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How User's Participation in Feasibility Study Enhances Use of Business Intelligence Systems

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Abstract

Business Intelligence (BI) system is a strategic tool that presents an analytical perspective about business and external environments. Even though its strategic value was well known, users often avoid using it or adopt it ceremonially. In fact, over 50 per cent of BI projects worldwide are reported to end in failure. Such an unexpectedly lower success rate has been a key issue in BI studies. In order to enhance a proper use of information systems, MIS field provided a number of theoretical constructs. One example is Goodhue & Thompson's Task-Technology Fit (TTF). In addition, internalization, the degree to which people make their own effort to modify behavior, was recently suggested as another important determinant of use. Though in MIS community both TTF and internalization proved to be a key determinant of system use, there has been not much study aiming to discover antecedents influencing these constructs. In this study we assert that user participation should be highlighted in BI projects. Especially, we emphasize user participation at the phase of feasibility study that is mainly conducted to determine whether a BI system is essentially necessary and practicable. Our research model employs participative feasibility study as a major antecedent for TTF and internalization that consequently will lead to user satisfaction and actual use. This model was empirically tested on 121 BI system users. The result shows that user participation in feasibility study is positively associated with TTF and internalization, each being related to user satisfaction and system use. It implies that, if an organization has BI users get involved in strategic feasibility study phase, the BI system would turn out to fit users' tasks and, furthermore, users would put more efforts spontaneously in order to use it properly.

Keywords : Business Intelligence, User Participation, Feasibility Study, Task Technology Fit (TTF), Internalization

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1. Introduction

Today's companies need to respond quickly to changes in business environment. Quick response requires analyzing swiftly much information about business and external environments. Their need is often realized through an introduction of analytics-oriented information system. We call this type of system Business Intelligence (BI) system [Davenport et al., 2010; Olszak, 2014; Popovic et al., 2014]. It is defined as information system that enables users to obtain a variety of insightful business information through the application of analytic techniques.

The demand for BI system is quite overwhelming. In fact, BI has been one of Gartner's top technology priorities for chief information officers (CIOs) for the last 10 years or so. That is because CIOs have discovered an opportunity to empower end users with insightful information and furthermore to convert IT from a cost center to a competitive enabler [Rossi, 2012]. Accordingly, many firms have actually deployed BI systems. Accenture's 2014 survey indicated that 64% of firms worldwide have ever pursued BI or big data projects in order to seek a strategic goal [Accenture, 2014]. And, according to IDC, 37% of Asia Pacific manufacturers are using BI systems for lower cost, higher productivity, and more attractive new customers.

Such prevalence of BI projects does not necessarily denote their success. Many BI projects are reported to end in failure and a number of BI systems deployed are left unused. [Chaudhary, 2004; Howson, 2008; Isik et al., 2011; Schick et al., 2011; Watson and Wixom, 2007]. Nonuse was indicated as one of major problems with BI systems [Yates et al., 1996; Benbasat and Wang, 2005].

To increase the chance of BI success, quite a number of BI studies have been conducted in recent years. Some studies emphasized characteristics of the system such as the quality of the system or the quality of information stored in the system [Popovič et al. 2012; Popovič et al. 2014; Gonzales, 2015]. And, behavioral attitudes of managers to use BI system were also investigated [Chang et al., 2014; Wang, 2014; Chang, et al., 2015]. Besides, organizational capability to utilize BI system was also found as a key factor [Watson and Wixom, 2007; Isik et al., 2013; Wang et al., 2014; Foshay et al., 2015; Sangari and Razmi, 2015].

All of the above mentioned factors belong to implementation or post-implementation variables. That is, the previous studies have attempted to discover what an effective BI system ought to look like, what kind of attitudes a manager ought to possess in order to use the deployed BI system effectively, and what capabilities an organization ought to retain in order to get much benefit from the utilization of the deployed BI system.

The distinctiveness of BI may require a different point of view. BI system is entirely different from operational (or transaction-oriented) system. Transaction processing system is a task-execution tool that operational workers have to use in order to conduct their day-to-day operation. In this sense, the use of transaction processing system is close to mandatory. In contrast, BI system is close to discretionary or voluntary use [Lynch and Gregor, 2004]. Some users may just avoid using it on the excuse that the deployed BI system does not fit their decision-making style or task requirements.

Therefore, for a successful BI system it is more critical for us to address, instead of rushing into development of BI system, an issue of whether a BI system is ever needed to our organization. Such a pre-development decision is generally made at feasibility study phase where we evaluate whether a proposed solution meets organizational needs truly. The proposed solution, in order to lead to actual implementation, must be feasible in all three principles of operational, technical, and economical practicability [Kendall and Kendall, 2014].

