

Measuring the performance of Customs Information Systems (CIS) in Malaysia

Mohd Afandi Md Amin

Abstract

In the scope of this study, 'performance measurement' includes the collection and presentation of relevant information that reflects progress in achieving organisational strategic aims and meeting the needs of stakeholders such as merchants, importers, exporters and other clients. Evidence shows that utilising information technology (IT) in customs matters supports import and export practices and ensures that supply chain management flows seamlessly. This paper briefly reviews some practical techniques for measuring performance. Its aim is to recommend a model for measuring the performance of information systems (IS): in this case, the Customs Information System (CIS) used by the Royal Malaysian Customs Department (RMCD). The study evaluates the effectiveness of CIS implementation measures in Malaysia from an IT perspective. A model based on IS theories will be used to assess the impact of CIS. The findings of this study recommend measures for evaluating the performance of CIS and its organisational impacts in Malaysia. It is also hoped that the results of the study will assist other Customs administrations evaluate the performance of their information systems.

Introduction

This study was motivated by the positive effects that information and communication technology (ICT) can have on customs modernisation. For over a decade, Customs administrations around the world have faced a variety of pressures and demands from political bodies, law enforcement agencies and the business community as they modernise customs services in line with the development of information technology (IT) and international trade. Challenges include improvements in trade facilitation, social protection, national security, and revenue collection (McLinden 2005). In facing up to these challenges, customs services have adopted the latest ICT as a means of reinforcing the development of their organisations and ensuring the efficiency and effectiveness of customs operations.

Both national governments and international organisations are promoting the implementation of ICT as a means of facilitating trade. The initiative is supported by the Malaysian government, the Organisation for Economic Co-Operation and Development (OECD), World Bank, World Customs Organization (WCO) and World Trade Organization (WTO). As a member of the WCO, Malaysia also employs ICT initiatives to comply with global trade requirements such as the WTO's Valuation Agreement and 'to enhance trade facilitation functions and improve the process of customs modernisations' (Lewis 2003). The implementation of CIS represents a major step towards the implementation of e-commerce solutions using electronic data interchange (EDI), with paperless transactions being the ultimate goal.

In many organisations, a key component of strategic planning consists of measuring the performance of the resultant strategies and initiatives as well the planning itself. In order to measure performance in

today's organisations, one must ask 'how effectively', the organisation in question delivers its products and services to satisfy the needs of its stakeholders (for example, the government and private sector participants). In terms of customs administration, performance measurement can be seen as ensuring Customs' effectiveness in facilitating trade by means of trade facilitation techniques or in protecting a nation from illegal import and export (for example, smuggling and drug trafficking).

In view of the need to measure performance from an IS perspective, this paper suggests how an existing system can be measured using IS theories and end-user reactions. This will form the framework for assessing the performance of CIS in Malaysia.

This paper is divided into three sections: the first explains the concept of performance measurement and its significance to Customs; the second discusses methods of performance measurement. The final section elaborates the various theories underpinning the measurement of performance from an IS perspective and forms the bulk of the study. From the various models used to define IS performance, one was selected as a means to provide comprehensive explanations, measure CIS implementation and assess impacts on the Royal Malaysian Customs Department (RMCD) administration.

Measuring performance

There are many reasons why organisations wish to measure their performance (Behn 2003). Cameron and Whitten (1983) attempt to measure the performance of an organisation by summarising as six questions the variables that drive organisational performance. Following a survey of 29 organisations they updated their guidelines and formulated seven questions to help measure an organisation's performance (see Table 1, below). Other researchers have used these guidelines to ascertain the function and performance of IS (Myers & Prybutok 1998).

Table 1: Questions for measurement guidelines

Questions	CIS Implementation
Question 1: What domain activity is being focused on?	e.g. clearance of import, export and transit
Question 2: Whose perspective, or which constituency's point of view, is being considered?	e.g. top management and other stakeholders
Question 3: What level of analysis is being used?	Periodically, ranging from quarterly to annually Subjective: perceptual data from individual
Question 4: What timeframe is being employed?	Monthly or yearly
Question 5: What types of data are to be used?	e.g. usage data feedback reports
Question 6: What referent is being employed?	
Question 7: What is the purpose of the evaluation?	e.g. performance evaluation acceptance

Source: Adapted from Cameron & Whetten (1983)

Definition of performance measurement

Performance measurement represents one cornerstone of business excellence. Business excellence models not only promote the use of performance measures but also enquire whether performance measurement systems are designed in a way that reflects the overall strategy and ensures the system is effective in monitoring, communicating, and propelling performance.

Baird and Stammer (2000), using Baldrige's criteria, explain the task of 'measuring performance' by referring to its constituent components. Accordingly 'measuring' concerns the numerical data that quantifies input, process, output, performance of the processes relating to products and services as well as overall organisation; 'performance' on the other hand, reflects the output results obtained from processes ('output' here relating to services and products) that permit the evaluation of subjective goals, standards, past results, as well as organisational aspects. Performance can be measured in financial or non-financial terms.

The importance of measuring performance

In the business world, it is difficult to measure performance because it is determined by various nebulous factors. Similar to customs matters, performance measures not only involve a variety of procedures and regulations but also various dimensions such as increases in revenue collection, shorter processing and customs clearance time, preventing the loss of revenue, or the simplicity of procedures, forms and processes.

