Learning to Use ERP Technology: a Causal Model

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Abstract

The premise of this paper is that the technically successful implementation of a complex IT does not always result in its effective use. Through the analysis of case study data related to an ERP implementation within a public organization, a causal model is proposed. This model, inductively developed, reveals key factors leading to the construct of "quality of use." It suggests that the inclusion of factors relating to learning allows to better understand why "quality of use" may vary among individual users. More specifically, factors affecting formal and informal training, and their impact on the extent of learning, are emphasized.

1. Introduction

Enterprise Resource Planning (ERP) packages, increasingly popular among organizations, can integrate all aspects of business under a uniform system and common database. ERP's functionalities have recently been extended to include Internet interfaces, supply-chain management, sales-force automation, call centers, product data management, and data warehousing. These extensions, along with the sophistication of integration, contribute to make ERP packages quite complex [11] [19]. When introduced within organizations, such complex information technologies (IT) typically impose a substantial burden on would-be adopters to use them effectively [4] [10]. Tornatzky and Fleischer [31] claim that complex technologies tend to be "fragile," because they do not always operate as expected. Moreover, they argue that complex ITs often require hand-holding in their appropriation[1], because they are difficult to learn.

Because of this complexity, even the successful implementation of an ERP package does not always lead to its effective use. This is consistent with past research, which shows that it is common for complex IT to be successfully implemented, while unsuccessfully appropriated. For an example, organizational members often resist changes induced by technology [14]. They also use technology in ways that are not expected a priori (e.g., [15]). As a result, unanticipated (and sometimes contradictory) changes may result from an implementation that was technologically labeled as successful [23]. In such a scenario, expected benefits may only be partially, if at all, attained

Considering that success is a multi-dimensional concept that includes more than a technological component, it is purported that a fully successful implementation of an ERP package is contingent upon its adequate appropriation. ERP, in other words, must be utilized in all of its potentiality in order for significant benefits to emerge from its use. Based on this assumption, a case study of a technologically successful ERP implementation was conducted. This inquiry led to the development of a causal model identifying factors influencing the learning of an ERP package, which in turn contributed to the more effective use of the software.

This paper is structured as follows. First, a discussion about the construct of use is provided. Then, the research approach, including the site selection and the data collection and analysis, is presented. Next, the causal model emerging from the analysis of the case study data is presented. In the later part of the paper, the value of this causal model, as it relates to the use of complex technology, is discussed.

2. Revisiting the construct of use

The literature on the construct of use within the field of information systems unveils that use is one of the most frequently reported measures of system implementation success [7] [28]. However, IT use has generally been defined narrowly. Indeed, researchers have typically understood use in terms of "usage" and "user satisfaction" [5]. When understood in terms of usage, use is further subdivided according to three dimensions [32]. The first dimension associates use with a certain amount of time. For example, use may be evaluated by calculating a cumulative number of hours per period of time one utilizes a technology. The second dimension relates use to reliance. Use, in such a case, may be

[1] Appropriation should here be considered in its general sense, that is, "to set apart for a specific use" (*The American Heritage College Dictionary*).

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assessed by the extent to which one depends on a particular technology to conduct work. The third dimension equates use to diversity. According to this dimension, use may be appraised by the number of different software features one utilizes. Although this perspective on use has been valuable to past research, it is not as compelling when one tries to assess how "well" an end-user understands a piece of software and how able this person can exploit the capabilities of the software in the most relevant circumstances. In other words, "usage" is not an accurate surrogate for "quality of use".

To date, research efforts directed towards the creation of a richer conceptualization of use are few [1]. Notable steps in this direction have been taken by Saga and Zmud [26], who focused on the infusion of technology. Infusion is "the extent to which an innovation's features are used in a complete and sophisticated way" ([9], p. 110). Saga and Zmud distinguished three levels of infusion: extended use, integrative use, and emergent use, with each level being more sophisticated than the preceding. Auer [5] also suggested a taxonomy of five classes of issues to look holistically at quality of use. Contributing to a richer operationalization of use, Nambisan *et al.* [21] developed a construct labeled "intentions to explore," which measures one's willingness and purpose to find new ways of applying IT to work tasks.

