REFLECTING WITH THE DELONE & MCLEAN MODEL

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Abstract

This paper introduces a new approach to utilise the information system success model developed by DeLone and McLean. In practice, the new approach was to illustrate an information system project retrospectively and by interpretation with the help of the model created and evaluated by numerous scientific studies. In our approach, no quantitative measures or statistical concepts were used. The empirical research material was based on a prior information system implementation that was retrospectively reflected through the model. The interpretive reflection allowed the decision makers and managers to catch a glimpse of an information system implementation retrospectively to help them proceed in future. The described approach contributes both practitioners when they seek for explanations and improvements; and academic audience in using different lenses in information system research.

Keywords: DeLone & McLean IS success model, Information system implementation, IS evaluation.

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1 Introduction

This paper describes the use of the DeLone & McLean information system (IS) success model (DeLone & McLean, 2003) by interpretation in order to reflect an IS implementation project. In our approach the model was applied in a new way to give a descriptive view of the implementation. The purpose for the new usage was to rationalise the occasion when a passed IS project is introduced and described for decision makers and managers.

The DeLone & McLean IS success model (D&M) has been widely used and researched since its introduction in 1992 (DeLone & McLean, 1992, 2003, 2004, Petter et al., 2008). DeLone & McLean updated their original model in 2003 and they highlight that D&M is aimed to be modified according to the context it is used (McLean & DeLone, 2003, 2004). We applied the model both by interpretation and in a factory environment. Thus, our approach was innovative in two ways.

Our study was qualitative and interpretive. In our study we interpreted the empirical material that was collected earlier. With this research we responded to the suggestion by Chen and Hirschheim (2004) who in their paradigmatic and methodological examination of ISs research desire more interpretative research in contrast to positivistic research. Furthermore, in widely accepted positivistic and interpretive IS research there is a problem of theory-practice inconsistencies that are found between researchers' assumptions and the actual research with gained results (Smith, 2006). We believe that our study that grounded on a thorough description of a passed IS implementation and justified interpretations of applying the chosen model, leaves no space for dubious assumptions.

The empirical material was collected in a coating department of a factory where the workers coated cable in an industrial hall full of several machines. As the coating was carried out in a noisy machine, the context was strongly mechanic oriented but computers were not received with pleasure. The cables were customised according to national and international orders and the coating details had so far been hand-written on A4 sheets. In many ways, the environment was a challenge to the IS implementation. In this paper, we limit the research to cover the time when the information system was used and exclude all later phases in the context.

Our study produced a significant improvement in presenting retrospectively an IS project as the new applied model is descriptive and easy to understand. The adaptation is an extension to the DeLone & McLean IS success model. Contrary to earlier adaptations, our approach does not refer to correlations or to other statistical concepts.

This paper continues as follows. First, key concepts are introduced. We focus on evaluating IS success with D&M and highlight issues related with information system implementations and resistance to change. After that we describe our research approach keeping in mind the strong interpretive nature of the approach. That is followed by a full case description in detail to enable the reader to adopt an impression about the context. Due to the interpretative approach, the description is exhaustive. After that, we describe the results. Then we discuss the findings and the paper ends with conclusive words.

2 DeLone & McLean IS success model

In this section we take a look at how D&M is modified by its users. The D&M model developed by DeLone and McLean was targeted to assess the success of ISs (DeLone & McLean, 1992, 2003). DeLone and McLean developed their model because they felt the urgent need to make comparisons between different measures. In their seminal article Shannon and Weaver (cited in DeLone & McLean, 1992) defined technical level, semantic level and effectiveness level to be used when evaluating ISs. Later, Mason (1978) reformulated the concepts by emphasising influence of IS that is expressed both as a change in recipient behaviour and a change in system performance.

Ten years later DeLone and McLean (2003) introduced an updated IS success model. The main changes concerned quality, and service quality was uploaded into the model. DeLone and McLean (2003, 23) note: “As discussed earlier, quality has three major dimensions: information quality, systems quality and service quality.” They also wanted to add an attitude (“intention to use”) as a difference to behaviour (“use”) in their model. Finally, they removed “individual impact” and “organisational impact” from the model and replaced them with “net benefits” and added feedback loops to “intention to use” and “user satisfaction”.

