

The Challenges of Measuring the Quality of Information Systems in the Private vs Public Sector

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Abstract. Information systems (IS) are designed to deliver useful information in support of business operations such as corporate strategy, general operations, management analysis and decision making process. Regardless of the state of the economic market, the investments in implementing and maintaining information systems must enable an organisation to fulfil their business demands in a more efficient manner. However, there are very few options available to decision makers that provide guarantees on the effectiveness of information systems. Therefore, decision makers and managers that are responsible for adopting or retaining information systems must rely primarily on conceptual or theoretical models for measuring the quality of information systems which increases the margin of error or inaccuracies. This overarching issue of measuring the quality of information systems means that the effectiveness and cost benefits of implementing information systems may not be realised until a considerable amount of time has passed since the initial investments. This issue, amongst many other that will be identified throughout this paper, is applicable to both the private and public sector. However, the measuring of information systems effectiveness in the public sector raises some unique and significant additional challenges that the private sector is often immune to. This paper highlights some of the novel challenges identified in the public sector in order to invoke additional studies or models of measuring the success of information systems that are designed specifically for the public sector that do not rely upon profit-based outcomes and measurables.

Keywords: Information Systems, System Quality, Public Sector, Private Sector, System Analysis.

1 Introduction

As the successful and competitive functioning of public and private organizations is increasingly determined by the reliance upon the quality of information systems, there is an increasing appetite for these organizations to seek out effective mechanisms that measure the quality of those systems (Guimaraes, 2009). It is important to have access to effective mechanisms that measure the quality of information systems as this is the

method that allows these organizations to implement improvements and dedicate resources towards. However, there exist numerous challenges to achieving the optimal mechanism for measuring the quality of information systems. These challenges are ultimately caused by the different systems that are used by various organizations as it has been determined that a singular universal mechanism for measuring the quality of information systems is not easily achieved. However, the most prevalent challenge in producing coherent results from models that measure the quality of information systems relates heavily to the subjective nature in which the data is collected. Furthermore, as most organizations have numerous stakeholders with conflicting objectives, the measure of the quality of organizational outputs that rely on information systems vary depending on the stakeholder. Ultimately, information system effectiveness is a multi-dimensional construct which means there is very rarely a single universal mechanism for measuring quality (Pitt & Watson, 1995).

A study conducted by Petter et al (2008) identified that many organizations are opting for less traditional methods for measuring the quality of information systems such as balanced scorecards (Kaplan & Norton, 1996) and benchmarking (Seddon et al, 2002). The exclusive measuring of financial outputs to determine the quality of information systems is not necessarily the best way to measure whether an information system is effective as there exist many other alternative factors that are likely to impact the financial performance of an organisation. Furthermore, there are additional methods for measuring quality that have been developed by researchers that emphasize the requirement to utilize more consistent success metrics other than just financial ones. Nevertheless, in the private sector, the financial impacts of implementing an information system are likely to remain the most preferred option. The public sector is not a profit-based organisation and therefore, measuring financial performance is not a tangible solution to measuring the quality of information systems.

2 Literature Review

Keen (1980) describes the overall objective of an information system as ‘the effective design, delivery, use and impact of information technologies in organizations and society’. Keen emphasizes the importance of the term ‘effective’ as without this effectiveness the value of an information system is severely degraded. Therefore, it is vital that prior to the decision being made to implement or retain an information system that the effectiveness of that system is properly understood. In order to understand the effectiveness of an information system, there have been a variety of models proposed that are designed to measure the quality of an information system.

The most important model that is typically relied upon when measuring the quality of information systems is the one proposed by DeLone and McLean (2003), known as the DeLone and McLean Information System (IS) Success Model. This D&M IS Success Model systems quality measures technical success, information quality measures semantic success, and use, user satisfaction and individual impacts measure effectiveness success (DeLone & McLean, 2003). DeLone and McLean suggest that these six