A framework proposed by Lassila and Brancheau [16] appears particularly appropriate to better understand the use of package software such as ERP. These authors' framework allows for the investigation of the differences in IT utilization based on the relationship between technology and organization change. Inspired by the work of Johnson and Rice [12], Lassila and Brancheau suggest four "equilibrium states," corresponding to increasing levels of use of a software package. These states represent limited use (i.e., low-integration), use to support existing processes (i.e., standard adoption), use to redesign existing work processes (i.e., expanding), and use to allow the extension of the capabilities of the technology and the work environment (i.e. high-integration). The progression towards higher levels of use is reflective of increasing comfort with the technology, as well as increasing control over the technology and the work processes. Although Lassila and Brancheau's framework aims at discovering how an organization, taken as a whole, may progress towards higher levels of use, their framework can also be applied at an individual level. This way, it is be possible to capture how individuals, confronted with an identical technology implemented within the same organizational context, may appropriate IT differently.

Although these alternative perspectives constitute valuable efforts extending the construct of use beyond its more simplistic operationalizations, none of them offer much insight about what allows one to progress towards a more sophisticated level of use (i.e., a "high" quality of use), particularly in the context of integrated, complex technology such as ERP. Quality of use is defined as the ability one has to correctly exploit the appropriate capabilities of a software in the most relevant circumstances. The use of information technology, rather than being predetermined, is contingent upon people's interpretations and practices [22]. In this research, ERP users' interpretations and practices are investigated. Through this work, the relevant factors influencing quality of use in the context of a complex IT implementation are uncovered.

3. Research approach

3.1. Research site

The organization chosen to conduct this case study is a state government institution in the Southeastern United States. In 1999, it employed 2,925 individuals and had a total budget allocation of $324 million. This institution claimed to have successfully implemented the financial software components of a popular ERP vendor, which will here be referred to as "Compass" (a pseudonym). Compass had been minimally customized by the institution, and its implementation had been both on time and on budget. The total inquiry, which lasted 15 months, was post-implementation and concentrated on the "shakedown" stage of the ERP transition process, when organization come to grips with their new system [20].

3.2. Research methodology

The grounded theory research methodology was chosen for the pursuit of this inquiry [29]. More specifically, the "Straussian" version of the methodology was used [17]. This version of grounded theory allows for the potential of prior theory, literature, and personal and professional experiences to help researchers gain insight into the data [30]. Grounded theory uses a qualitative approach and techniques of induction, deduction, and verification to develop or elaborate a theory about a phenomenon [27].

The techniques used to collect data were participant observation, interviews, and analysis of documents. Participant observation was possible because the author of this paper had access to the implementation team members and the meetings they attended. Over the period of inquiry, 30 such meetings and training sessions were attended. Furthermore, the project leader agreed to send the author to a two-week training program to get more

familiar with the ERP system being implemented. This allowed the author to not only to get a deeper understanding of the technology, but also to get involved in the development of a few financial reports, giving her a sense of the issues surrounding the ERP system itself.

The project leader also allowed the author to conduct as many interviews as desired, from any organizational member affected by Compass. Overall, 74 interviews were conducted with 65 organizational members holding a variety of roles within the institution. These interviewees were affected by the new system at different levels, some using it intensively and others only indirectly. They also were from different hierarchical levels, with some responsible for clerical work, and others more involved with the institution's strategy. Interviews lasted, on average, one hour. They were semi-structured in their format, with the early interviews having more general, open-ended questions, and the later interviews having more specific, but still open-ended, questions. This increased specificity reflects two practices at the heart of the grounded theory methodology: the circular process of induction and deduction, and the theoretical sampling procedure. All interviews were tape-recorded (except for five) and fully transcribed. Anonymity of all respondents was ensured.

