executive user, "I think the system is easy to use. It is good that you picked MS Excel as a tool, which enables the reports to be presented in analytical format. This can be adjusted to be seen in multiple perspectives. Number, Chart and graphical interface are also included. In doing our Performatica, we need this important technology" (MG).

However, there were some complaints about the difficulties in filling in data into the uploading spreadsheet template. One of the users claimed, "I think the system is still complex, especially inputting the performance data. I need to input the past data at each time of uploading, which I think is redundant. So I have to maintain and copy the same data. I need to be more aware of what I enter, but if I only input new data and the system can maintain that of the past, I think it will be easier for me. I want this to be improved" (PM).

Another executive user also stated, "It can be separated into two parts. I think for me I just click and view the information, which is quite easy. But for the people who input the source data, I think it is still difficult in some parts. There is some work that needs to be redone, for example, my staff has to do it in Excel first

before entering the data into the system. Also another staff member must prepare the data for access, and then enter it into the system. If these separate functions can be linked it will be easier to use and reduce the redundant data entering process" (MG). This issue should be taken into account for any future development effort in order to improve the easier use of Performatica.

User's perception of Performatica's usefulness is significantly affected by Perceived Ease of Use. The user-friendly interface of Performatica plays a crucial role in determining user's perception of usefulness. If the difficulty of use cannot be overcome, then a Performatica user might not perceive the usefulness of the system thereby having negative attitudes towards use which consequently affects the intention to use; he or she might then totally reject use of the system.

#### E. Discussion on the User Acceptance of Performatica

An extended version of TAM proposed by Davis (1989) was employed to examine user's perceptions regarding the acceptance of Performatica [9]. This phase of the study can be regarded as a kind of 'proxy' assessment. The evaluation of Performatica's user acceptance is then used as a proxy for project success, which in turn is a proxy for the feasibility of Performatica. Moreover, the results of Phase 2 can be used to ensure that the findings obtained from the development process aligned with the user acceptance of Performatica. This also can be used to determine whether Performatica resulted in an acceptable CPM system. By employing Performatica, the user can monitor the problem, analyze its root cause and promote collaboration, which triggers system evaluation. Sometimes, this evaluation involves changes to a function; and sometimes it leads to the development of new application, which even leads to changes in organizational business processes.

The findings presented in the previous sections provide an assessment of user acceptance of Performatica developed at ByteComp. In general, the majority of users revealed positive perceptions and beliefs regarding Perceived Usefulness, Perceived Ease of Use, Subjective Norms, Attitude Toward Use, Behavioral Intention to Use, and Actual System Use in the extended TAM. Although some negative factors have been identified, the users generally provided positive perceptions of Performatica in every measure of the extended TAM. If user acceptance of Performatica can indeed be measured by using these factors, it can be categorized as an acceptable system by the users. In examining users' perceptions and their beliefs, the evidence provides an explanation of continued and growing user acceptance of ByteComp's CPM system. The users perceive that Performatica is useful and easy to use, and they will not hesitate to use it when the chance arises. This Attitude Towards Use and the Subjective Norms can influence Behavioral Intention to Use of Performatica. This indicates why the Performatica development has had an increasing Actual System Use when corporate performance is measured. This in turn increased their individual work performance and positive organizational impact at ByteComp.

This study has shown that the extended TAM is a useful theoretical model in helping understand and explain use behavior of Performatica. The extended TAM has proved to be of quality and to yield statistically reliable results. By gathering user perceptions of the CPM system's usefulness, ease of use and subjective norms, designers can more accurately determine whether the CPM system will be accepted or rejected by users. Due to the benefits of the extended TAM that is of low cost and easy of application, designers could gather data at various points during the system development process. The attitude of users towards the system can be monitored as it moves through the development life cycle, ensuring it will be accepted after it is completely developed.

Although the extended TAM can be used to determine a user's intention to accept or reject a CPM system by suggesting that the system's usefulness, ease of use and social influence are important influential factors, it cannot give advice on how to improve the system in order to increase the degree of system acceptance. For example, TAM may predict that a CPM system would not be used because the potential users believed the system is not useful; however, it cannot tell designers what to change to increase usefulness. Likewise, while TAM indicates that a CPM system is difficult to use, it cannot tell designers what would make the system easier to use.

If user acceptance can be measured in terms of the factors proposed by the extended TAM, then Perceived Usefulness, Perceived Ease of Use, Subjective Norms, Attitude Towards Use, Behavioral Intention to Use within the extended TAM are reasonable predictors of Actual System Use. It is believed that these factors are also positively influenced by Performatica employed by the development team of the system. As noted previously, the development process has generated a perception among users that the system produced by the designer will be useful and easy to use, which positively impact on the attitude towards use. The Attitude Towards Use and Subjective Norms variables will influence the Behavioral Intention to Use of the system. This then positively increases the level of Actual System Use of Performatica. If the users do not perceive the system to be useful and easy to use, or perceive a low level of subjective norms, the system will evolve and soon become useful. Therefore, it can be predicted that user acceptance of Performatica will remain as long as the perception and belief of the users regarding the independent factors in the extended TAM are maintained through the Performatica development activities.

In evaluating Performatica, the findings from the development process of the Performatica investigation show that the development method employed was both effective and feasible at the client organization. Moreover, the users of Performatica recorded positive perceptions, concerning the system acceptance of the developed CPM system; these mirror the findings obtained from the development process. Using data quality and data warehousing approaches with an evolutionary

development method, the CPM system provides better subjective norm, perceived ease of use, and perceived usefulness. This leads to more attitudes toward use and intention to use, which later positively impact on actual use of Performatica. Thus, it can be argued that Performatica has passed through the evaluation process of the design-science research method successfully, in spite of the number of issues raised and negative feedback from the ByteComp case. These issues and feedback were used to revise the Performatica to provide positive revisions in CPM systems development.

## V. CONCLUSION

Using Performatica to support effective CPM often results in a highly acceptable system. This case study has demonstrated the feasibility and effectiveness of Performatica in an actual development project. A number of practical issues of concern, and feedback obtained from the evaluation process will be used to improve Performatica in the future.

CPM is a key organizational issue, but one that has had mixed results for the IT industry. The development of Performatica to support effective CPM to help solving the issues of data quality, data warehouse design, and evolutionary development, and Performatica to facilitate that evolution as well as reducing the technical complexity of the task will hopefully improve the IT industry's track record in CPM systems development.

## VI. ACKNOWLEDGMENT

This work has been done exceptional thanks to committees of TOT Public Company Limited and Sripatum University. Without their guidance and support, this study would not have taken its current form, nor would it have come to completion. Foremost, I would also like to thank the people in the school of Information Technology for their support. And thanks also to the Dr. Wasuwath Pongkachorn Dr. Tau-Tong Pungsuwan and Asst. Prof. Dr. Ratchadawan Nimmual for making some useful comments on both the concept of the evolutionary approach and a draft of the paper.

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