In information systems field, it is widely known that an involvement of users in system development has many advantages. Mumford [1983] and Hirschheim [1983] indicated that a participative system design approach enables users to acquire design knowledge and competence and exert control over the goals throughout the process, therefore leading to the development of a user-friendly and effective system. Benefits of participatory design were also identified in many of follow-up studies [Hirschheim, 1985; McKeen, et al., 1994; McKeen and Guimaraes, 1997]. In the same manner, it can be asserted that user participation in feasibility study would help to assess accurately the feasibility of BI system in question.

Provided that a clear and thorough assessment about BI system was ever made at the phase of feasibility study, it would be less likely that the BI system deployed are left unused. This study aims to investigate how participative feasibility study comes into play in BI projects. To be more concrete, we are going to examine impacts of participative feasibility study on both the appropriateness of BI system to be developed and the commitment of user to the BI system and, moreover, impacts of these factors on the satisfaction and use of BI system.

2. Related Work

2.1 Business Intelligence

Business Intelligence (BI) is a strategic process that turns data about business and external environments into insightful information. Owing to the increasing complexity of business environments and the continuous emergence of new analytic techniques, an enterprise is more likely to rely on BI system in order to better understand its business and make timely business decisions [Chen et al., 2012]. In fact, BI was ranked as one of the top priority applications in many field surveys [Luftman and Ben-Zvi, 2010; Gartner, 2011; Accenture, 2014].

The popularity of BI attracted many researchers' interest [Jourdan et al., 2008; Chen et al., 2012]. There have been a number of BI studies. These studies can be classified into two areas: BI-related techniques/applications and BI-related management strategies. The former type of research mainly aims to first introduce techniques such as BI algorithms and development methods [Chaudhuri et al., 2011; Anandarajan, et al., 2012; Chen et al., 2012] and to propose fresh application areas of BI such as e-business, CRM, and performance management [Gessner and Volonino, 2005; Chen et al., 2012; Yeoh et al., 2014]. As a result, a number of ingenious techniques became readily available for BI systems in many different domains. However, despite the prevalence of BI-related techniques, there are not many reported BI cases that successfully have brought positive results [Clark et al., 2007; Jourdan et al., 2008]. One major reason behind unsuccessful BI projects is that they neglected a business perspective and instead focused too much on technology itself [Yeoh and Koronios, 2010].

Accordingly, the other type of BI research attempted to look into BI-related management strategies. A number of success factors and management considerations have been compiled from this type of BI research. First, some researchers considered characteristics of BI system or information as a key factor. Wixom and Watson [2001] found that both system quality and information quality were associated with a high-level of perceived benefit from BI system. In Popovič et al.'s study [2012; 2014], however, only information quality had a direct influence on the use of BI while system quality did not. And, Gonzales et al. [2015]'s study showed that the use of BI system is directly related with none of system, information, and service quality.

Second, individual attitude or style was also investigated. Chang et al. [2014] discovered that managers regard BI-providing information as being useful but tend to delegate report-creating tasks to IT or subordinate personnel instead of doing for themselves. While emphasizing that BI usage intention can be divided into reading information, exchanging reports, and creating reports, Chang et al. [2013] identified that the intention to read information has a positive influence both on the desire to exchange reports and the intention to create reports. Furthermore, they suggested that a variety of reward be provided in order to reinforce BI usage intention. In Wang's study [2014], it was managers' involvement characteristics that determine whether managers actually implement BI systems in their organization. In the same vein, Seah et al. [2010] emphasized that a committed leadership style of managers may be an essential factor for effective BI exploitation.

Third, organizational capability was found to be a factor of great importance. In Isik et al. [2013]'s study, technological capabilities such as data quality, user access, and the integration of BI with other systems were found to be more important to BI success than organizational capabilities such as flexibility, shared risks and responsibilities. While identifying three types of technological, organizational, and human capabilities, Foshay et al. [2015] provided a comprehensive framework to assess BI capabilities. Sangari and Razmi [2015] found that BI competence comprising managerial, technical, and cultural competence is a key enabler of business agility.

Most of factors covered in the above BI studies are closely related to issues of what to do during or after the implementation. With BI system, a concrete feasibility study prior to the beginning of implementation would be more important. Whether to use the deployed BI system or not would depend much on how users perceived the feasibility of the system at first. Some users just tend to avoid using it on the excuse that the deployed BI system does not match their decision-making style or task requirements. It would be better if a less feasible BI system proposal had been excluded from further review.

2.2 Participatory Design

In the traditional approach to the design of computer systems, technical people used to take care of almost all design tasks. This technician-oriented approach, which treats people as adjuncts to machine [Mumford, 1983], has come under heavy criticism for an unfulfilled need of users and a much resistance from users.