The following lists the main reasons why performance measurement represents an important part of an organisation:

1. *Clients' requirements.* For example, customs' services are bound to meet the requirements of a wide range of stakeholders, including the government and private sector. Measuring performance allows Customs to find out whether services are simple, transparent and effective.
2. *Understanding processes.* By measuring performance, Customs can identify the critical aspects of their procedures. This enables them to understand the procedures or processes in question, thereby directing their attention to crucial aspects.
3. *Fact-based decision-making.* Defining performance reduces the risk that customs officers will make an incorrect decision. The use of IT can simplify some procedures thus reducing the time that brokers spend dealing with customs officials.
4. *Improvement.* By defining performance measures, Customs can identify the improvements needed to provide a better quality service such as the controls of goods in transit, calculation of customs value and risk management.

Evaluating methods of performance measurement

There are various 'theories' providing different frameworks and reference models for measuring performance. Some are reflected in standards and global measures related to the 'core-business'. They include the balanced scorecard approach (BSC), key performance indicators (KPI), the economic value-added approach (EVA), activity-based costing (ABC) and total quality management (TQM). This section briefly reviews the typical methods used to measure performance in a business context.

The balanced scorecard approach

The balanced scorecard (BSC) was developed by Kaplan and Norton (1992) and is based on stakeholder theory (Graham 2009). BSC offers a way of measuring performance which covers four interrelated

dimensions: (1) financial, (2) customer, (3) internal business process and (4) learning and growth perspective. This framework recognises that traditional financial accountancy measures are incapable of describing, implementing and managing strategies (Amaratunga, Baldry & Sarshar 2001). Instead, it measures performance using logical structures, objectives and criteria (Abran & Buglione 2003).

BSC does not yet provide a direct means of measuring the success/impact of IS. However, as many IS researchers are now recognising that financial criteria alone cannot measure IS success/impact (Murphy & Simon 2002), the BSC can provide useful indicators for IS evaluation. Indeed, several attempts have been made to adapt BSC to measure IS. For example, Martinsons, Davison and Tse (1999) introduced a BSC-for-IS framework which consolidates four perspectives from traditional BSC in order to assess the performance of the IS department, project and applications.

According to a recent report presented by the Performance Measurement Association (PMA) about user satisfaction, 39 per cent of the Financial Times Stock Exchange (FTSE) 100 companies actively use the BSC (BPIR 2010). Other researchers claim that between 40 to 60 per cent of Fortune 1000 companies are currently implementing BSC (EPM 2010).

Key performance indicators

Key performance indicators (KPIs) can be defined as ‘performance indicators that have a significant impact on the overall performance of an organisation in the area of strategic, tactical, operational planning, and control’ (Gunasekaran, Patel & McGaughey 2004). All indicators are quantifiable and reflect critical success factors (CSFs) within the organisation (Fortner 2010).

In relation to customs administrations, KPIs have been employed by UK Customs (HM Revenue and Customs [HMRC]) ‘to help the department make sure it is on track to achieve...[its] objective’ (HMRC 2007) in the following core areas of its business: the aggregate level of losses for VAT, excises, direct tax and National Insurance contributions taken together, level of tax credit error and fraud, as a percentage of finalised entitlement, applications for Working Tax Credit, Child Tax Credit and Child Benefit.

In addition, RMCD has also employed KPIs as part of its modernisation drive in the public sector and in conjunction with a government initiative on KPI implementation. This initiative was started in 2005 and measures performance based on core business, core process, clients, and performance targets. All methods of measuring KPIs must be specific, measurable, achievable, realistic, and time-bound (SMART).

Information systems performance measurement

Generally, the implementation of IT tends to increase costs and is therefore a cause for concern in management circles (Heo & Han 2003). As part of its customs modernisation initiative, Malaysian Customs has been granted a large budget to implement IT in the various customs administrations. In view of this, CIS performance should therefore be managed in light of the system’s strategic role rather than its return on investment (ROI) (Ballantine et al. 1998; DeLone & McLean 1992).

It is important to ensure that the measures used to evaluate performance are related to CIS’s strategic role. According to El-Masri (2009), there are two lines of research into the evaluation of IS: (1) the contextual antecedent and behavioural determinant of IS performance and (2) improving IS evaluation definition (for example, success and impact) from the stakeholder’s standpoint.

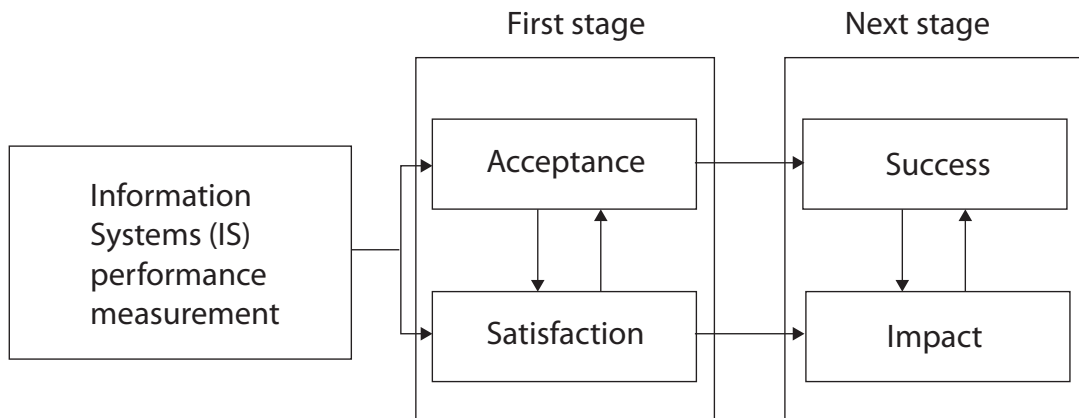
There are also five fields of research on measuring IS performance within a business context (El-Masri 2009):

- *Behavioural perspective*: refers to the implementation of IS as well as related steering and control processes.