The D&M model has been widely used as expressed in the extensive article by Petter et al. (2008). D&M has been modified to meet the requirements set by several kinds of ISs from different points of view. For instance, Holsapple and Lee-Post (2006) edited the model to be used in evaluating e-learning. Lin (2007) modified the D&M success model to be used in the assessment of successful use of online learning system. Further, Wang et al. (2007) used it when they assessed the efficiency and success of e-learning ISs from the viewpoint of organisations and their employees. DeLone and McLean used their success model (D&M 2003) when they evaluated success of e-commerce. From the e-commerce point of view, the key users are – instead of internal users – the customers and providers. In addition, interaction and business processes can be evaluated with the help of six measures (DeLone & McLean, 2004.) Halonen et al. (2010) applied the model when they evaluated knowledge transfer in a virtual learning environment. One of the latest is the meta-analysis carried out by Petter and McLean (2009) who stated that the majority of the relationships posited in the updated D&M model in 2003 have been supported.

In all, the D&M model has been evaluated as is in several papers. In our paper the model is used as a descriptive tool to depict an IS implementation.

3 Information system implementations

An IS is a set of interrelated components that collect, process, store and distribute information to support decision-making and control in an organisation (Laudon & Laudon, 1998). ISs have also been seen as trouble-makers that tend to encourage the bureaucratisation, standardisation and mechanisation of information processes that do not meet the realities of organisational activity (Lyytinen, 1986).

Laudon and Laudon (1998) taught that managing an implementation requires controlling risk factors, overcoming user resistance, designing for the organisation, allowing the human factor and applying sociotechnical design. They continued that organisations and the persons involved have natural need to stay stabile and the change in this stability causes resistance and raises need to fight against the change. Furthermore, Mathiassen's (2002) study about the development of computer-based ISs highlights the role of the local organisational environment. Mathiassen’s study combined interpretative understandings of practice with normative propositions to support professional development.

The development and implementation of an IS are instances of organisational change (Davis & Olson, 1985; Lyytinen, 1987), and they often lead to changes in the work processes and structures of the personnel (Eason, 1988; Sahay & Robey, 1996). Correspondingly, cultural and social background has its impact on changes in organisations and on the implementation of new technology (Walsham, 1993). Culture in ISs research was also explored by Leidner and Kayworth (2006) who emphasise culture’s impact on information technology and information technology’s impact on culture. Walsham (2002) notes how the concept of culture refers to shared values and attitudes within a specific organisation or other form of social grouping.

The implementation of an IS can be made more difficult by the negative attitude that users express against the new IS. Resistance to change can harm the implementation and slow down the implementation as a whole or influence on the age of the new IS making the life cycle shorter than it could be. The size of resistance to change is related to the amount of the use of the new IS. Without the full support from the managers it might be difficult or impossible to inform adequately about the different tasks concerning the implementation project, as the organisational changes are often business

related or otherwise secret before publicity. Resistance can be so strong that the reduction is not improving the final implementation of the IS. Resistance to change can evolve to a problem when its power becomes too strong but if it is impossible to handle the problems, the blame should not be pointed on the technological system (DeLone & McLean 1992; Markus, 1983; Halonen, 2004).

The role of user participation in IS developments and implementations has been under discussion for decades (Markus, 1983; Davis & Olson, 1985; Markus & Benjamin, 1996; Sahay & Robey, 1996; Kumar et al., 1998; Cairns & Beech, 1999; Kujala, 2007). User involvement is essential at the very beginning of an IS project in order to find out the requirements needed (Jiang et al., 2002). On the other hand, Nonaka and Takeuchi (1995) explain that most customers' needs are tacit, meaning that they cannot tell exactly or explicitly what they need or want.