Participative system design is an involvement of users in system design. Users are involved in the process as a team with technicians to perform design activities and exercise control over their own socio-technical environments and design outcomes. This approach was supposed to provide many benefits. It allows users to control their own interests, to identify more with the system, and to acquire related user skills and knowledge [Hirschheim, 1983; Mumford, 1983; Hwang and Thorn, 1999].

Ives and Olson [1984] have identified two areas of theory behind user participation. First is participative decision-making theory [Locke and Schweiger, 1979] that aims to increase inputs of subordinates into management decision for increased job satisfaction and improved productivity. The theory of participative decision-making, which user involvement can be viewed as a special case of, forms a basis for improved quality of the system. Particularly, the quality of the system can be improved by increasing user's understanding about the system or user requirements or by avoiding development of unimportant or unfeasible features [Ives and Olson, 1984]. Planned organizational change is the other area of theory. With a view that success of the system highly depends on the quality of the implementation process, this theory emphasizes *substantive participation*, which can induce attitude change and furthermore organizational change, such as a joint effort or negotiation [Ginzberg, 1979; Zand and Sorensen, 1975].

Based on the theory of planned organizational change, Mumford [1983] stated three principles of participative system design. First, because participative system design allows users to be able to exert control over the system to develop and the process to develop the system, users will be able to reduce personal uncertainty and secure an ordered future for themselves with regard to system development. Second, because more than one interest group are involved in participative system design, conflict of goals between different groups have to be reconciled on some common objectives. Third, since participative system design requires design competence to exert control and order in design activities, a learning process should be involved.

A number of studies were made to empirically evaluate effects of participative system design. However, contrary to many people's expectations, empirical studies on participative system design do not always provide positive results. While several studies have found positive relationships with user involvement and system success measures [Swanson, 1974; Alter, 1978], others have found mixed or inconclusive results [Hedberg, 1975; King and Rodriguez, 1981; Ives and Olson, 1984; Hirschheim, 1983].

In an experiments whose subjects were part-time MBA students with more than 5 years of business experience, King and Rodriguez [1981] showed that participation in the development of the BI system has some effect on the attitudes of participants such as their perception of the worth of the system but has no effect on the amount of system usage. In their review of 22 studies that had examined the link between user involvement and system success measures, Ives and Olson have found that only eight demonstrated a positive relationship and the rest showed a mixed or negative results.

Why did not the expected come out? A number of studies were made to give an answer to this question. Anderson [1985] emphasized that, because user involvement is a complex phenomenon [Hirschheim, 1983], it may produce far different results depending upon managerial actions to be taken. For instance, in order for participatory design to be meaningfully contributing, users should have enough knowledge and experience in related technology domain and an organization should be willing to accept conflicts and time delays associated with user involvement [Anderson, 1985]. McKeen et al. [1994] showed that the relationship between user participation and user satisfaction varies with contingency factors such as task complexity and system complexity.

Conceptual differentiation has also been made in several studies. Contending that participative design is a wider concept than user involvement, Hirschheim [1985] emphasized the leading role of users in the development process. Going further, Hedberg [1975] claimed that participation is not enough and users must be powerful enough to exert influence on system development. User influence, rather than participation or involvement, was confirmed to be the key component in influencing system outcomes by Lynch and Gregor [2004].

Moreover, a few researchers criticized an underlying theme of participative system design. Kraft [1979] and Ehn and Sandberg [1979] argued that involving users in system development is too late because by that time key system development decisions had already been set up. In this situation, there would be not many alternatives to users, except for keeping shy or being indoctrinated by the system people [Hedberg, 1975]. In this sense user participation in system development may be undemocratic and useless [Kraft, 1979; Ehn and Sandberg, 1979]. Instead, user participation should be initiated from the feasibility study phase in which whether or not to introduce technical change is determined [Mumford, 1983]. This view was confirmed by McKeen and Guimaraes's study [1997] that identified user's being a member of the project team for feasibility as one of most beneficial participative behaviors.

3. Research Model and Hypotheses

With BI, it is important that impracticable BI system proposals should be screened from the beginning. Such screening ought to be made at the feasibility study phase. Furthermore, because users are ultimately accountable for the elimination of unfeasible BI system proposals, users will tend to more actively take part in feasibility study discussions. We claim that this participative feasibility study plays some positive roles in many ways. The objective of our paper is to investigate how user participation in feasibility study contributes to the acceptance and use of BI system. To this end, we provide a research model that rests on several theories including user participation theory, task-technology fit theory, and psychological ownership theory.