- *Technological perspective*: views the IT component as the principal determinant of success (Zhu et al. 2004).
- *Operational perspective*: views IS implementation in terms of internal organisational performance and individual staff performance (Zhu et al. 2004) and impact (Gable, Sedera & Chan 2008)
- *Business perspective*: relates to the strategic and financial impact on the organisation (Kaplan & Norton 1992).
- *Attitudinal perspective*: concerns the psychological aspect that could impede or drive success. It is viewed in terms of user satisfaction and progress in IS implementation.

Figure 1 illustrates how IS performance measurements relate to measures within the generic framework. Accordingly, the first stage of measuring IS performance is to ascertain a new technology's 'user acceptance' and 'user satisfaction'. The next stage determines 'success' and 'impact' by referring to the way the technology is used. This study aims to measure the success of CIS implementation and ascertain the impact on RMCD.

Figure 1: IS performance measures



Source: As proposed in the RMCD study

The following section presents the concepts of 'user satisfaction' and 'user acceptance' as elaborated in IS studies. Both measures can be used to define the performance of CIS in terms of how it is perceived by individual users or the staff. In this context, 'success' and 'impact' refer to the organisational effectiveness of CIS implementation measures adopted by RMCD. In measuring CIS performance, all measures are interrelated in the short term (first stage) and long term (subsequent stage).

User satisfaction

In most IS research, user satisfaction is found in a system that meet user expectations (that is, the quality of the system and how the user feels about using it). These expectations are relayed through a psychological paradigm whereby the users evaluate a system and provide feedback. This could be negative or display a lack of trust in the system. However, user satisfaction is an abstract concept and depends on various factors; in terms of CIS, the user's attitude towards the system will have an impact on user satisfaction.

Additionally, Wixom and Todd (2005) have found that user satisfaction literature explicitly enumerates the attributes of system and information design (for example, information accuracy and system reliability). This represents a potentially useful diagnostic tool for system design. However, other researchers (Davis 1989; Goodhue & Thompson 1995) have also established that user satisfaction is a weak indicator of system usage. According to Ajzen and Fishbein (2005), this is due to the fact that beliefs and attitudes about objects (that is, the systems) are generally poor indicators of behaviour (that is, system usage).

User acceptance

Considering that the acceptance of a system may be determined by user satisfaction, the user's belief in the system's capacity to handle the tasks in question is also a relevant consideration. Therefore, user satisfaction can result either in acceptance (that is, if the user has positive belief in terms of for example, time and effort) or rejection (that is, if the user has a negative impression in these respects). Concerning CIS implementation, the quality of information will have a positive effect on the perceived usefulness of the system and satisfaction in using it. This is supported by Davis (1989) who argues that there is a direct correlation between the quality of information and the user's job performance. Dillon (2001) defines user acceptance as 'the demonstrable willingness within a user group to employ information technology for the task it is designed to support'. According to this definition, acceptance depends on the user providing evidence of their use of technology.

Researchers of human-computer interaction (HCI) have also identified the human factors determining users' responses to the system interface. According to their findings, acceptance largely depends on the concept of usability. HCI research is based on the assumption that the acceptability of technology for users depends on its usability (Dillon 2001).

Additionally, user acceptance of technology derives from the theory of self-efficacy (Bandura 1997). Self-efficacy is defined as 'people's judgments of their capabilities to organise and execute courses of action required attaining designed types of performance'. Research shows that users who trust the systems in question are more likely to accept them. Moreover, reinforcing users' self-efficacy could save time, effort and money. These factors could also have a positive impact on acceptance because it would give users an incentive to use the system (Venkatesh et al. 2003). Therefore, in terms of CIS, users are more likely to accept a system they believe will save time and increase their productivity.

According to Wixom and Todd (2005), user acceptance literature (for example, the theory of acceptance model) – unlike that on user satisfaction (Venkatesh et al. 2003) – provides a good indicator of usage by measuring behaviours against attitudes and beliefs (that is, regarding ease of use and usefulness) that reflect users' interests in terms of time, target and context (for example, system usage).

Theoretical models for measuring IS performance

IS research has developed several theoretical models for ascertaining how people adopt new technology. Here again there are two lines of research: (1) an individual's acceptance (as described in the section above), and (2) 'success' and 'impact' at organisational level (depicted in Figure 3). In this context, IS research has adopted rigorous theoretical models that define indicators of technology acceptance on the basis of psychology and IS.

Individual measures

IS performance is measured using psychological factors (that is, human behaviours indicating acceptance and/or rejection of technology) and the system itself. Concerning the former indicator, Figure 2 depicts two theoretical models which are widely used to define technology acceptance and satisfaction.