Newman and Noble (1990) state in their case study that the contribution of user participation is not always evident and that the user participation may be only weakly associated with the success of implementation. On the other hand, the failure rate of IS projects is generally known to be high (Sauer, 1993; Griffith & Northcraft, 1996; Schmidt et al., 2001). Furthermore, the assessment of success may change over time, also depending on the win or lose side of the evaluator (Newman & Sabherwal, 1989). Later, Larsen and Myers (1999) discuss the issue if an IS turns out to be a failure even if it was at first evaluated to be successful.

In all, one can conclude that IS implementations have been researched for decades and that there are severe and versatile issues to be considered.

4 Research approach

The approach was a retrospective qualitative case study that enabled us to interpret and understand the success of the environment (Walsham, 1993, 1995; Scott, 1997; van der Blonk, 2003). As case study can be positivistic, interpreting or critical, we adopted the interpretative form that is characteristic to IS research where the reality can be understood only through the social structure in the case (Klein & Myers, 1999). In addition, this research followed accounts made by Scott (1997) who reports how a researcher has mapped the research area based on experience and knowledge but despite that, there remains place for change, realignment and modification. He continues that the researcher discovers such issues during the course of the research, which they did know. Further, that leads to the fact that reflexive practices are seen significant components in the research agenda and they relate to examination of both the researcher's own conceptual and affective maps. The empirical case was reported bearing in mind the idea of van der Blonk (2003), who states that cases are written with a purpose that heads to the goal of the research. The case needed to be described in sufficient detail to give a good understanding of the environment. The case was lineated from its surroundings and the grounds for that were explained.

The empirical material was collected in the environment in mid 1990s when an IS was designed and implemented in the target organisation. At the time, the researcher was able to observe and act in the actual setting when carrying out the IS implementation (see Halonen, 2008). In this paper we applied retrospective research method when returning to the documents and proofs kept in safe. In retrospective research the researcher enters the research scheme after the process to be explored is finalised (Scott, 1999). The role of retrospection is emphasised as the chosen approach is applicable irrespective of the timetable and time of evaluation (see Larsen & Myers, 1999).

The importance of interpretation was emphasised in the study. In our study we adopted an interpretative understanding of action (O'Shaughnessy, 1987 cited in Grant et al., 2001), which realises when phenomena are considered in their own context, taking account of the subjects' views and trying to understand their concepts in the situation at hand (Grant et al., 1999).

With the help of our retrospective view and interpretation we applied the D&M in our qualitative approach that did not include quantitative calculations or statistical concepts.

5 The empirical case

The target organisation was a department in a factory that produced cables for various purposes. The primary function of the factory was to design and manufacture cables for the global telecommunications industry. The empirical material was collected in a department where workers coated cable with a specific machine. The workers in the cable-coating department were middle-aged men whose educational level was comprehensive school or vocational training. The coating was executed with large and noisy cable covering machines in a large industrial hall.

The coating process was a process where uncoated cable was fed into one end of the machine and run via several barrels containing liquid materials such as rubber and insulation materials. During the coating process, the rubber and insulation material were hardened, so that at the other end of the machine the cable emerged fully coated with the specified material. The temperature in the machine varied according to the coating material, being extremely hot in certain points. In the industrial hall, there were many machines serving different cable lines for e.g., copper, optical, cellular and data cable. Sometimes the coating phase would last for many hours and the shift would change during the prevailing coating. Especially in those cases, it was important to distribute information about the coating to the next shift. During one shift it was also possible to execute several consecutive coatings in cases when the amount of cable for a particular kind of coating was small.

The number of customers was limited as there were not many significant enterprises providing telecommunication services, so that the workers generally knew which kind of cable each customer ordered. Every now and then customers ordered exactly the same type of cable; sometimes the order differed from the previous ones. There might be changes in cable thickness or coat thickness and in the length of the cable but usually the workers knew exactly the cable type.

5.1 The legacy system

The legacy system was pure manual, based on paper and pen. The coating information was handwritten on A4 sheets (Fig. 1) that could be found in files on shelves or on tables.