User participation theory states that user participation in system development will produce better system outcomes [Mumford, 1983; Hirschheim, 1983; 1985]. Hirschheim [1983] provided several arguments for this positive effect: 1) allowing individuals to protect the interests of users, 2) to redesign their work and working environments, 3) to control activities in the process, 4) to identify more with the system, and 5) to acquire skills and knowledge associated with the solution. To sum up, Mumford [1983] understood the desirability of participatory design as the following two: 1) the controllability of users and 2) an enlarged learning opportunity of users.

However, whether to involve users in system development or not is probably not so important [Hedberg, 1975; King and Rodriguez, 1981; Ives and Olson, 1984; Hirschheim, 1983]. The important thing would be when to begin to involve users. A number of studies [Hedberg, 1975; Kraft, 1979, Ehn and Sandberg, 1979] have shown that user participation in system development phase may be useless because by that time key design decisions had already been set up and, as a result, users have no opportunity to influence or control the system development process [Adams, 1975]. Instead, they emphasized user participation in feasibility study phase in which to determine whether organizations ever need BI system [McKeen and Guimaraes, 1997]. In this context, we regard participative feasibility study as a key antecedent variable.

We assume that fundamental principles of user participation theory will be also applied at the phase of feasibility study. Participative feasibility study enables users to control the feasibility study process by providing their own needs without reluctance, examining solutions to better meet the needs, avoiding unnecessary or unacceptable features or solutions, and proposing their work redesign ideas, if needed [Locke and Schweiger, 1979; Ives and Olson, 1984; Kendall et al., 2014; Segar and Grover, 1998]. As a result, they are more likely to come up with a solution proposal with a good fit between task and technology. This logic leads to our first hypothesis.

Hypothesis 1: The more the users participate in feasibility study, the higher task-technology fit solution they will formulate as a result.

For the same reason, participative feasibility study is assumed to enable users to identify better with the solution proposal and to have more opportunities to learn and acquire related skills or knowledge [Mumford, 1983; Hirschheim, 1985;

Kendall et al., 2014]. Better identification and more learning opportunities have been a matter of importance in technology adoption. While challenging the intention-to-actual usage linkage that has rested on Fishbein and Ajzen [1975]'s logic that intention is the immediate determinant of behavior, Bagoozi [2007] claimed that a variety of group or social behavior or actions can occur between intention and actual usage decision. One such action is internalization, which refers to accepting influence because the induced attitudes and behaviors are congruent with individual's own values [Kelman, 1958]. That is, individuals tend to accept the practice and become committed to the practice when they view the practice as valuable [Kostova and Roth, 2002]. This internalization occurs through a number of processes such as education, training, and indoctrination [Bagozzi, 2007]. The second hypothesis is formulated from these theoretical basis.

Hypothesis 2: The more the users participate in feasibility study, the higher chance they arrive at the state of internalization.

A number of user participation studies were made on a premise that a positive relationship exists between user participation and system success [Baroudi et al., 1986; Straub and Trower, 1988; McKeen et al., 1994]. Alter [1978] has found that, when the system project was not initiated by users, users more likely resist the introduction of system. In other words, for a system project that was not confirmed as feasible by users we should not even make an attempt to develop it.

Hypothesis 3: The greater the users participate in feasibility study, the higher chance they come to use the system.

Using organizational contingency theory and cognitive cost/benefit research, Goodhue and Thompson proposed a concept of task-technology fit (TTF) to better understand the linkage between technology and system success [Goodhue and Thompson, 1995; Goodhue et al., 2000]. An underlying theme behind TTF theory is the assertion that for technology to be used effectively, the technology must be a good fit with user tasks it supports. However, TTF may not assure system utilization if the system is not mandatory [Goodhue and Thompson, 1995]. Voluntariness is a necessary condition in order for TTF to be activated [Moore and Benbasat, 1992]. Because use of BI system is rather voluntary, two essential arguments of TTF theory, higher TTF solution leading to an increase in not only system satisfaction but also system utilization, are expected to work on this study.

Hypothesis 4: The more task-technology fit solution users will formulate, the higher chance they come to use the system.

Hypothesis 5: The more task-technology fit solution users will formulate, the higher chance they become satisfied with the system.