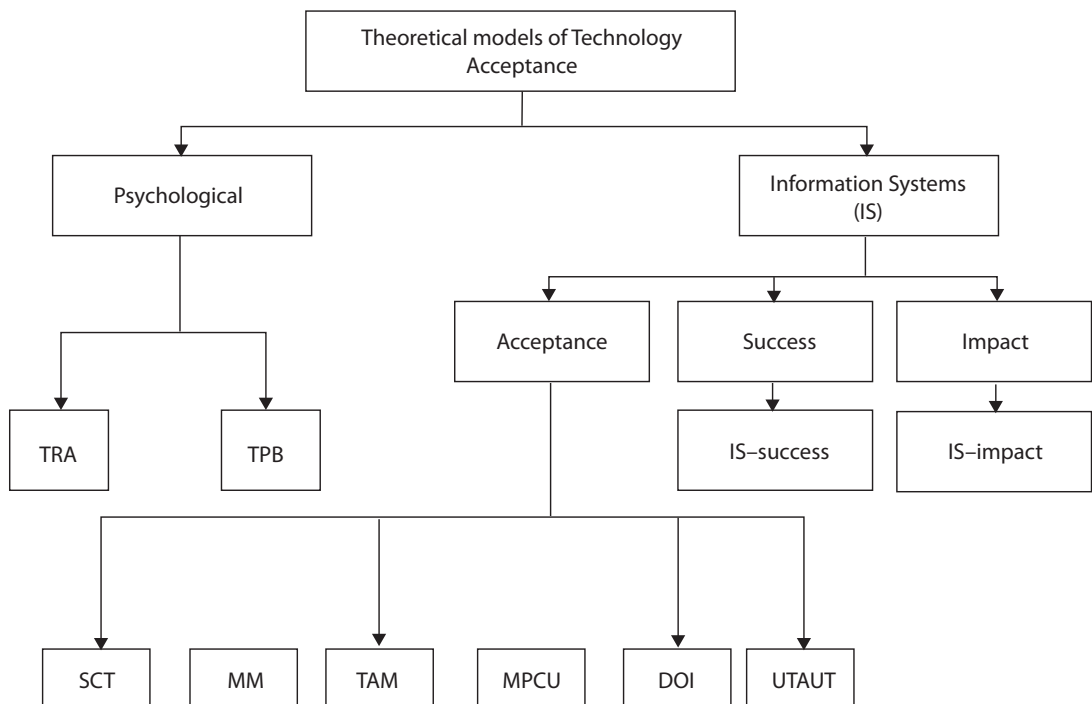
Psychological measures

The two models are: the theory of reasoned action (TRA), and the theory of planned behaviour (TPB). TRA (Ajzen & Madden 1973) is the most basic and influential theory on human behaviour and has been used to predict a wide range of behaviours. Davis (1989) constructed the theory of acceptance model (TAM) from TRA to assess an individual's acceptance of technology and found that the explanation for

predicting the way users intend to use technology was consistent with studies that had employed TRA in other contexts. TAM is considered the most influential and commonly employed theory to describe an individual’s acceptance of IS (Lee, Kozar & Larsen 2005).

TAM assumes that an individual’s acceptance of technology is defined by two major variables: perceived usefulness and perceived ease of use. TPB (Ajzen & Fishbein 1980) has been used to explore the determinants of individual acceptance and usage in many technologies (Venkatesh et al. 2003). The core constructs of TPB are attitudes, subjective norms and perceived behavioural control. These constructs define how easy or difficult it is for users to perform behaviour (for example, to use and accept a new technology).

Figure 2: Theoretical models of acceptance of technology



Source: Proposed for this study

Information systems

There are several other theoretical models which offer alternatives to the psychological method. They define acceptance using the following concepts: (1) diffusion of innovation (DOI); (2) social cognitive theory (SCT); (3) the motivational model (MM); (4) the model of PC utilisation (MPCU); (5) TAM and (6) the unified theory of acceptance and use of Technology (UTAUT). Table 2 summarises these models:

Table 2: Comparison of theoretical models

Theories/Model	Descriptions	Seminal Authors
Motivational Model (MM)	Demonstrates general motivation theory; extrinsic and intrinsic motivation are indicative of human behaviours towards technology.	Vallerand (1997)
Social Cognitive Theory (SCT)	The most powerful theory of human behaviour; it consists of the following variables: performance outcome expectations, personal outcome expectations, self-efficacy, attitude and anxiety.	Bandura (1986)
Model of PC Utilisation (MPCU)	Developed and used to predict the utilisation of personal computers (PC). Defined by the following variables: job-fit, complexity, long-term consequences, attitude towards use, social factors, and facilitating conditions.	Triandis (1977)
Unified Theory of Acceptance and Use of Technology (UTAUT).	A recent theoretical model formulated from the above theoretical models. It adopts a holistic approach to better explain user acceptance and usage of new technology. It has four variables: performance expectancy, effort expectancy, social influence and facilitating conditions. Its variables are gender, age, experience and willingness to use the technology.	Venkatesh et al. (2003)

Source: Venkatesh et al. (2003)

Organisational measures

Furthermore, Figure 3 shows that, in organisational terms, IS research can be categorised under two headings – success and impacts – which are based on two theoretical models: IS-success and IS-impact, respectively. These models are explained below.

IS-success model

Using the findings of Shannon and Weaver (1963) and Mason (1978) as a basis, DeLone and McLean (1992) reviewed 180 conceptual and empirical studies and from them extracted 100 measures used to evaluate IS-success. These were used to create the IS-success model which is most widely cited today (Heo & Han 2003).