As a last source of collected data, documents such as training manuals, meeting minutes, newsletters, and some electronic mails were also made available. This third source of information allowed to triangulate some of the data collected from the other techniques.

The data analysis incorporated different types of coding suggested by Strauss and Corbin [29]: open, axial, and selective coding. Open coding was the process of breaking down, comparing, conceptualizing, and categorizing data. Such coding was realized by comparing each incident, event, quote, and instance gathered during the data collection for similarities and differences. From the verbatim interviews and field notes, similar textual segments were labeled and grouped to form codes. During this coding, 188 codes were created. Each code was associated with one or many text segments, so that overall, the 188 codes represented 2,090 text segments. Axial coding necessitated that the data be put back together in new ways by making connections between codes to form factors. This was done by grouping codes based on their conceptual similarity. Through the axial coding emerged a model (called "theoretical network" in grounded theory) revealing factors influencing the use of the ERP package. Finally, during selective coding, the most relevant of these factors were selected to establish a stronger and more parsimonious model representing the main phenomenon. To clarify under-developed factors or relationships between factors, additional interviews were conducted (data collection and analysis are intertwined in grounded theory). Selective coding was considered completed when theoretical saturation was obtained, that is: when no new or relevant data seemed to emerge regarding a factor; when the factor development was dense; and when the relationships between factors were well established and validated. Resulting from this analysis was a causal model explaining the extent of use of the new ERP technology. The different components of this model are discussed next.

4. Results

Following the implementation of Compass, employees from the state institution struggled while trying to utilize the new package for the conduct of their work. Provided the amount of knowledge necessary to interact with such complex technology, this was hardly surprising to the project leaders. However, 15 months following the implementation, these project leaders were quite overwhelmed by the number of users who were not yet at ease with Compass. From their assessment, the technology was not being used in its full potential ─ far from it. They suspected that for many users, the understanding of the package was barely sufficient to perform their immediate task, and that these users did not have much comprehension of the sophistication of the business processes embedded in the package:

> [There are] many features people don't know. They [users] are not comfortable with query, extracting information. I don't think that people use it as a good management tool, yet.

> Many people work with the system, but they only master their particular path and they do not attempt to understand all of it. So, it's more rote processing. There are a lot of people who are learning that right now: they say, "I want to do a travel authorization — what do I do?" And you say: "In this screen, give it this number, in this other screen, push this button, etc."... and that is all they want to learn. They will just scribble that on a little note and they'll just remember it, but they won't be able to tell you anything else; they won't be able to tell you the "why."

Therefore, although the state institution was renowned to have been successful in its ERP implementation, project leaders candidly admitted their disappointment towards the system's under-utilization. A majority of employees used the system in a very limited way; others,

however, had been able to take better advantage of it to use it more extensively.

4.1. Limited use

Many users were quite incapable of interacting with the computerized interface of the system because of lack of know-how: "They [the users] don't know how to use it... they don't understand it," commented one project leader. Instead of directly interacting with the system (i.e., entering the information on line), these individuals used it indirectly through the available paper forms. For instance, a user would choose the appropriate paper form to a particular transaction, fill it with the required information, obtain the necessary signatures for its approval, and transmit it to one of the staff in the Finance and Administration department. As to those users who would venture in using the system more directly, they felt highly intimidated by it. They were hardly successful in doing anything with Compass, and blamed their inadequacy on their lack of understanding of the system:

> I don't know how to use half of the functions in this system. I don't know if they pertain to me or not. I know enough to get what I need to get in there.

> Most of us use the system like monkeys: we are pushing buttons. We have directions in front of us, that say "Push this button," "Push that button"... we don't push other buttons. People are afraid of pushing the wrong buttons.... They know the buttons to push for their task, but not necessarily what is around.