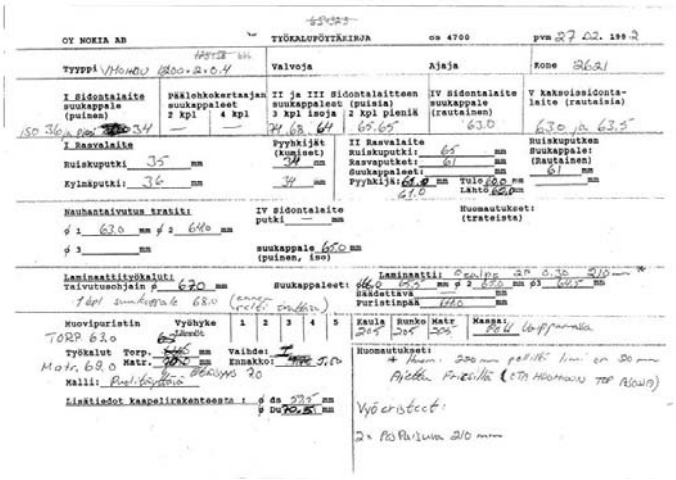


Figure 1. Handwritten coating information.

Workers monitored different measures and from time to time made adjustments according to their knowledge about the current type of cable on hand. They made records of such adjustments on the

paper sheets. Sometimes there were other problems with the coating and they had to be reported. All this information was handwritten on the same paper sheets as it had been written for years. As the exact information was handwritten with a lead pencil or ballpoint pen, required changes were made wiping the old information away or adding the new information with a thicker pencil onto the old information. In addition, even if the workers wore covering clothing, the dirty and untidy working place resulted in unclean hands that often led to contaminated paper sheets. The information sheets were impossible to read by anyone other than the workers on that cable line. With their tacit knowledge gained during their working career, the workers were professionals in their job.

At those times, the managers wanted to make the coating process visible and make sure that the cable was coated properly. Besides the managers, the customers had started to inquire about the manufacturing process. They wanted to be able to track the process – seeing the outcome was no longer enough. The new IS was to collect all the data about the production of coating. Therefore, a computer-based IS was needed, including all types of information identified from the A4-sheets (Fig.1).

5.2 The IS implementation

The design process began with calling for volunteers to assist an IS designer in developing the new IS. As nobody wanted to enter, the manager had to nominate some participants. In the first phase two men were nominated – a foreman and a line worker - and after nomination they were very eager to participate in the project. Because the factory environment and the coating process were totally unfamiliar to the designer, the worker representatives were in key roles. The first phase was to clarify the requirements for the new system. The nominated workers guided the designer to the factory hall and explained the workflow in the coating. The cable line was the outermost in the factory hall and the shelves and tables full of papers and files were beside the line. All the men working there were very eager to explain the different phases and terms used in the coating. It seemed like the workers were only too happy about somebody being so interested in their jobs. The designer perceived it difficult to understand the importance of the many phases in the coating and to understand all the parameters that had to be known to get the right type of cable. The noise also made it difficult to hear and thus it increased the difficulty of understanding the coating process.

The workers wanted the new system to look similar to the old paper sheets. Even the textboxes had to be found exactly on the same locations as they were on the old A4-sheets. The designer received several A4-sheets with handwritten information about coating over years (Fig. 1). The papers were dirty and difficult to read. Therefore, the designer needed plenty of help to understand the markings on the papers because they were handwritten, with many in the margins of the paper. It seemed that the designer should have been able to read the information even under the text despite new thicker writing over it. Extra difficulty came from erased and several times re-written information on the sheets.

The first prototype of the new coating IS was demonstrated to the workers in the designer's workstation in her office. The prototype was introduced one screen at a time. A new feature was that the screen did not include previous data what to change, contrary to the A4-sheets, even if the same cable type had been in production for years.

The workers were asked to deliver their impressions and to question freely. The prototype unveiled misunderstandings that troubled the workers. When presenting the characteristics of the prototype the designer used terminology unfamiliar to the workers – like "space bar", "field", "parameter", "menu", and "window". In addition, she also used fictitious names and parameters in the prototype and so doing, she caused additional annoyance because the workers argued about the impossible coating material name or that this specific customer never orders such a cable type. This misunderstanding increased the workers' resistance and decreased their trust in the competence of the designer. The elimination of this distrust demanded several discussions and talk sessions with the workers.