The IS-success model is the most popular model for researchers evaluating or measuring the success of IS (Myers et al. 1998; Sedera & Gable 2004). It consists of six interrelated and interdependent dimensions of success: ‘system quality’, ‘information quality’, ‘use’, ‘user satisfaction’, ‘individual impact’ and ‘organisational impact’. This model has contributed to the success of IS research by summarising common factors in prior studies of IS-success (Gable, Sedera & Chan 2008).

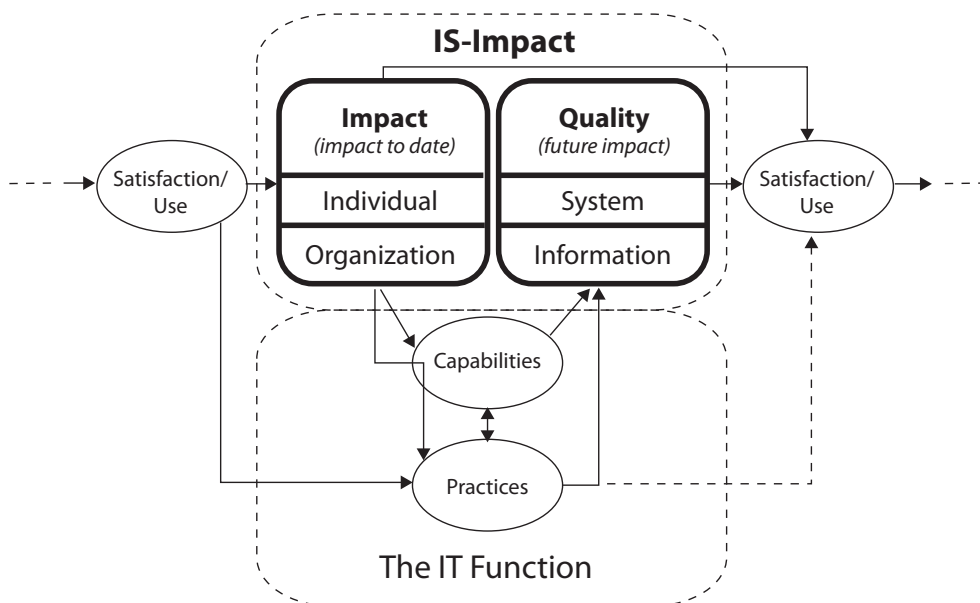
Prior to DeLone and McLean’s work, IS-success was often measured in isolation, and so their work allows a better understanding of the research as a whole. Indeed, the IS-success model has been criticised by various researchers who argue that its combination of the process model and other references is confusing. Moreover, it inappropriately conceptualises the concept of ‘use’ (Seddon 1997; Seddon et al. 1999).

Furthermore, Shang and Seddon (2000) introduced an enterprise system (ES) benefit framework, which lists the benefits that can result from an ES. The framework divides benefits into five dimensions: operational, managerial, strategic, IT infrastructure and organisational. This is an ES-specific success model and accommodates multidimensional and relevant ES success measures which focus on the organisation rather than the system itself. However, Gable, Sedera and Chan (2008) perceive these measures as ‘overlapping across dimensions’.

IS-impact measurement model

After reviewing the literature pertaining to the measurement of the success of IS performance, we found that the IS-impact measurement model was the one which was most comprehensive and up-to-date. It was also the model which contained the most recognised indicators for measuring the impact of IS. This IS-impact model includes 27 measurements distributed across four distinct dimensions, namely: system quality (SQ), information quality (IQ), individual impact (II) and organisation impact (OI). Furthermore, according to Gable, Sedera and Chan (2008), ‘the IS-impact model is a holistic index representing the stream of net benefits; the ‘impact’ half measuring net benefits to date, while the ‘quality’ half, forms our ‘best’ proxy measure of probable future impacts, with ‘impacts’ being the common denominator’. This is depicted in Figure 3.

Figure 3: The IS-impact measurement



Source: Adapted from Gable, Sedera & Chan (2008)

According to Gable, Sedera and Chan (2008), IS-impact is ‘a measure at a point in time, of the stream of net benefits from the IS, to date and anticipated, as perceived by all key-user groups’. Furthermore, Gable, Sedera and Chan (2003) point out that the IS-impact model deviates from the IS-success model in the following ways: it depicts a measurement model rather than the causal process of success; it omits the use of construct; satisfaction is treated as an overall measure of success, rather than as a construct of success; new measures have been added to reflect the contemporary IS context and organisational characteristics; and it includes additional measures to provide a more holistic organisational impacts construct.

In addition, compared to the original IS-success model, Gable, Sedera and Chan (2003) have eliminated the use and user satisfaction dimensions via multistage data collection and statistical analysis (Ifinedo 2006, 2008). The IS-impact model has been extensively validated statistically and employs mainly perpetual measures. According to Petter, DeLone and McLean (2008), 'this IS-impact model has started to develop standardised measures that can be used to evaluate the various dimensions of success as specified by DeLone and McLean's model', rather than examining one or more relationships using the qualitative technique of meta-analysis. As a result, it can lead to a better understanding of how to measure success.