Provided their superficial understanding of the system's functionality, these users had difficulty retrieving information from Compass, as this was considered a very challenging task. In fact, most users were totally incapable of doing so. Verifying that a purchase requisition had been approved, for example, was something they could not do. Confirming that a check had been cut was also deemed infeasible. Likewise, finding out the free balance of a particular account was problematic. In sum, even though they could enter a basic transaction within the system, users could not, for the most part, track the information; it was "lost in cyberspace."

> I don't really know of any way of going back to check and see where things are, or if things went through. If you put a request, you order something, and it never arrives, you don't know if somebody down the line is having problem with the system, or if the system failed and you didn't put in the order correctly. So, you wonder, did it work?

In sum, many of the new system's users could only interact with Compass in a very superficial way. Their "limited use" of the software was similar in content to the "low-integration" level of use described by Lassila and Brancheau [16]. These individuals used the software because "they had to," but they had not assimilated many of its functionalities.

4.2. Extended use

Other users, however, demonstrated a much better understanding of the system. Instead of using the paper forms, these users took advantage of the Compass through its computerized interface to not only do their job but also to experiment with it.

> I enjoy entering the information and digging information out [with Compass]… With Compass, I am more in control because I am actually entering the information myself, whereas before I would type it and submit it and someone else would put it in. I like to be empowered to put my own stuff in.

These users' attitudes were much more upbeat, as they saw the advent of the new system under extremely favorable lights. For these users, Compass provided real-time information, it banished the shadow systems (which were originally necessary to make up for the outdated information of the legacy system), fostered a paperless office, eliminated perfunctory tasks, and allowed for better reporting capabilities. Not surprisingly, when conversing about Compass, these users often choose engaging adjectives, such as "beautiful," "fun," "positive," or "fantastic".

Moreover, as these users became familiar with the system, they eventually felt capable of "tweaking" Compass to better respond to their needs when facing its constraints. Such "tweaking," also called "workarounds," allowed them to use the system in a slightly different way than it was intended to work, so that they would get things processed the way they wanted them. Instances of workarounds included the use of a field (the "statistical code") to capture information of another nature (i.e., credit card payments); the use of multiple referenced records to handle a single vendor that has multiple locations; the use of "header comments" to compensate

for a line item too short; and the use of a line item to indicate a particular action to take:

> On a purchase order, if you find that you have to add money, you can't just go and change the line amount. It's not going to work; something is going to happen and Disbursements won't be able to pay it. So, a workaround we have here is to add an additional line to say "Increase PO by x amount of dollars!" just so the dollar amount equals what you need it to equal.

Thus, some users interacted with Compass beyond its basic capabilities. This "extended use" is reminiscent of the "expanding" level of use described by Lassila and Brancheau [16]. These users greatly enjoyed interacting with Compass, and they were comfortable enough to experiment with it and create alternate ways, also called workarounds, to get what they wanted from the system.

4.3. Learning as a key predictor of use

What exactly influenced some users to appropriate the new ERP system in a limited way, while others thrived in using it in a more extended fashion? Respondents pointed to many factors affecting their level of use, but one particular group of factors appeared as being critical to their "quality of use": the extent to which they had learned (and thus understood) the system. Provided ERP packages' renowned complexity, it is necessary (but not sufficient) for an individual to first understand a technology quite well before aspiring to use it in a somewhat sophisticated manner. Factors bearing on learning can be categorized into two learning channels: formal training and informal training. Factors influencing each type of learning are described below.

4.3.1. Factors influencing formal training. Formal training was one major component that clearly influenced the extent to which some users did not understand the system while others appeared to master it. Depending on job descriptions, training sessions were mandatory for some users and optional for others. Users that were mandated to get trained did so, but many of those who were not forced to get trained decided to bypass the formal training sessions. Although project leaders encouraged all users to attend training, these leaders were not in a commanding position vis-à-vis most of them and therefore had little impact:

> I think if your boss says, "You have to go to these sessions," you go. But it didn't come from him; it came from this nebulous training program. Everyone's like, why bother with this... I'll figure it out later. I'm too busy; I don't want to take time away from what I'm doing right now.