It was impossible to include on one screen the amount of information that was available on the A4-sheets due to for example the required font size or the layout that was not possible to be similar to the legacy paper sheet. This character of the new system led to a solution that presented several buttons to be chosen: whether it was a question of printing out new instructions or to look at an older run or if the worker wanted to create new instructions (Fig. 2).

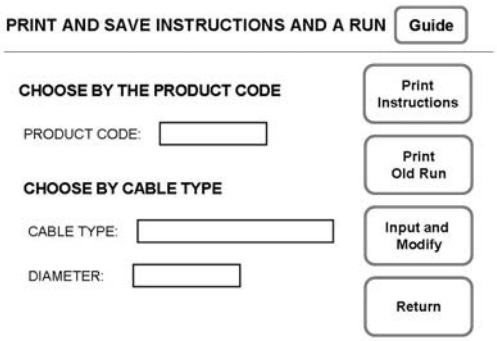
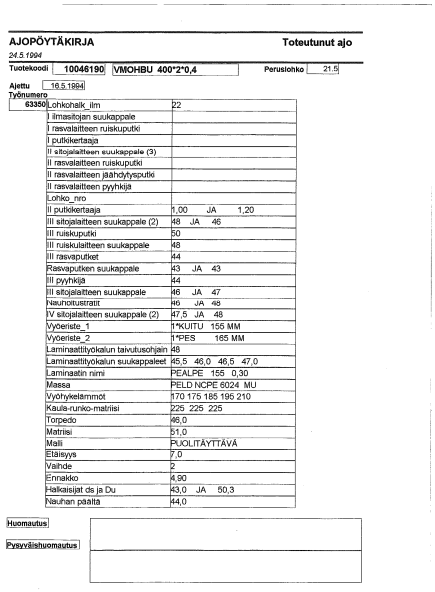


Figure 2. Several choices in the new user interface.

A significant difference compared to the old A4-sheets was the amount of new documents that were needed. While the A4-sheet included all information concerning the cable coating such as parameters needed for a certain type of cable, actual use of parameters in the current type of cable, tool details etc. (see Fig. 1), the new system produced several documents to be used in the same process of coating cable. One important requirement was to allocate space for additional remarks that earlier were written on the margins of the sheet or even on the back side (see Fig. 1, right corner down). In the new instructions the field was specified for the current run but the actualised report (see Fig. 3, empty fields) had to include two kinds of remarks, namely permanent remarks and occasional, run-related remarks.



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Lohkohalk_ilm	22
I ilmasitojan suukappale	
I rasvalaitteen ruiskuputki	
I putkikertaaja	
II sitojalaitteen suukappale (3)	
II rasvalaitteen ruiskuputki	
II rasvalaitteen jäähdytysputki	
II rasvalaitteen pyyhkija	
Lohko_nro	
II putkikertaaja	1,00 JA 1,20
III sitojalaitteen suukappale (2)	48 JA 46
III ruiskuputki	50
III ruiskulaitteen suukappale	48
III rasvaputket	44
Rasvaputken suukappale	43 JA 43
III pyyhkija	44
III sitojalaitteen suukappale	46 JA 47
Neuhoitusraiti	#6 JA 48
IV sitojalaitteen suukappale (2)	47,5 JA 48
Vyöeriste_1	1*KUITU 155 MM
Vyöeriste_2	1*PES 165 MM
Laminaatitiyökalun taivutusohjain	48
Laminaatitiyökalun suukappaleet	45,5 46,0 46,5 47,0
Laminaatin nimi	PEALPE 155 0,30
Massa	PELD NCPE 6024 MU
Vyöhykelämmöt	170 175 185 195 210
Kaula-runko-matriisi	225 225 225
Torpedo	46,0
Matriisi	51,0
Malli	PUOLITÄYTTÄVÄ
Etäisyys	7,0
Vaihde	2
Ennakko	4,90
Halkaisijat ds ja Du	43,0 JA 50,3
Nauhan paalta	44,0

Huomautus

Pysyvälshuomautus

Figure 3. Memo of actualised run.