Performance measurement for customs information systems

Evaluating the performance of IT via its organisational impacts is one of the critical issues in IS literature (Kim & Kim 1999) since the impacts of IT are often indirect and influenced by human, organisational, and environmental factors (Petter, DeLone & McLean 2008). In the literature, it is recognised that a myriad of measures and dimensions for IS success/impact exist. However, there are only a few structured and robust models that capture the whole IS success/impact scenario (Petter, DeLone and McLean 2008). Referring to analytical theory (Gregor 2006), Gable, Sedera and Chan (2008) argue that a reference model or theoretical framework should display the characteristics of a strong analytical theory that fulfils the criteria in terms of utility, intuitiveness, mutual exclusivity, completeness and (where relevant) appropriate hierarchy.

Gable, Sedera and Chan (2008) also suggest that, beyond those qualities of analytical theory, a framework of IS success/impact should reflect the full range of IS-impact and accommodate all views of the multiple internal stakeholder group. We have identified several salient models that surpass the others in terms of the relevance of their measures, their completeness and appropriate model structure.

Customs Information System

The CIS was implemented in RMCD in 1995 and proved to be a major undertaking. It formed part of the Malaysian Government's trade facilitation initiative carried out under the auspices of the Ministry of Transport. The project was a joint venture between a single provider – Dagang Net Technology (DNT) – and RMCD and was referred to as 'Sistem Maklumat Kastam (SMK)-DagangNet'. However, it was only available on a nationwide basis by 2002, once DNT had completed the implementation and upgrading of new hardware, software, and network equipment in order to reinforce the existing system.

This initiative reflects the trend among Asian nations of using Electronic Data Interchange (EDI) to sustain economic growth (UNECE 1996). Since 1994, RMCD has spent over RM300 million on its IT initiative and has earmarked an annual RM4 million budget for using the e-commerce solutions provided by DNT's EDI facilities (BNet 2004). All IT initiatives by RMCD follow the same track: in 2007, the Malaysian Government spent around US\$413.3 million (approximately 12 per cent of the nation's IT expenditure) replacing traditional IS in government agencies with more sophisticated IS (Hussein et al. 2007; Hussein, Selamat & Karim 2005).

The need for including an EDI system in customs modernisation, particularly at Malaysian airports and sea ports, is universally accepted. Many ports in Europe and developed countries in the Asia-Pacific region (for example, Australia and Singapore) have long reaped substantial benefits from the EDI system (BNet 2004). Thus, in 1993, Port Klang became the first Malaysian sea port to be equipped with EDI – the Port Klang Community System (PKCS) – as part of the government's trade facilitation initiative. Under this initiative, DNT was awarded an exclusive contract to provide the RMCD with an EDI solution. With the inception of PKCS, the SMK-DagangNet was established and has enabled various other government agencies (OGA) to be linked to the customs' clearance process on a national basis.

Performance measures

Measures for performing impact analysis are based on the dimensions of the original IS-impact and its extension, which are portrayed in Table 3 below.

Table 3: The distribution of impact statements

	Dimensions	Measures	In relation to customs procedures and modernisation
Original IS-impact measures and dimension	Individual Impact	Learning Awareness/recall Effectiveness of decisions Individual productivity	Learning a new system
	Organisational Impact	Organisational costs Staff requirement costs Overhead costs Overall productivity Improved outcomes and output Increased capacity Organisational process Business process change	Risk management Clearance and licensing procedures Re-engineering BP
	System Quality	Data accuracy and relevancy Data currency Database integrity Ease of use Ease of learning Access User requirements System features System accuracy Interface flexibility Reliability Efficiency Sophistication Integration Customisation	Tariff User-friendliness
	Information Quality	Importance Availability Usability Understandability Relevance Format Content accuracy Conciseness Timeliness Uniqueness	Data is important Data always available
Extended impact	User Satisfaction	Overall satisfaction Dissatisfaction Preferences	
	Organisational Factors	Centralised decisions Certified by top management Top management support Resources adequacy Objectives Responsibility	
	Overall performance	Positive impacts Individual positive impact System quality satisfaction Information quality satisfaction Excellency Organisational performance Problems Advantages	

Source: Proposal based on the IS-impact model

Research model

The research model adopted in this study is based on the IS-impact (Gable, Sedera & Chan 2003, 2008), as previously described. The model and approach employ perceptual measures and offer a common instrument covering all relevant stakeholder groups. This will enable stakeholder perspectives to be combined or compared. In particular, current research into the adaptation of the model to new contexts employs 37 IS-impact measures based on the a priori model developed by Gable, Sedera and Chan (2008).

Future research

At this stage, data is being collected from users who deal with customs personnel involved in the CIS with regard to various services (for example, internal taxes, customs, technical service, and preventive measures). We expect to have 200 valid responses from the survey.

The survey instruments have to be constructed according to the measures defined in Table 3 in order to evaluate the CIS in RMCD in terms of IS-performance. The data gathered from the survey will be analysed using the sequential equation modelling (SEM) technique in connection with the partial least square (PLS) analysis. The use of PLS offers one method of statistically validating the proposed model and testing the relationship between those constructs (for example, individual impact, organisational impact, system information quality and information quality).

Conclusions

The overall aim of our research is to adapt one of the most rigorous and comprehensive theoretical models relating to IS – the IS-impact model – in order to measure the performance of CIS. This paper has attempted to explain how the performance of customs information systems can be measured in terms of IS-impact and create a framework for doing so. The next step in the research will focus on the measurement of impact, data and statistical analysis using PLS. It will also seek to adapt the IS-impact model to the CIS context.