In addition to voluntariness as a precursor factor to formal training, the perceived ease of use of the system induced many users not to attend formal training. If training was optional, many pondered, it was probably because Compass was quite easy to learn and that no special guidance was needed in order to use it:

> It made me believe that it would be a much more user-friendly system so therefore they didn't force you to go to these training sessions because you would be able to figure it out even if you didn't attend them.

Many users had previous experience with basic information technologies, that is, with the previous legacy system and desktop applications such as word processors and spreadsheets. Users' relative experience with technology gave them the (false) confidence that they could learn the system by themselves and did not have to bother with formal training. As an ERP system is, by definition, a package, many users thought that it would be generic enough to be self-taught:

> I didn't think the training would be that crucial... that sounds terrible, but I thought that maybe it would be something that you could OJT [on job training] a little bit, that you could learn on the job.... Every system we had here, we learned it that way. You sit down, and you learn it by yourself. So, I had the feeling that this is a standard program, a package... I mean, it is not even specific [to our type of institution], so how hard can that be? That's what I thought. It is not like it was written specifically for us, so we thought that it was created with general, pre-assumed, code.... I did think I would be able to pick it up on the fly, so to speak.

The quality of the system also had an impact on the attendance of formal training sessions. Users were annoyed by the new system's interface, which they considered extremely cumbersome and unintuitive. One of them commented, "as human-interface goes, this is the most horrible, bizarre, plain old stupid interface I've every seen in my life!". Moreover, users were highly troubled by what they perceived as a "buggy" system, and therefore, did not consider Compass as a system ready for usage or learning. As the word spread that the system's operationality was questionable and its interface was burdensome, many users made the decision to disregard

training sessions until Compass would be fixed. In other words, for the users who perceived the new system as being of poor quality, formal training was considered a waste of time and effort. The general assessment was that there was no point in learning a package that was surely going to be modified:

> I have this kind of German mentality, rigid mentality, where I think that it ought to work. So, I'm waiting for them to straighten that out, I don't feel like, anymore, that I need to go dancing around in circles: I've done enough stuff.

Finally, another factor that motivated users to either embrace or reject the formal training sessions was the perceived dependence associated with the use of Compass. Many users realized that, without the system, they would not be able to respond to different requests from their supervisor. More specifically, users' concern was that, if they would not learn the system, they would not know how to track the transactions they had initiated. Indeed, although they could call the Finance and Administration staff to inquire about a transaction, the transaction number (provided by the system) was generally needed in order to find any information about a it. If a paper form was used instead of the Compass system, the transaction number was unknown, and therefore the transaction was much more difficult to track:

> I definitely wouldn't use paper system on purchase requisitions, just because I don't have no way of finding out purchase order numbers. The only way of finding it is to go through the requisition ID number. There is no way I would go back to doing paper forms on purchase requisitions.

> Now, I don't think anybody should try to do this without having gone through the training. I don't think they would even know where to start!

For those users who felt that their job requirements did not allow them to be ignorant of the system's functionalities, formal training became a "must" as this was the most direct way to understand Compass' multiple capabilities.

The previous five factors had an influence on the extent to which some users attended the formal training sessions while others did not. For those users who elected not to take advantage of these sessions, the learning of the system had to occur through a different means. Informal training, or the training that occurs in a very unstructured and unplanned way, became this alternative mode for learning.

4.3.2. Factors influencing informal training. Informal training took multiple forms. It incorporated "water-cooler" conversations, casual questioning of more knowledgeable users, and spontaneous demonstrations of some of the system's functions. For the most part, the interactions underlying informal training emerged from a "need to know" basis rather than being predetermined. At a given time and for a particular system function, a user could either become unofficial trainer or trainee. When one would discover how to perform a particularly useful task, peers were quickly updated about the tip:

> I can't tell you how many things that we learned, not because of training, not because the trainers knew it, but because somebody figured it out, and it became kind of folk knowledge.