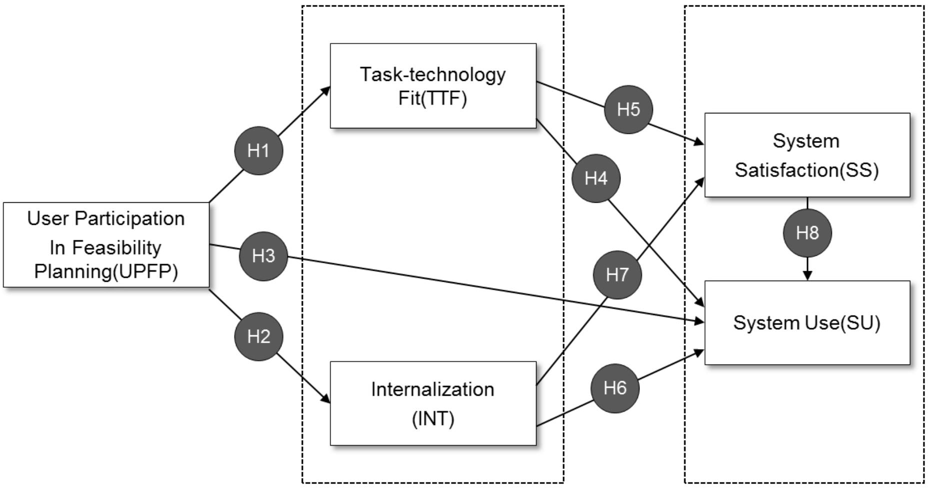
Institutionalization theory and psychological ownership studies have considered *internalization* as an important variable in many organization studies. For instance, knowledge transfer between multinational corporations and their subsidiaries [Kostova and Roth, 2002], deployment of quality management programs [Nair and Prajogo, 2009; Tari, et al., 2012], and knowledge practice such as customer relation nship management (CRM) [Chen and Wang, 2006] are good examples. We understand the internalization as a process through which value is given to new work practice and psychological motivation for the new work practice is attached to individuals [Berger and Luckmann, 1967; Deci et al., 1985]. For new work practice to be institutionalized within an organization, adopter's subconscious has to bear objectives of the new practice [Wuthnow et al., 1984; Joshi et al., 2007]. At this very stage, individuals would become more satisfied with the new practice or information system and become true, not ceremonial, adopters [Kostova and Roth, 2002]. By the same token, users with a higher level of internalization through more commitment in BI-related learning practice are probably more satisfied with the BI system and come to use more of the system.

Hypothesis 6: The more users arrive at the state of internalization, the higher chance they come to use the system.

Hypothesis 7: The more users arrive at the state of internalization, the higher chance they come to satisfy the system.

In addition, it is quite natural to assume the positive relationship between system satisfaction and system use. This relationship has already been proved in many previous studies including TTF research [Goodhue and Thomson, 1995] and IS success model [DeLone and McLean, 1992].

Hypothesis 8: The more users satisfy the system, the higher chance they come to use the system.



〈Figure 1〉 Research Model and Hypotheses

4. Research Methodology

4.1 Sample and Procedures

A survey method was used to test our research model. The samples were solicited from people who participated BI seminars run by a BI related industry association of Korea. The questionnaire was delivered to the participants through email. On the cover page, we mentioned that only those who are/were a BI user and ever participated at the stage of planning for BI system are requested to answer. Their response were collected through email between March 2 and April 30 in 2015. A total of 133 responses were collected and 12 incompletely answered ones were removed from further analysis.

<Table 1> shows the industry area that the respondents belong to. It appears that their industry areas are well mixed, including IT and telecommunication industry (29%), manufacturing industry (28%), and finance service industry (19%).

〈Table 1〉 Demographic Characteristics of the Sample

Demographic variable	Sample Composition (N = 121)
Industry	
Finance	23(19%)
Manufacturing	33(28%)
Distribution and Logistics	8(7%)
IT and Telecommunication	35(29%)
Service	13(11%)
Public service	3(3%)
Others	5(4%)

4.2 Measurement

To ensure content validity of the scales, we mostly used previously tested question items and modified some for our own use. <Table 2> summarizes their definitions and sources.

〈Table 2〉 Definition of Constructs

Construct(abbreviation)	Definition	Authors
User Participation In Feasibility Planning (UPFP)	The degree to which users control the feasibility study process is measured in the 5 items: 1) Alignment: Whether the linkage between the IS strategy and business strategy was sufficiently reflected? 2) Analysis: Whether a concerted effort was made to better understand the internal operations of the organizations? 3) Cooperation: Whether a sufficient cooperation was attained in reaching agreements concerning development priorities, schedules, and role & responsibility? 4) Improvement in capability: Whether a participation in planning improved your capabilities to support the organization? 5) Contribution: Whether a participation in planning contributed to the effectiveness of the BI system?	Grover and Segar [2005]
Task-technology Fit (TTF)	The perception that the BI System capabilities match with the user's task requirements	Goodhue and Thomson[1995]
Internalization (INT)	The degree to which user tends to accept the practice when he views the practice as valuable and becomes committed to the practice	Nair et al.[2009], Kostova[2002], Tari et al[2013], Venkatesh et al.[2000]
System Satisfaction(SS)	User's level of satisfaction with the BI systems.	Chung-kuang Hou[2012]
System Use(SU)	The degree and manner in which user utilize the capabilities of the BI systems.	Davis et al.[1989]

The questions for measuring user participation in feasibility planning were adopted from items that Segar and Grover [2005] used in measuring the level of user participation in feasibility study. We borrowed task-technology fit items from Goodhue and Thomson [1995]. Only the items with respect to users were included while IT engineer-related items such as the relationship with users were not. The selected instruments are currency, right data, right level of detail, locatability, meaning, authorization, compatibility, timeliness, system reliability, ease of use. We adopted the items for users and do not consider items for IT engineers such as the relationship with users items.