measurables are interrelated rather than independent which has been identified as a pivotal observation when considering the measuring of the quality of information systems. For example, if an information system produces a high level of system or information quality then it is likely that same system will lead to higher user satisfaction. However, a large number of researches have proposed nuanced approaches that either adapt or expand upon the D&M IS Success Model. Grover et al (1996) introduced an alternative model that utilizes a theoretically based approach or theory of organizational effectiveness. This model proposes six information system effectiveness categories that are organizational impacts (included in the D&M IS Success model); market measures; economic measures; usage measures; perceptual measures (i.e. user satisfaction); and productivity measures. This model suggests that system quality and information quality are precursory measurables whilst the D&M IS Success Model considers them to be attributes that must be utilized to measure the success of an information system. The Grover et al model inspired DeLone and McLean to expand upon their original model by including additional measurables that include the impacts of the market or industry. Furthermore, Smithson and Hirschheim (1998) proposed an additional model that utilized a conceptual framework that considers the issue sometimes caused by the increasing appetite for outsourcing information systems. This additional model has been identified by DeLone and McLean as a key source for identifying and developing information system evaluation measures as opposed to the potentially limiting single frameworks of success and their interrelationships. Despite many perceived benefits of the Smithson and Hirschheim model, it has been suggested that this model may be challenging to implement in practice considering that it fails to specify tangible success constructs with their related measures.

There are very few studies that have been conducted in this field that exclusively focus upon the perspective of the public sector. Therefore, this paper will rely upon widely accepted assumptions about the operations of the public sector when compared to the private sector.

3 Challenges with existing Quality Measures

The aspects of a typical information system that must be measured to determine the quality or success rate of the system are widely disputed across the field of study. As highlighted in the literature review, many researchers disagree on what the important measurables are and how to approach the quality measuring of an information system altogether. However, the model proposed and updated by DeLone and McLean (1992; 2003) is almost always referred to by alternative studies and therefore, this paper will rely upon the mechanisms proposed by the D&M IS Success Model. However, it is essential that this model is understood in more detail before it is analyzed in the perspective of the public sector.

The D&M IS Success Model proposes six main aspects that must be measured which are, information quality; system quality; service quality; use; user satisfaction; and net benefits of use (Delone & Mclean, 2003). This paper will explore each of these aspects from the perspective of private and public institutions. It will also compare these

two perspectives in order to identify the core challenges of measuring information systems in the public sector.

3.1 Measure of information quality

The measure of information quality can be identified as the most desirable characteristics of the information system output that are commonly observed as items such as management reports and webpages (Petter et al, 2008). Some of the approaches to measuring information quality in this manner can be identified as characteristics such as the relevance, understandability, accuracy, timeliness and usability. One of the primary issues with measuring the information quality through these characteristics is that these can be very subjective attributes. This is relevant for all the attributes mentioned above but would be particularly relevant to those such as understandability and usability. The subjective nature of this approach means that the measurement will often rely upon the opinion of the end-users. Unfortunately, this reliance upon collecting data from the opinion of end-users means that two organizations using the same systems for the same purposes may produce very different results as they rely upon additional contributing factors such as quality of training or how much experience the end-user has using the system. Nevertheless, information systems in the public sector should be developed and deployed in a manner that leads to a better experience by the end-user, but this approach would require the bespoke development of information systems that are tailored to the demands of each and every customer. In the absence of a highly customizable information system, this approach would not likely align with the business demands of the system providers and therefore, would likely not be financially viable. Furthermore, as the services provided by the public sector are predominately focused on the needs and demands of the general public, the quality of the information provided by public sector information systems will be measured by two different perspectives. First, the perspective of the public and secondly, the perspective of the public sector employees. This is in comparison to the results produced in a for-profit private organisation that are predominately produced from increasing profit margins that can be observed with or without opinions gathered from internal or external stakeholders.

3.2 Measure of system quality

The same subjective issues can be applied to the measuring of the system quality. The system quality is understood to be the desirable characteristics of the information system itself as opposed to those of the system outputs. Some of the approaches to measuring system quality can be identified as characteristics such as, flexibility, system reliability, ease of learning and response times (Petter et al, 2008). Again, the most effective approach to measuring these attributes would be through collecting data from end-user experiences. Rivard et al (1997) produced a highly effective model that measures eight system quality factors across 40 items. The most prominent features of this model measure attributes such as portability, user friendliness, understandability, maintainability, economy, and verifiability. Nevertheless, the subjectivity of these attributes still remains a challenging obstacle for the public sector to measure their information system's quality. If the attribute, ease of learning, is taken as an example to demonstrate