Peer pressure was one of the main factors that motivated some users to seek informal training of the new system. Less knowledgeable users, who were reluctant to directly interact with Compass (through its computerized interface), were often urged by more knowledgeable users to abandon paper forms. Indeed, when they processed paper form transactions, but later received them back with instructions of re-entering them into Compass, the message was clear that the paper-form method was not tolerable anymore:

> They said we could use paper, but when it came right down to it... it was not an acceptable thing to do.

In fact, as the most experienced users had an extra burden of work because they had to take upon themselves the work that less experienced users were not doing (such as data entry), they often sought to persuade inexperienced users of the value of the system and offered assistance with Compass:

> Usually, when I am called and asked if there is a need to enter maintenance agreements into Compass, I tell that they should practice with the system… And most people will say "yes you are right, O.K. I'll do it, but if I have any questions I will call you back." At which point I say "I hope I can help you with it."

As the previous quote indicates, casual support from colleagues was common. Formal support from the help desk, however, was more difficult to obtain. Many users

were in fact disgruntled by the help desk's incapability to respond to user requests in a timely fashion. Because the support group at the help desk had more requests than it could handle, its staff was quite backed-up and generally needed a few days before addressing a user's problem. One of these users explained why she preferred relying on a colleague when encountering problems:

> I often call Robert, simply because he is there. He will usually answer the phone and I can get an answer right away. If I call the help desk it would have been 2 or 3 days before getting an answer.

Inadequate user documentation was another reason official support was considered unsatisfactory. Indeed, the release of user guides had been delayed by a few months. The only paper support available to users were handouts distributed in meetings. These handouts, however, quickly became out of date due to the constant evolution of the system. Indeed, because the system was changing so fast (as bugs were being fixed), it was hard to provide an exact rendition of its computerized interface and functionalities. This discrepancy created a lot of frustration to users, who felt upset about having to deal with such a complex system without any formal, reliable, written documentation:

> It's sort of like being given a Lamborghini or something, and then you are given the car to drive and there is no owner's manual, there is nobody telling you how to fix the car. And that, to me, seemed to be an obvious oversight.

Because of the support group's inability to promptly address user problems, along with inadequate paper documentation, many Compass users took control of their own destiny and started to informally relying on each other for help rather than requesting the assistance of the official helpers. Formal user support, which was perceived as being deficient by many, thus contributed to foster informal training.

In sum, two factors (perceived peer pressure and perceived support) greatly influenced the extent of informal training. This informal training was particularly necessary for users that had taken little advantage of the formal training sessions that had been offered before the system implementation. Both formal and informal training influenced the extent to which users had learned (and thus understood) the new system, which in turn impacted their quality of use of the system. Figure 1 graphically represents the resulting model integrating all of these factors and relationships.

5. Discussion

Observing how users appropriate technology permits one to take a fresh perspective on an old construct: IT use. In this case study, equating use to any of the three dimensions of usage previously discussed (e.g., time, reliance, and diversity) would have misled one to believe that Compass was successfully used. Indeed, although some users exhibited *limited use* of Compass, they, at the same time, were spending many hours a week on the system (often through indirect interactions), they relied on it to conduct their work, and they interacted with a panoply of its functions (including the processing of purchase requisitions, travel authorizations, express vouchers, consultant agreements, petty cash advances, reimbursements, and journal entries). In other words, according to the dimensions of time, reliance, or diversity, usage was high. Nevertheless, as it was demonstrated, quality of use was low, or limited, for many users. Rather than considering use in a simplistic way, it is proposed to reframe this construct so as to make it more appropriate to the study of complex technologies. Quality of use, in the context of ERP implementation, is thus a more valuable way to assess use.