There are no established measures available for internalization in information system. Thus, we developed the four-item scales based on Nair et al.'s [2009] quality management constructs. The item of documentation, a key component in quality management program, was excluded in our study. Moreover we adjusted them to suit the BI context, using the ideas of Kostova [2002], Tari et al. [2013], and Venkatesh et al. [2000].

The measures of system use were adopted and combined from most widely quoted previous studies [Davis, 1989; Hartwick and Barki, 1994; Igbaria, Guimaraes, and Davis, 1995; Leidner and Elam, 1993; Mathieson, Peacock, and Chin, 2001; Venkatesh and Davis, 2000]. Frequency of use, duration of use, and extent of use by the individual were chosen.

The questions for measuring system satisfaction were adopted from Chung-kuang Hou's [2012] BI study. They include content value, ease of use, and timeliness.

All scale items were rephrased to suit the BI context. Each item was measured using a seven-point Likert-type scale (from 1 = "strongly disagree" to 7 = "strongly agree"). To ensure the content validity of scales, a pre-test was conducted with seven industrial experts and twelve experienced BI users in Korea. They were asked to evaluate the clarity of wording and the appropriateness of the items in each scale. Based on their feedback, we made several minor modifications in the wording and readjusted the item sequence.

5. Data Analysis and Results

We used SPSS 21.0 and AMOS 21.0 to test model. The analysis involved two stages: (1) assessment of the measurement model for item reliability, convergent validity, and discriminant validity, and (2) assessment of the structural model. The item weights and loadings indicated the strength of the measures and the estimated path coefficients showed the strength and sign of the theoretical relationships. In addition, path significance levels, were estimated by the bootstrap method. Finally, the predictive validity was assessed by examining the R^2 and the structural paths.

5.1 Assessment of the Measurement Model

The internal consistency of each dimension was assessed by computing the Cronbach's alpha; the lowest value was 0.846 for internalization; all the others exceed well the Nunnally's criterion of 0.70.

〈Table 3〉 Reliability of Constructs

Construct	Items	Loading Paths	Mean	Std. deviation	Cron-bach's α
UPFP	UPFP1	0.77	4.12	1.18	0.935
	UPFP2	0.84			
	UPFP3	0.91			
	UPFP4	0.89			
	UPFP5	0.84			
TTF	TTF1	0.76	4.49	1.20	0.919
	TTF2	0.77			
	TTF3	0.81			
	TTF4	0.76			
	TTF5	0.75			
	TTF6	0.76			
	TTF7	0.62			
	TTF8	0.83			
	TTF9	0.83			
	TTF10	0.82			
INT	INT1	0.88	3.61	1.31	0.846
	INT2	0.89			
	INT3	0.77			
	INT4	0.81			
SS	SS1	0.86	4.07	1.22	0.907
	SS2	0.88			
	SS3	0.97			
SU	SU1	0.65	4.84	1.30	0.864
	SU2	0.87			
	SU3	0.92			

In our study as summarized in <Table 3>, all of the items had loadings over 0.70 for their corresponding constructs except TTF7, SU1 (with a loading of 0.62, 0.65, still acceptable and therefore were included in further analysis).

As summarized in <Table 4>, the CRs for the constructs with multiple items ranged from 0.87 to 0.97, and AVEs ranged from 0.69 to 0.74, both of these exceed the approved cutoff point, exhibiting acceptable convergent validity.

Discriminant validity verifies whether each construct is unique. <Table 5> shows the diagonal elements representing the square root of the variance shared between the constructs and their measures; the off-diagonal elements are the correlations among the constructs. All diagonal elements are greater than their corresponding off-diagonal elements and thus the respective constructs exhibit acceptable discriminant validity.

The fitness measures for the measurement model are tested by χ^2/d.f, Root mean square error of approximation (RMSEA), Goodness-of-Fit Index (GFI), Comparative fit Index (CFI), Normalized Fit Index (NFI), Incremental Fit Index (IFI), Tucker-lewis Index (TLI), and Root Mean Square Residual (RMR).