The new IS was installed on the scheduled time. A new microcomputer was purchased for the coating line. It was placed next to the coating machine to limit the steps needed to be taken to enter the information. Its use was compulsory even if the coating was possible with the help of the old paper files. With the new computerised system, the information had to be strictly formal, written in the very same way as the information was to be retrieved from the system. The workers found that very annoying. They could no longer make spelling mistakes when entering the data, because this would mean that the information could not be retrieved. On the other hand, the workers had to enter the data literary correct when searching or browsing passed runs or the information was not found in the database.

On the paper sheets the misspellings had not bothered anyone. Furthermore, the paper sheets were easy to browse and the workers could quickly find the data they were searching just with a few glimpses on the papers. Along with the weeks and months passing, the application slowly fell out of use and the workers went on using the sheets of paper on tables and shelves.

6 Interpretation

The D&M success model includes six factors, namely information quality, system quality, service quality, intention to use, use and user satisfaction. These factors influence net benefits (DeLone & McLean, 2003). Next, we apply D&M in our empirical context.

Information quality: The information in the database was entered by the workers. The workers also complained the significance to avoid spelling errors that had previously not harmed anybody who coated cable in the department, not even had the managers complained of the messy paper files. Due to spelling errors, the information was not found in the database. Therefore, we interpret the information quality to be a negative factor.

System quality: The IS was a simple application that enabled information to be entered and retrieved from the database. As it was only intended to replace handwritten notes, there were no high-level requirements for the system. The IS was never reported to be unavailable, either. The given requirements were achieved. Therefore, we interpreted the system quality to be a positive factor.

Service quality: The IS was installed near the workers to enable its effortless use. As the IS was a simple application, after its implementation it needed no extra support from the IT people in the factory. Therefore, we interpreted the factor not significant in the current context.

Intention to use: The need for the IS was expressed by the managers instead of the workers. The workers were satisfied with their paper sheets that were perceived easy to use. The workers did not need the IS and they were reluctant to adopt it and to use it. Therefore, we interpreted the factor to be negative.

Use: The managers urged the workers to use the computer-based IS because they wanted to get easy reports from the process of coating cable. In this sense, its use was compulsory. However, the workers tried to avoid the use as much as possible and finally they abandoned it totally. Therefore, we interpreted the factor as negative.

User satisfaction: From the very beginning of the IS project, strong resistance to use was evident and it never ceased. The workers expressed that the system was difficult to use. We interpreted the factor to be negative.

Net benefits: According to the D&M model, net benefits are strongly dependent on the other factors and on the context, too (DeLone & McLean, 2003). An important issue is to define whose benefits are measured, that is, is the interest in individuals' perspective, the employers' perspective or even that of the industry or of the nation (DeLone & McLean, 2004). Despite their negative feelings the workers were able to utilise the reports produced by the system. The managers received the computer-based IS with pleasure because now they had evidence to present to the customers who were interested in the

process of coating cable. The managers also needed the information for their administrative purposes and they were satisfied with the system. Therefore, we interpreted the factor to be positive.

7 Results

Next, we placed the main findings into the D&M model. The model was adopted as given as it already was verified by numerous research efforts as Petter et al. (2008) report in their literature review. In other words, we did not question the relationships between the success dimensions. Instead, we included all six dimensions as factors that influence the success of an IS. The information in the model was collected retrospectively, as the IS implementation took place already in 1990s.