References

- Abran, A & Buglione, L 2003, 'A multidimensional performance model for consolidating balanced scorecards', *Advanced Engineering Software*, vol. 34, no. 6, pp. 339-49.
- Ajzen, I & Fishbein, M 1980, *Understanding attitudes and predicting social behavior*, Prentice-Hall, Englewood Cliffs, NJ.
- Ajzen, I & Fishbein, M 2005, *The handbook of attitudes*, Mahwah, NJ.
- Ajzen, I & Madden, F 1973, 'Attitudinal and normative variables as predictors of specific behavior', *Journal of Personality and Social Psychology*, vol. 27, no. 1, pp. 41-57.
- Amaratunga, D, Baldry, D & Sarshar, M 2001, 'Process improvement through performance measurement: the balanced scorecard methodology', *Work Study*, vol. 50, no. 5, pp. 179-89.
- Baird, M & Stammer Jr, R 2000, 'Measuring the performance of state transportation agencies: three perspectives', *Transportation Research Record: Journal of the Transportation Research Board*, [10.3141/1729-04], vol. 1729, no. 1, pp. 26-34.
- Ballantine, J, Bonner, M, Levy, M, Martin, A, Munro, I & Powell, PL 1998, 'Developing a 3-D model for information systems success', in *Information Systems Success Measurement*, series in Information Technology Management, Idea Group Publishing, pp. 46-59.

- Bandura, A 1986, *Social foundations of thought and action: a social cognitive theory*, Prentice Hall, Englewood Cliffs, NJ.
- Bandura, A 1997, *Self-efficacy: the exercise of control*, http://books.google.com/?id=eJ-PN9g_o-EC.
- Behn, R 2003, 'Why measure performance? Different purposes require different measures', *Public Administration Review*, vol. 63, no. 5, pp. 586-606.
- BNet 2004, 'Customs keen on IT implementation', *Malaysian Business*, 16 February, http://findarticles.com/p/articles/mi_qn6207/is_20040216/ai_n24907300/pg_2/?tag=content;coll.
- BPIR 2010, 'What is performance measurement?', www.bpir.com/what-is-performance-measurement-bpir.com.html.
- Cameron, KS & Whetten, DA 1983, 'Some conclusions about organisational effectiveness', in *Organisational effectiveness: a comparison of multiple models*, Academic Press, New York, NY, pp. 261-77.
- Davis, FD 1989, 'Perceived usefulness, perceived ease of use and user acceptance of information technology', *MIS Quarterly*, vol. 13, no. 3, pp. 319-40.
- DeLone, WH & McLean, ER 1992, 'Information systems success: the quest for the dependent variable', *Information Systems Research*, vol. 3, no. 1, pp. 60-90.
- Dillon, A 2001, 'User acceptance of information technology', in W Karwowski (ed.), *Encyclopedia of human factors and ergonomics*, Taylor & Francis, London.
- El-Masri, M 2009, 'A model of IS project success', <http://asac2009.somethingon.com>.
- EPM 2010, 'Driving focus and alignment with the balanced scorecard', *EPM Review*, www.epmreview.com/Resources/Articles/Driving-Focus-Alignment-with-the-Balanced-Scorecard.html.
- Fortner 2010, 'Key performance indicators (KPIs)', www.fortner.com.my/Consulting_KPI.htm.
- Gable, G, Sedera, D & Chan, T 2003, 'Enterprise system success: a measurement model', Paper presented at the *Twenty-Fourth International Conference on Information Systems*, 14-17 December 2003, Seattle, WA.
- Gable, G, Sedera, D & Chan, T 2008, 'Re-conceptualising information system success: the IS-impact measurement model', *Journal of the Association for Information Systems*, vol. 9, no. 7, pp. 337-408.
- Goodhue, DL & Thompson, RL 1995, 'Task-technology fit and individual performance', *MIS Quarterly*, vol. 19, no. 2, pp. 213-36.
- Graham, H 2009, 'Measuring organisational performance: beyond the triple bottom line', *Business Strategy and the Environment*, vol. 18, no. 3, pp. 177-91.
- Gregor, S 2006, 'The nature of theory in information systems', *MIS Quarterly*, vol. 30, no. 3, pp. 611-42.
- Gunasekaran, A, Patel, C & McGaughey, RE 2004, 'A framework for supply chain performance measurement', *International Journal of Production Economics*, vol. 87, pp. 333-47.
- Heo, J & Han, I 2003, 'Performance measure of information systems (IS) in evolving computing environments: an empirical investigation', *Information & Management*, vol. 40, pp. 243-56.
- HM Revenue & Customs 2007, *Departmental Strategic Objectives: Comprehensive Spending Review*, HMRC, London.
- Hussein, R, Karim, NS, Mohamed, N & Ahlan, AR 2007, 'The influence of organisational factors on information systems success in E-government agencies in Malaysia', *Electronic Journal on Information Systems in Developing Countries*, vol. 29, no. 1, pp. 1-17.
- Hussein, R, Selamat, H & Karim, NS 2005, 'The impact of technological factors on information systems success in the electronic-government context', Paper presented at the *Second International Conference on Innovations in Information Technology*, 26-28 September 2005, Dubai, UAE.

