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Assessing call centers' success: A validation of the DeLone and Mclean model for information system

Hesham A. Baraka [a,*], **Hoda A. Baraka** [b], **Islam H. EL-Gamily** [a]

[a] *National Telecommunication Regulatory Authority, Egypt*
[b] *Computer Engineering, Faculty of Engineering, Cairo University, Egypt*

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Abstract Business process outsourcing (BPO) is becoming one of the most growing industries in 21st Century and a significant workforce in the global economy. Revolution in telecommunications, free trade agreements, and cultural behavior in a number of developing countries paved the way for the growth of BPO industry. Technology based BPO services are those services provided by Call centers, services that vary from receiving simple phone calls, to marketing services, sales services, and up to remote diagnosis and technical support services.

This paper introduces a model to evaluate the performance of call centers based on the Delone and McLean Information Systems success model. A number of indicators are identified to track the call center's performance. Mapping of the proposed indicators to the six dimensions of the D&M model is presented. A Weighted Call Center Performance Index is proposed to assess the call center performance; the index is used to analyze the effect of the identified indicators. Policy-Weighted approach was used to assume the weights with an analysis of different weights for each dimension. The analysis of the different weights cases gave priority to the User satisfaction and net Benefits dimension as the two outcomes from the system. For the input dimensions, higher priority was given to the system quality and the service quality dimension. Call centers decision makers can use the tool to tune the different weights in order to reach the objectives set by the organization. Multiple linear regression analysis was used in order to provide a linear formula for the User Satisfaction dimension and the Net Benefits dimension in order to be able to forecast the values for these two dimensions as function of the other dimensions

* Corresponding author. Tel.: +20 1006042190; fax: +20 235344155.
E-mail address: hbaraka@tra.gov.eg (H.A. Baraka).

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1. Introduction

Business process outsourcing (BPO) is defined [1] simply as the movement of business processes from inside the organization to an external service provider. With the global telecommunications infrastructure now well established and consistently reliable, BPO initiatives often include shifting work to international providers. Research from Gartner [2] forecasts the

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growth of the BPO industry 5% worldwide in 2012, The Asia/Pacific (excluding Japan) business process outsourcing (BPO) market forecast to reach $9.5 billion in 2016, up from $5.9 billion in 2011. Top countries in BPO industry include India, China, Philippines, Malaysia, and Poland. In 2007, Egypt has launched a national BPO strategy with a substantial ongoing government investment [3] and support that resulted in improving Egypt's ranking in A.T. Kearney Global services location Index [4] from number 13 in 2007 to number 6 in 2009 and to number 4 in 2011. The positive growing impact of this industry on the Egyptian economy [5] reaching $1.7 billion in 2012, and the large number of job opportunities offered to youngsters in different disciplines make this research critical to the development and growth of this industry in Egypt.

Technology based call centers are used by outsourcing companies to fulfill a large number of business process outsourcing services. A call center system [6] is a computer-based system that provides call and contact routing for high-volume telephony transactions, with specialist answering "agent" stations and a sophisticated real-time contact management system. The definition includes all call center systems that provide inbound contact handling capabilities and automatic contact distribution, combined with a high degree of sophistication in terms of dynamic contact traffic management. Therefore, its effective and efficient operation is a key ingredient to the overall success of any BPO service.

Measuring the performance of call centers has been extensively addressed in the literature; The Outsourcing Institute [7] indicates the growing importance of identification of qualitative metrics in measuring the performance of the outsourced call center. In [8], NAQC Issue Paper presents best practices in performance measurement and management to maximize call center Efficiency and Quality. The paper proposes identification of performance evaluation indicators instead of the classical ways based on customer surveys, customer praise, complaints, and observation of customer interactions. The modeling and simulation techniques in [9–11] are used to study the effect of different call centers parameters and to forecast the performance of the system.