Figure 4 displays D&M as a mirror that reflects the IS implementation. DeLone and McLean (2003) delineate that the arrows depict assumed relations between the success factors but the model does not reveal if the relation is positive or negative. The arrows in the figure are as introduced in the original model by DeLone and McLean (2003) except the appearance of the arrows differs. With this change we wanted to highlight the descriptive nature of the use of the model. The factor "service quality" was interpreted non-significant in the empirical material and therefore we could not assume any relation to the factors "intention to use" and "user satisfaction". In addition, the arrows related to "net benefits" are marked as dashed because we could not interpret any influence of "net benefits" to "intention to use", "use" or to "user satisfaction" in our analysis. Likewise, the arrows from "system quality" pointing to "intention to use" and "user satisfaction" were dashed because we interpreted that the factor "system quality" did not influence the other factors.

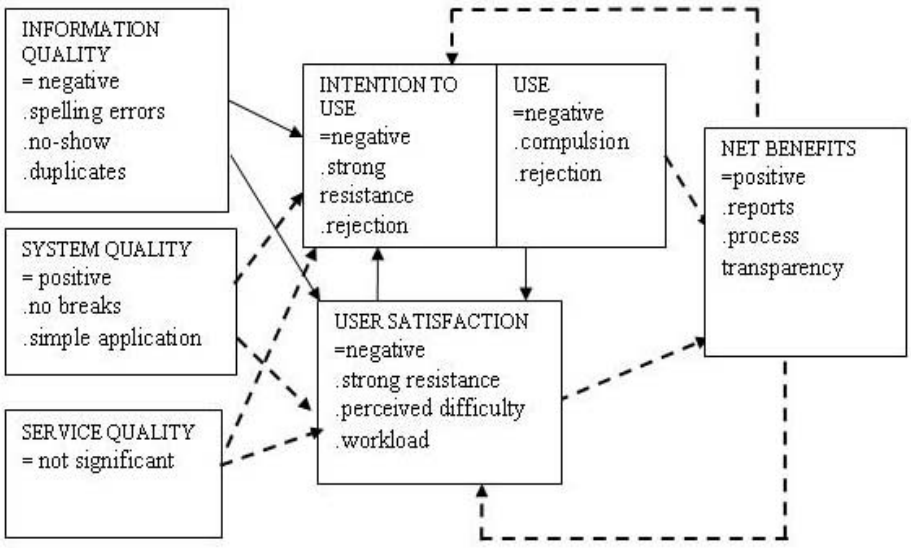

Figure 4. D&M IS success model as a mirror.

As a descriptive tool, D&M revealed that the factor "information quality" was interpreted negative and, according to the model, it influenced the factor "intention to use" and the factor "user satisfaction". From the figure we could see that the factor "intention to use" was also interpreted negative with its notes of strong resistance and even rejecting behaviour. Figure 4 also shows that the factor "system quality" was interpreted positively charged but its influence was not seen as a positive impact on factors "intention to use" and "user satisfaction".

In addition, Figure 4 indicates that the factors “intention to use”, “use” and “user satisfaction” were interpreted negative and that the factors were interdependent as the original model displayed (DeLone & McLean, 2003).

The presented D&M model enables the reader to see the IS success measures filled with interpreted observations. With the help of the applied model, the reader may form a concept of the output of the implementation. What the model does not reveal is the strong resistance already before the IS project was started. That information is interpreted in the factors “intention to use”, “use” and “user satisfaction” and finally it was realised in the total abandonment of the IS carried out by the workers.

8 Discussion

In this paper we explored an IS implementation retrospectively and reflected the implementation with the help of the DeLone & McLean IS success model (DeLone & McLean, 2003). The results were presented in the format introduced by DeLone and McLean except the outlook of the arrows that differed according to the interpretation. In addition, we added explanatory words in the boxes. In so doing, the output highlighted the pros and cons at a glance and the illustrative model enabled decision makers and managers to adopt a good conception about the passed IS implementation.

The empirical actualised IS was perceived as a trouble-maker (see Lyytinen, 1986) and the workers as its users felt it only as a sign of bureaucratisation of tasks that were earlier experienced flowing. The change from the legacy system to the new system was huge. Earlier, the workers had to handle one paper sheet (see Fig. 1). After the IS implementation, the workers had to manage several screens when browsing and updating information and to handle several printouts (see Fig. 2 and Fig. 3).