- Ifinedo, P 2006, 'Extending the Gable et al. enterprise systems success measurement model: a preliminary study', *Journal of Information Technology Management*, vol. XVII, no. 1, pp. 14-33.
- Ifinedo, P 2008, 'Impacts of business vision, top management support, and external expertise on ERP success', *Business Process Management Journal*, vol. 14, no. 4, pp. 551-68.
- Kaplan, RS & Norton, DP 1992, 'The balanced scorecard: measures that drive performance', *Harvard Business Review*, January-February, pp. 21-29.
- Kim, Y & Kim, Y 1999, 'Critical issues in the network area', *Information Resource Management Journal*, vol. 4, no. 4, pp. 14-23.
- Lee, Y, Kozar, KA & Larsen, KRT 2005, 'The technology acceptance model: past, present, and future', *Communications of the Association for Information Systems (CAIS)*, vol. 12, no. 50, pp. 752-80.
- Lewis, G 2003, 'The impact of ICT on customs', *World Customs Journal*, vol. 3, no. 1, pp. 3-11.
- Martinsons, MG, Davison, RH & Tse, D 1999, 'The balanced scorecard: a foundation for the strategic management of information systems', *Decision Support Systems*, vol. 25, no. 1, pp. 71-78.
- Mason, RO 1978, 'Measuring information output: a communication systems approach', *Information and Management*, vol. 1, no. 4, pp. 219-34.
- McLinden, G 2005, 'Integrity in Customs', in Luc De Wulf & José B Sokol (eds), *Customs modernization handbook*, World Bank, Washington, DC, pp. 67-89.
- Murphy, KE & Simon, SJ 2002, 'Intangible benefits valuation in ERP projects', *Information Systems Journal*, vol. 22, no. 4, pp. 301-20.
- Myers, BL, Kappelman, LA & Prybutok, VR 1998, 'A comprehensive model for assessing the quality and productivity of information systems functions: toward a theory of information systems assessments', in EJ Garrity & GL Sanders (eds), *Information Systems Success Measurement*, series in Information Technology Management, Idea Group Publishing, pp. 94-121.
- Petter, S, DeLone, WH & McLean, ER 2008, 'Measuring information systems success: models, dimensions, measures, and interrelationships', *European Journal of Information Systems*, vol. 17, no. 3, pp. 236-63.
- Seddon, PB 1997, 'A respecification and extension of the DeLone and McLean Model of IS success', *Information Systems Research*, vol. 8, no. 3, pp. 240-53.
- Seddon, PB, Staples, S, Patnayakuni, R & Bowtell, M 1999, 'Dimensions of information systems success', *Communications of the Association for Information Systems (CAIS)*, vol. 2, article 20.
- Sedera, D & Gable, GG 2004, 'A factor and structural equation analysis of the enterprise systems success measurement model', Paper presented at the 25th International Conference on Information Systems, Washington, DC.
- Shang, S & Seddon, PB 2000, 'A comprehensive framework for classifying benefits of ERP systems', Paper presented at the 6th Americas Conference on Information Systems, Long Beach, CA.
- Shannon, CE & Weaver, W 1963, *Mathematical theory of communication*, University of Illinois Press, Urbana, IL.
- Stacie, P, DeLone, W & McLean, E 2008, 'Measuring information systems success: models, dimensions, measures, and interrelationships', *European Journal of Information Systems*, vol. 17, no. 3, pp. 236-63.
- Triandis, HC 1977, *Interpersonal behavior*, Brooke Cole, Monterey, CA.
- United Nations Economic Commission for Europe (UNECE) 1996, Electronic Data Interchange – a management overview (Electronic Commerce Initiatives), submitted by the Economic and Social Commission for Asia and the Pacific, item 3, provisional agenda of the Meeting of Experts on Data Elements and Automatic Data Interchange, fifty-fourth session, 16-20 September 1996, [Trade/WP.4/5.1222], Geneva.

- Vallerand, RJ 1997, 'Toward a hierarchical model of intrinsic and extrinsic motivation', in M Zanna (ed.), *Advances in experimental social psychology*, Academic Press, New York, NY, pp. 271-360.
- Venkatesh, V, Morris, MG, Davis, GB & Davis, FD 2003, 'User acceptance of information technology: toward a unified view', *MIS Quarterly*, vol. 27, no. 3, pp. 425-78.
- Wixom, BH & Todd, PA 2005, 'A theoretical integration of user satisfaction and technology acceptance', *Information Systems Research*, vol. 16, no. 1, pp. 85-102.
- Zhu, K, Kraemer, KL, Xu, S & Dedrick, J 2004, 'Information technology payoff in e-business environments: an international perspective on value creation of e-business in the financial service industry', *Journal Management of Information Systems*, vol. 21, no. 1, pp. 17-54.

Mohd Afandi Md Amin



Mohd Afandi Md Amin is a Senior Customs Officer in the Royal Malaysian Customs Department (RMCD) with some 17 years' experience in Customs administration. He has been actively involved in the strategic planning of RMCD as well as in Customs Information Systems (CIS) management. He holds a BEd (Hons)(Statistics), an MSc (IT) and is currently pursuing his doctorate in Information Technology at Queensland University of Technology, Brisbane, Australia. His research interests are in web technologies, user acceptance of technology, measuring the impact of technology and Customs performance from an information technology perspective.