The proposed model shows that the χ^2/d.f. is 1.514, which is less than 2 [Kettinger and Lee 1994]. The RMSEA is 0.067, which is less than 0.1. The GFI 0.801 is greater than the recommended value of 0.8 [Scott, 1995]. The CFI, IFI and TLI are 0.949, 0.95 and 0.941, which are higher than the recommended value of 0.9 [Bentler and Bonnett, 1980]. The RMR is 0.092, which is less than 0.1.

〈Table 4〉 Inter-Construct Correlations

	CR	AVE	UPFP	TTF	INT	SS	SU
UPFP	0.93	0.74	0.86				
TTF	0.97	0.74	0.79	0.86			
INT	0.90	0.69	0.75	0.71	0.83		
SS	0.88	0.72	0.69	0.73	0.65	0.85	
SU	0.87	0.70	0.64	0.77	0.70	0.79	0.84

〈Table 5〉 Fitness for the Measurement Model

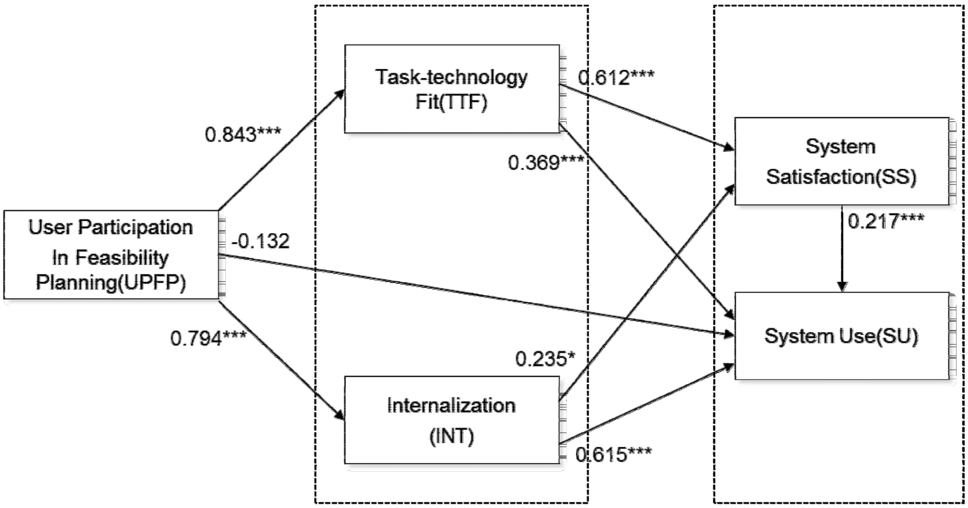
Fit indices	model	Recommended value
Chi-square/degrees of freedom	1.514	≤ 2.0
Root mean square error of approximation (RMSEA)	0.067	≤ 0.1
Goodness-of-Fit Index (GFI)	0.801	≥ 0.8
Comparative fit Index(CFI)	0.949	≥ 0.9
Normalized Fit Index (NFI)	0.865	≥ 0.9
Incremental Fit Index (IFI)	0.950	≥ 0.9
Tucker-Lewis Index (TLI)	0.941	≥ 0.9
Root Mean Square Residual (RMR)	0.092	≤ 0.1

5.2 Assessment of the Structural Model

This study examines the structural equation model (SEM) by testing the hypothesized relationships between five variables. As shown in Figure 2, the results show that UPFP has a significant effect on TTF(ß = 0.843, $p < 0.001$) and INT(ß = 0.794, $p < 0.001$), supporting H1 and H2. Contrary to our expectation, UPFP has no direct influence on SU (ß = -0.132, $p > 0.05$), not supporting H3. In addition, TTF (ß = 0.369, $p < 0.001$) and INT(ß = 0.615, $p < 0.001$) have a significant effect on SU, supporting H4 and H5. Therefore, it indicates that the effects of TTF and internalization were identified. And we come to conclude that user participation in feasibility planning appears the key antecedent variable on TTF and internalization.

We also found that TTF (ß = 0.612, $p < 0.001$), INT (ß = 0.235, $p < 0.05$) and SS(ß = 0.217, $p < 0.001$) have an effect on SU, supporting H6, H7 and H8. The summary of hypotheses testing is shown in <Table 6>.

The proposed model shows that the χ^2 /d.f. is 1.530, which is less than 2 [Kettinger and Lee, 1994]. The RMSEA is 0.068, which is less than 0.1. The GFI 0.803 is greater than the recommended value of 0.8 [Scott, 1995]. The CFI, IFI and TLI are 0.951, 0.952 and 0.942, which are higher than the recommended value of 0.9 [Bentler and Bonnett 1980]. The RMR is 0.099, which is less than 0.1.