IS literature emphasises the role of user involvement in IS projects (Markus, 1983; Davis & Olson, 1985; Markus & Benjamin, 1996; Sahay & Robey, 1996; Kumar et al., 1998; Cairns & Beech, 1999; Kujala, 2007). In the factory case, the workers were in key positions because the context was unfamiliar to the designer who produced the IS. As users with their backgrounds are part of the organisation, the organisational change is evident (Davis & Olson, 1985; Eason, 1988; Leidner & Kayworth, 2006). However, the organisational change was not evident in the factory case, probably due to the short life cycle of the IS. On the other hand, cultural and social background (Walsham, 1993) did influence the implementation project in several ways. In the factory the blue-collar people worked downstairs and the white-collar people upstairs. The need for the IS came from the white-collar people. Further, the workers found it difficult to write the coating parameters and codes without spelling errors. As the customers were international, also the language produced problems for the workers.

Resistance to change appeared to be a severe problem in the IS implementation. According to experiences from different organisations it seems that in implementing new technological systems there is always resistance to change (Halonen, 2004). In the factory case the problem was evident in the very beginning as nobody volunteered to participate in the development project. As the negative attitude was experienced very strong it was difficult to evaluate what its final influence was. Even if Newman and Noble (1990) report that the user participation does not always influence positively the success of IS implementation we question if the output of the factory IS would have been different without user participation. In the empirical case, the negative attitude of the prospective users was easily interpreted as negative impact on the IS implementation.

To conclude, we did not evaluate if the IS was a success or a failure. We accepted the influence of time when assessing the success or failure (Larsen & Myers, 1999) and we also believe that “the beauty is in the eyes of the beholder” meaning that the evaluation may be totally contrary depending on the evaluator’s position in the organisation (Newman & Sabherwal, 1989). On the other hand, our approach allowed applying the model either shortly after the implementation was ready or later when the system was abandoned by its users. In either case the spectator might look at the factors and make further plans based on the interpretations in the model.

In all, we propose that the DeLone & McLean IS success model is adaptable as a descriptive tool when an IS implementation must be presented briefly. With the small changes in the appearance of the arrows D&M offers a possibility to get a conception of a passed IS implementation. Figure 4 represents the factors verified by several studies (Petter et al., 2008) and the brief information in each box displays the interpreted findings in the current case. At a glance, a decision maker or a manager is provided with a good starting point for further actions.

9 Conclusion

From the prior literature we read that the DeLone & McLean IS success model (DeLone & McLean, 2003) has been used in several applications of ISs, for example e-commerce and e-learning (DeLone & McLean, 2004; Holsapple & Lee-Post, 2006; Lin, 2007; Wang et al., 2007; Petter et al., 2008; Halonen et al., 2010). While most of the earlier papers applied quantitative research methods, our research was qualitative in nature. In addition, our paper did not evaluate the model in the way the earlier research papers generally do but applied it as it is. The descriptive output showed the elements completed with short explanations such as "information quality" with "spelling errors", "no-show" and "duplicates" (see Fig. 4). Specifically, our approach did not apply any statistical analysis and no statistical concepts were presented. In addition, our paper proved that the DeLone & McLean IS success model is adaptable by interpretation in order to mirror an IS implementation and to give a general view of the implementation.

We applied the model retrospectively in an IS implementation project that was carried out in a factory environment. The IS was to replace a manual system that necessitated a lot of tacit knowledge and experience of the users. The manual system was built on paper and pen and it was almost impossible to find explicit information without earlier experience. However, the workers were satisfied with it.

In our paper, we described the implementation with the help of descriptive pictures that realised the deep gap between the legacy system and the desired IS. As the IS implementation had been evaluated both a failure and a success, it was also interesting to explore what the DeLone & McLean model revealed. In our case, D&M (Fig. 4) offered a clear picture of the IS to be used by practitioners who design future systems in the same context or by decision makers who make plans for future in the organisation.

It would be interesting to see D&M utilised as a mirror in other IS implementations and in other environments. In addition, it would be worth exploring if practitioners value the descriptive model or the original evaluative model.

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