Typically, the construct of use is investigated through models of Diffusion of Innovations [24] [25] and its variants, the Theory of Reasoned Action [2], Theory of Planned Behavior [3], and the Technology Acceptance Model [6]. It may be argued that such models are not suited for the study of ERP implementation, as they are most relevant to "simple" technologies which can only be used in a limited number of ways. Eveland and Tornatzky [8] pointed out: "problems arise when the diffusion model is applied in situations where its basic assumptions are not met — that is to say, virtually every case involving complex, advanced technology" (p. 123). Given that ERP systems are inherently complex, the study of their implementation is not expected to be well served by these models.

By expanding these models with the inclusion of factors related to learning, however, one can better understand what causes some organizational members to use technology in a *limited* or *extended* way. In this case, the extent to which users understood the system greatly contributed to its appropriate use. Learning was acquired through two different channels, formal and informal training, which in turns were induced by seven different factors. The inclusion of learning elucidates why some factors have a counter-intuitive effect on the use of complex technology. The factor "perceived ease of use," as an example, would be expected to lead to "increased

use" in a traditional model of technology acceptance [6]. However, the inclusion of factors related to training makes clear why "perceived ease of use" may have an adverse effect. Indeed, users who believed that Compass was an easy system to use decided to skip formal training sessions. By doing so, they jeopardized the extent to which they could learn the system, which in turns adversely affected their quality of use. Thus, in this case, "perceived ease of use" had a negative effect on use.

As another example, the effect of the factor "perceived experience with IT" is also counter-intuitive. Empirical research, as well as common wisdom, indeed suggest that the more one knows about IT, the more this person will be able to appropriate a new package. Again, when "formal training" is considered as an intermediate factor leading to quality of use, it becomes clear why this may not always hold to be true. Here, experienced users of technology felt over-confident in their capability to learn Compass and therefore assumed that formal training was superfluous. However, because Compass was a complex technology, even experienced users could not learn the new system "on the job," as they had expected; their experience with technology thus negatively affected the extent to which they could reach high quality of use.

Of course, other factors are frequently suggested for explaining use of information technology. For instance, managerial interventions, perceived usefulness, and image enhancement, have previously been singled out as factors impacting post-adoption use [13]. Although these factors (and others) did emerge from the analysis of this study's data, they did not demonstrate direct influence on the intermediary constructs of formal and informal training, and therefore were not included in the resulting model. This is consistent with the grounded theory approach, which encourages one to derive a model from what actually emerges from the data.

In sum, although traditional models of technology acceptance and diffusion may be inadequate when used in their original form with complex technologies, they are still a good starting point to understand system usage. This research shows that the inclusion of factors relating to learning and training allows us to better comprehend what contributed to quality of use. Although these factors are not the only ones that will have an impact on quality use, they were, in this case study, the most critical ones to the state institution's employees.

6. Conclusion

It has long been recognized that technologies are often not used as designed or intended [22]. Although an implementation may be considered a technological success, it is risky for any project leader to presume how the new technology will be used, particularly if the technology is a complex one. This case study reveals that, although organizational members made use of the system, their quality of use was often quite limited, and therefore reduced their efficiency on the job. Such phenomenon ought to be considered seriously, given that previous literature has shown that the use of an IS may be associated with decreased individual performance [18]. Quality of use, therefore, is a construct worthy of further development and investigation.

Efforts towards a better conceptualization of use are supported by many, including Agarwal [1], who thinks that "greater value would be derived from novel ways of [studying] technology use" (p.102) and Karahanna *et al.* [13], who encourage the development of "a more sophisticated conceptualization of usage" (p. 202). This case study suggests that the inclusion of factors relating to learning allows us to better understand why quality of use may vary among individual users. A model was inductively created to represent the factors that appear to have the greatest impact on the learning of an ERP package. Further research calls for empirical validation of this model, in both similar and different organizational contexts.