〈Figure 2〉 Results of Structural Modeling Analysis

〈Table 6〉 Summary of Hypotheses Testing

No.	Meaning of Hypothesis	Results
1	More user participation in feasibility study → Higher TTF	Support
2	More user participation in feasibility study → Higher internalization	Support
3	More user participation in feasibility study → More likely to use the system	Not Support
4	Higher TTF → More likely to use the system	Support
5	Higher TTF → More satisfied with the system	Support
6	Higher internalization → More likely to use the system	Support
7	Higher internalization → More satisfied with the system	Support
8	More satisfied with the system → More likely to use the system	Support

6. Discussion of the Findings and their Implications

In this study, we have found that user participation in feasibility planning can be a key determinant on TTF and internalization. Through their active participation at the feasibility study phase, users could figure out how to identify their genuine needs and how to reflect them in the system plan so that the BI system to be implemented fits well their work environment. And, users could also grasp the value of BI system more easily and become more committed to the BI system. Based on our findings, we suggest that, in order to enhance the TTF and internalization of BI system, an organization has to come up with some measures that will help to induce users to participate at the feasibility study phase. The measures would be 'mandatory inclusion of users as a member of feasibility planning team' or 'reward system for users participating in feasibility study.'

As expected, our study empirically validated the positive impact of TTF on system satisfaction and system use. This finding is confirming the effect of TTF, which has already proven in many TTF studies [Goodhue and Thomson, 1995]. Similarity, the effect of internalization on system satisfaction and use was validated in our study. This finding also confirms the positive, direct or indirect, effect of internalization in technology adoption [Chen and Wang, 2006; Kim, 2016].

In this study, we have also found the higher level of TTF and internalization through participative feasibility planning influences system satisfaction and user. Previous studies based on participatory design theory has not consistent result between user participation and system success [McKeen et al., 1994; Anderson, 1985]. Such an inconsistence may result from an issue of 'when to begin to have users be involved'. Our study has empirically found that user participation would better start at the phase of feasibility study. It is understood that this finding supports the *untested claims* of Kraft [1979] and Ehn and Sandberg [1979] that user participation should occur prior to the system development phase in which by then most key system development decisions would have already been fixed [Mumford, 1983]. Based upon most BI success cases, we need to keep in mind that it is users that needs of BI system are originated from. What is important is how to empower users to play a key role at planning stage and keep them in the development phase to have a continuous ownership about the BI system.

One interesting point in our results is that user participation in feasibility planning does not have a direct effect on system use. This seems to have something in common with Mumford [1983]'s seminal work. Based upon experience of real cases that some participative design projects were even significantly disadvantageous, he emphasized participation strategies, which would allow for humanistic and effective change management. It seems to us that TTF or internalization would be a strategic target for participatory design. In this sense organizations should provide a variety of appropriate measures by which users can become not just passive but strategic goal-oriented player during participative design. Some examples would be technological capability program in which users can more easily understand the nature and merits/demerits of various technologies or continuous awareness-raising program in which users can come to feel psychological ownership about BI system on their own.

7. Summary and Limitations of the Study

This study is about how participative feasibility planning comes into play in BI projects. As was expected, we have found that the effect of user participation in feasibility planning plays a role for a higher level of task technology fit or internalization, each of which then functions to an increase in system satisfaction and system use. Thus, our study approached different view that users should participate from feasibility study rather than implementation stage. As users start to take a part from feasibility planning, they would be able to formulate more fitting solution with their work environment and to reach at the state of attaching a symbolic meaning to the BI system, consequently adopting the system more favorably. We presume that this study has proposed a new gateway to the BI community which is struggling in an unexpectedly lower success rate of BI projects.

This study contributes to management information systems (MIS) literature in several ways. First, we found the antecedent factor of *'participative feasibility planning'* for task-technology fit and internalization. Second, it shows that participative design theory can be extended even to planning phase, especially in BI system. Finally, we have again validated the already controversial issue that effect of participatory design is not natural. If not with clear and strategic objectives in mind, participative design may end up with unfavorable results only.

Regarding the managerial implications, practitioners can use our research results. Organizations trying to adopt BI system should have users start to participate from the early phase of feasibility study. They would better take, not technology push, user pull approach in which user needs and business goals are carefully weighed against technology solutions and psychological ownership about the planned solution is developed spontaneously in users.

Even though this study has offered some insights into BI system use, there are some limitations. First, the measurement of BI use was based on the individual's self-administered questions. This may result in limited validity from any research methodology relying on volunteers depends on their ability and willingness to volunteer and this may introduce bias. Second, because data were cross-sectional and not longitudinal, the posited casual relationships might only be inferred rather than proven. Finally, the study was based on a limited number of samples. The larger sample size would provide more statistical power.

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