the differences between the private and public sector, then it is likely that the results of using the same information system in these two entities would produce very different results. For an information system to be considered as 'easy to learn', there are many additional factors that must also be included in the process. If a highly complex information system is required to fulfil the requirements of a highly complex issue, then it is likely that the end-users of this system must also receive credible training. This training may be conducted by external bodies that do not necessarily maintain any responsibility in the development of an information system. Therefore, the quality of an information system then relies upon the quality of the training that is received by the end-users. When this logic is applied to the private/public sector dichotomy, there is a risk that those private sector end-users will receive the better training (or have the relevant experience) due to the increased availability of funding. However, this argument can also be reversed as many public sector departments are likely to have access to higher quality training. It can be realistically concluded that measuring the quality of information systems based on characteristics such as ease of learning will differ greatly between the private and public sector and therefore, a universal model cannot be applied here.

3.3 Measure of service quality

The service quality can be explained as the quality of the support that system users receive from the information system or IT support teams (Petter et al, 2008). It has been identified that this attribute is the most common measurable in this field of study, however, it has received widespread criticism. This criticism is driven by the increasing appetite for outsourcing the development and support of information systems as the data collated to measure the quality of information systems derives from external providers whom may often possess a totally different set of requirements. As the public sector begins to transition towards more outsourcing due to the increasingly complex nature of information systems, this issue may become even more prevalent for governments.

3.4 Measure of system use

The attribute referred to as system use can be identified as the degree and manner in which the staff and customers utilize the information systems. This can be quite easily characterized by factors such as, amount of use, frequency of use, nature of use, and extent of use (Petter et al, 2008). Measuring the quality of information systems through the studying of system use is a much less subjective approach as the results gained are not reliant upon end-user opinions. It has been identified that the wide range of measurables that relate to system use are likely to lead to conflicting results which delegitimizes the models of measuring information quality altogether. As Petter et al (2008) observed, the end-users that utilize information systems more frequently have been found to underestimate system use whilst the opposite is true of those end-users that utilize systems less frequently. This highlights the issue of self-reporting. It is likely that a model that utilizes both internal and external measurables would produce much more accurate results. However, this approach relies upon the presence of reliable external stakeholders. Additionally, those external stakeholders must also contribute to the measurement of information system success through the perspective of the internal stakeholders in order to produce results that are reflective of the organizations overall objectives.

3.5 Measure of frequency of use

Furthermore, frequency of use has been identified as a relatively weak approach to measuring overall quality of information systems as more use of a system does not necessarily mean that that information system is of better quality (Doll & Torkzadeh, 1998). It is likely that lack of funding for upgrading or developing new information systems will be a significant factor in how frequent a system is used. It may be that an information system is used for an extended period of time as it is considered as a highly effective system or it may be due to the fact that that organisation does not have the financial capability to invest more into a new system. Considering the constant advancement rates of modern technologies as well as the increasing demand from the general public or customers (depending on whether it is the public or private sector being observed), it is likely that if an organisation has been using a system for an extended period of time, then that system will be out of date. This is if it is assumed that those systems have not been routinely updated by the provider. Unfortunately, in order for an organisation to understand whether increased investments in an information system would be a viable option to further enhance its operations and outputs, it would need to have access to an accurate model to measure the quality of information systems. This highlights an issue with a feedback loop that may be difficult to break out of.

3.6 Measure of user satisfaction

User satisfaction literally refers to the satisfaction rates of the end-users. Therefore, this attribute may be the most subjective measurable attribute. Ives et al (1983) provides the most widely adopted model for measuring user satisfaction in terms of information systems. It has been identified that the measuring of information quality is strongly correlated with the measuring of user satisfaction (Ives et al, 1983; Baroudi & Orlikowski, 1988; Doll et al, 1994). Subsequently, information quality may not be measured as a standalone attribute which can lead to additional issues for overall information system studies. Despite the challenges caused by subjective measurables, the user satisfaction is undeniably a very important aspect of measuring the quality of information systems. The most widely adopted models for measuring user satisfaction are those models proposed by Doll et al (1994), EndUser Computing Support (EUCS) and Ives et al (1983), User Information Satisfaction (UIS). These models also include attributes that can be found within the other attributes such as system quality, information quality, and service quality. Therefore, the most commonly adopted models for measuring user satisfaction do not exclusively measure user satisfaction at all. It is likely that this is largely due to the fact that measuring the quality of information systems through subjective attributes is not a reliable enough approach to producing coherent results. The recurring issue that relates to the public sector refers to the fact that the satisfaction of the end-user should not be a standalone measurable as it does not consider the satisfaction rates of the general public. Arguably, the satisfaction rates of the general public who are the main customers of the public sector should be as important, if not, more important than the satisfaction rates of the users. If the satisfaction rate is high for the public sector end-users, but the public satisfaction rate is low, then the information system should not be considered of high quality.