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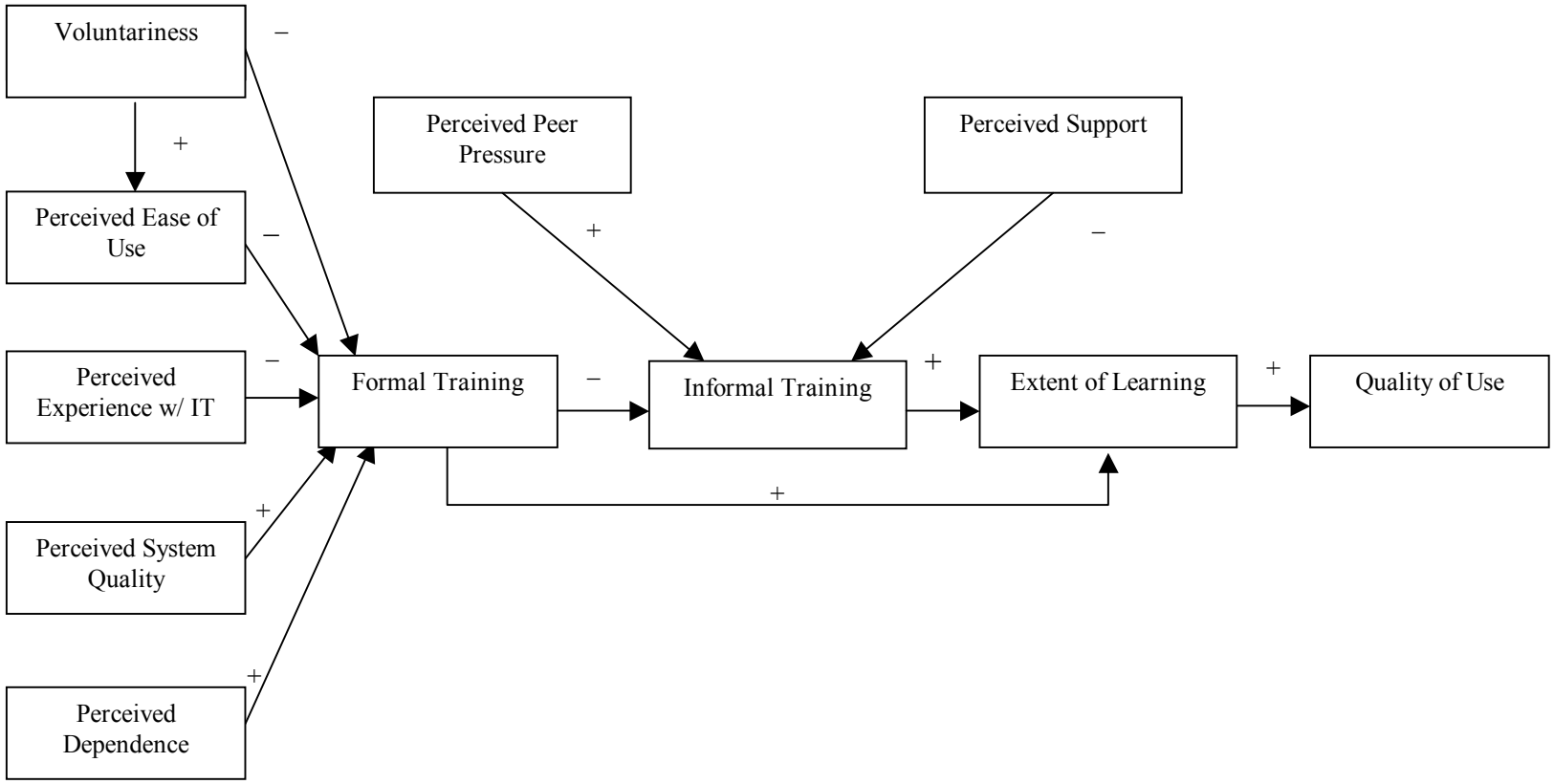

Figure 1. Learning impacted by formal and informal training