This paper presents a new methodology to evaluate the performance of call centers based on the DeLone and McLean Information System model [12]. A complete set of performance indicators for call centers are identified and mapped to the six dimensions of the Delone model. A weighted performance index is introduced to calculate the call center overall performance. Dimension weights reflect the relative priority of a certain dimension on the overall performance. The rest of the paper is described as follows: Section 3 describes the DeLone and McLean model as applied to Call centers. The indicators identified to track the call center's performance together with the mapping of these indicators to the six dimensions of the D&M model are presented in Section 3. Section 4 introduces the proposed Weighted Call Center Performance Index; Section 5 shows the results of the proposed methodology and the effect of different dimension weights on the performance assessment of the call centers under study. Finally, Section 5 concludes the paper.

2. The DeLone and McLean success model as applied to call centers

The original D&M IS success model [13] published in 1992 presented a conceptual framework to measure the success or failure of information systems. According to D&M [16,17], measurement of IS success is critical for understanding the value and efficacy of IS management actions and IS investments. Ten years later, an update of the model was introduced that was based on theoretical and empirical IS research conducted by different researchers who have tested or discussed the original model [12,14]. In [15], DeLone and McLean adapted the updated model to the measurement challenges of the e-commerce systems. Two case examples have been presented to demonstrate how the model can be used to guide the identification and specification of e-commerce success metrics. The updated model, presented in Fig. 1, consists of six interrelated dimensions that should be considered in the evaluation of information systems:

- System quality
- Information quality
- Service quality
- Usage
- User satisfaction
- Net benefits

Following the same conceptualization method, this paper is applying the updated DeLone model as a framework to measure the performance of call centers. In this work, the six success dimensions of the DeLone and McLean IS success model can be applied to the call centers environment as follows:

1. System quality measures the essential characteristics of call center systems. Characteristics include the following:
   a. Availability of the system (provides 7×24 customer services through the automated voice response unit).
   b. Reliability of the system especially that the call centers depend mainly on the telecommunication infrastructure.
   c. Intelligent call routing so that resources can be fully utilized, the use of intelligent call processing (ACD) routing determined by the choice of a variety of conditions.
   d. Flexible channels of communication, allowing customers with the sales representative when you are free to choose, including traditional voice, IP telephony, e-mail, fax, text chat, video, etc., any means of communication.
   e. Response time represented by calls abandoned, waiting time to answer, Average call-handling time (time actually on phone with customer).

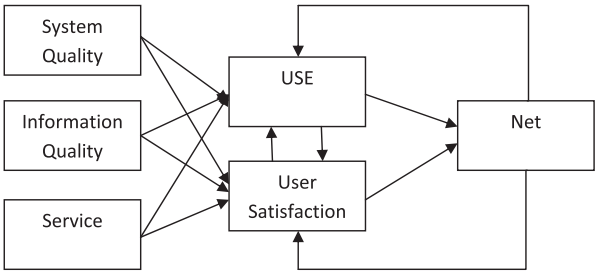

Figure 1 DeLone and McLean updated IS success model.

2. Information quality, customers should be properly authenticated, such that agents address the customers with personalized, complete, relevant, easy to understand, and secure content in case of customers will perform financial transactions.
3. Service quality, this dimension reflects the quality of service provided by the agents to the customers.
4. Usage measures the number of customers using the call center, the growth rate of customers using the system, as well as the rate of re-utilization of the same customer for the call center. From the agents' point of view, the Usage dimension can measure the utilization of the agents of the different modules of the call center system.
5. User satisfaction is an important means of measuring customers' feedback of the call center system and should cover the entire customer experience cycle based on the services provided from the call center. Examples of services may include information retrieval, marketing, technical support, remote diagnosis, remote data entry as in medical transcriptions, mobile, etc. A critical parameter to be measured for the user satisfaction is the rate of the escalation of calls beyond the agent representative as the existing modules failed to answer the customer query.
6. Net benefits are the most important success measures, because they reflect the global impacts of the call centers on the individual level represented by the customers and agents, as well as on the global level represented by the organizations, the call center industry, and the society.