3.7 Measure of Net Benefits

The net benefits of an information system can be identified as the extent to which the information systems directly contribute towards the overall success of the organisation. The net benefits of an information system may be identified through the improved decision-making process, the improvement of productivity, increased sales, cost reduction, increased profit margins, and economic development (Petter et al, 2008). This attribute may be the most challenging to measure in the public sector whilst being the simplest to measure in the private sector, most notably those for-profit organizations. As highlighted above, most of the factors that can be attributed to net benefits are heavily focused on financial factors. This provides the for-profit private sectors with a wide range of highly tangible measurables. However, the public sector is not a for-profit organisation and therefore, the overall net benefits of an information system can only really be measured through other channels. Furthermore, the net benefits found in the public sector will likely fall within one or a selection of the previous attributes already discussed in this paper which have been identified as almost always highly subjective. When attempting to measure the overall net benefits of a system that is designed to improve public services, there are some objective factors that can be utilized. However, this model, and most of the models proposed, do not consider this nuance with the public sector.

Although it is essential that institutions are able to measure the effectiveness of the information systems already integrated into their operations, it is also just as important to be able to assess the potential impact upon operations that new information systems will have prior to their implementation. In the private sector, the responsibility of the success or failure of the introduction of a new information system will almost always remain with internal decision makers. Although this is probably true within the public sector, there is an added level of accountability when the financial obligations are from public monies. Therefore, it is likely there is an element of apprehension when public sector departments are exploring new information systems which is likely to limit the number of new systems that are introduced. This apprehension is also likely to contribute towards extending the already relatively slow moving bureaucratic systems found across a plethora of public bodies.

Gorla, Somers and Wong (2010) suggested that the construct 'use of the system' should be removed from the models that measure the success of information systems. This is due to the fact that, within the public sector, it has been identified that there is little benefit of this construct when being applied to mandatory systems. Ultimately, when a system is mandatory, there is little to be gained from measuring its use as there is no alternative option. The only aspect of this construct that could potentially offer a beneficial measure of success is the presence or absence of a mandatory system. For example, if an information system is required for a specific public service but it has not been implemented yet. However, this would not be measuring the quality of any information system but rather this would be the measure the efficiency of government spending. Furthermore, Gorla et al (2010) suggest that 'user satisfaction' is also a redundant aspect to measure as this can be measured through other channels, such as the quality of information and the system quality.

4 Conclusions

As has been highlighted throughout this paper, there are a multitude of challenges to measuring the quality of information systems that are applicable to both the private and public sectors. The most concerning issue for the public sector however, relates to the fact that the most reliable source of measuring the quality of information systems in the private sector is not directly transferable to the public sector. The net benefits of adopting information systems are typically measured through attributes that relate to profits and the public sector is not a for-profit organisation. Additionally, when measuring the quality of information systems in the public sector, results must be gathered from both the perspective of the public and that of the public sector employees – which is likely to produce different results. There are a plethora of challenges in measuring the quality of information systems that have yet to be completely addressed in the current literature. However, the current models appear to be developed with the for-profit private sector as a primary consideration that do not necessarily consider the nuances of conducting the same process in the public sector.

5 Recommendations

As has been highlighted throughout this paper, many of the models proposed do not exclusively focus on the measuring of information systems from the perspective of a specific customer. One of the key challenges that is often referred to in this field of study emanates from the difficulty of proposing a model that is universally applicable. Therefore, it is suggested that more research be conducted on constructing bespoke models that are not only specifically applicable to the public or private sector, but also tailored to a specific industry or government department. It cannot be denied that the requirements of every possible end-user of information systems will vary and therefore, the models that are available must reflect this diversity of needs.

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