3. Mapping call center's performance indicators to the DeLone and McLean IS model

Many researchers and call centers industry associations and institutions have proposed a number of performance indicators [8,9] to be used to measure call centers operation. Some of these performance indicators are targeting measurement of the call center overall performance, others target the quality of service provided to the customers, while other indicators target the quality and skills of the individual employee. According to NCQI [8], the key performance metrics can be categorized into three main categories: service, quality, and efficiency, with the corresponding indicators, respectively. Tables 1–3 summarize the different proposed metrics for each category.

The defined performance indicators in Tables 1–3 cover only three dimensions of the six dimensions of the D&M model namely: the system quality dimension, the service quality dimension, and the user satisfaction dimension. In order to complete the performance indicators for the other three dimensions, a number of performance indicators are proposed based on the literature review for call center's performance indicators [8,9], and the DeLone and McLean e-commerce indicators model proposed in [18]. Tables 4–9 represent the grouping of the performance indicators for the call centers in correspondence to the DeLone and McLean six dimensions. A total of 43 indicators are proposed for the model to cover all the different angles of performance measures related to the call centers.

4. Proposed Weighted Call Center Performance Index (W-CCPI)

In order to assess the performance of the call center, the research proposes two methods for the assessment of call center's performance. The two methods are based on calculating a performance index for the call center based on the values of indicators proposed for the D&M model. The first method ''Linear Call Center performance Index'', L-CCPI assumes that the weights of all the indicators and all the dimensions are equal, while the second method ''Weighted Call Center Performance Index'', W-CCPI assumes different weights for indicators of a specific dimension as well as a different weight for each dimension.

4.1. Linear based CCPI

The Linear Call Center Performance Index L-CCPI in its simplest form can be calculated as the summation of the D&M Dimensions' performance index as follows:

Table 1 Service indicators.

Accessibility	
Blockage	Blockage is an accessibility measure that indicates what percentage of callers will not be able to access the call center
Hours of operation	The defined period of time of operation
Abandons	The abandon rate is measured by looking at the calls that abandon during the defined period of time compared with all calls for that period
Self-service availability	Many contacts today are being offloaded from call center agents to self-service alternatives, such as an upfront telephone menu using IVR and/or Web interactions
Speed of service	
Service level	It denotes the percentage of calls that are answered in a defined wait threshold and is most commonly stated as x percent of calls answered in y seconds
Average speed of answer	Average speed of answer (ASA) is the average delay of all calls for the period
Longest delay in queue	The ''worst-case'' experience of a customer over a period of time, such as a day

Table 2 Quality indicators.

Call-handling process	
Telephone etiquette	The degree to which general telephone communications skills and etiquette are displayed is generally measured via observation or some form of quality monitoring
Knowledge and competency	Is the ability of the agent or counselor to provide correct and thorough product and service information, and to be competent at handling caller questions and problems
Error/rework rate	The error and rework rate is the degree to which errors have to be corrected or work redone
Adherence to protocol	Ensuring callers receive a consistent call-handling experience regardless of the contact channel or the individual agent involved in the contact is particularly important to the perceived quality of the contact
Resolution	
First-call resolution rate	The percentage of calls completed within a single contact, often called the ''one and done''
Transfer rate	The transfer percentage indicates what portion of calls has to be transferred to another person to be handled

Table 3 Efficiency indicators.

Contact handling	
Average handle time	(AHT), which is talk time plus after-call work. AHT is used when determining overall workload and staffing requirements
After-call work time	ACW is the time, after the conversation, that the agent spends filling out associated paperwork, updating files, and doing similar work related to the call before the agent is ready to handle the next contact
On-hold time	On-hold time is the amount of time a caller spends on hold during the course of the conversation
Resource utilization	
Agent occupancy	The percentage of logged-in time an agent is busy on a call or doing after-call work compared with available time. It is calculated by dividing workload hours by staff hours
Staff shrinkage	The percentage of paid time that agents are not available to handle calls
Schedule efficiency	The degree of overstaffing and understaffing that exists as a result of scheduling design
Schedule adherence	The degree to which the agents work the specific hours scheduled
Availability	The percentage of time that staff are logged in and available to take calls
Cost efficiency	
Conversion rate	The standard conversion rate in a call center refers to the percentage of calls in which a sales opportunity is translated into an actual sale
Cost per call	The cost-per-call rate can track just labor costs per call or it can include all the telecommunications, facilities, and other service costs in addition to labor costs

Table 4 Dimension 1 – system quality.

Accessibility	Speed of service	Resource utilization
Blockage	Service level	Agents occupancy
Hours of operation	Average speed of answer	Staff shrinkage
Abandons	Longest delay in queue	Schedule efficiency
Self-service availability		Schedule adherence
		Availability

Table 5 Dimension 2 – information quality.

Relevant and correct
Complete
Secure
Accuracy in data entry and call coding
Personalized
Courtesy and professionalism
Grammar and spelling in text communication (email and chat)

Table 6 Dimension 3 – service quality.

Call-handling process	Resolution
Telephone etiquette	First-call resolution rate
Knowledge and competency	Transfer rate
Error/rework rate	
Adherence to protocol	

Table 7 Dimension 4 – usage.

Nature of use	Amount of use
Enquiry	User retention rate
Orders	New customers
Technical support	Customer re-occurrence
Financial transactions	
Other services	

Table 8 Dimension 5 – user satisfaction.

Contact handling	Cost efficiency
Average handle time	Conversion rate
After-call work time	Cost per call
On-hold time	

L-CCPI (Linear Call Center Performance Index)

$$= \sum_{j=1}^{m} I(D_j)/(m) \tag{1}$$

where m represents the six dimensions of the D&M model, and $I(D_j)$ is the Index value for each dimension.

The Index value for each dimension of the model $I(D_j)$ is calculated based on the values of the indicators defined for each dimension as follows:

$$I(Dj) = \sum_{i=1}^{m} (a_{ji})/(n) \tag{2}$$

where n is the number of indicators for dimension j, and a_{ji} represents the value for the indicators for the dimension (D_j).

Based on Eqs. (1) and (2), the Linear Call Center Performance Index is calculated as follows:

L-CCPI (Linear Call Center Performance Index)

$$= 1/m \sum_{j=1}^{m} \sum_{i=1}^{n} (a_{ji})/(n) \tag{3}$$

4.2. Weighted based CCPI (W-CCPI)

In its general form, the W-CCPI can be calculated as the weighted average of the D&M Dimensions' performance index as follows:

W-CCPI (Weighted Call Center Performance Index)

$$= \sum_{J=1}^{M} \alpha_j W\_I(D_j) \tag{4}$$

where a_j is the weight given to the dimension (D_j), the value for a_j varies from 0 to 1, and

Table 9 Dimension 6 – net benefits.

Growth in customer base
Increased sale
Market share
Global reach
Profit
Productivity
Return on investment

$$\sum_{j=1}^{m} \alpha_j = 1 \tag{5}$$

The model also proposes a second level of analysis as a weighted average for the indicators for each dimension. The Weighted Index value for each dimension of the model $W\text{–}I(D_j)$ is calculated based on the weighted values of the indicators defined for each dimension as follows:

$$W - I(Dj) = \sum_{j=1}^{m} (\beta_i a_{ji}) \tag{6}$$

where β_j is the weight given to the indicator $\beta_j a_{ji}$, the value for β_j varies from 0 to 1, and

$$\sum_{i=1}^{m} \beta_i = 1 \tag{7}$$

Based on Eqs. (4) and (5), the W-CCPI is calculated as follows:

W-CCPI (Weighted Call Center Performance Index)

$$= \sum_{j=1}^{m} \alpha_j \sum_{i=1}^{n} (\beta_i a_{ji}) \tag{8}$$

Selection of values of α and β varies from a call center to the other based on the type of services provided and the customers served. Even if we believe that the importance of all the dimensions should be the same, that is, equal weights, we still see that the weighted value at the level of every indicator will definitely help and support call centers managers in analyzing the performance of the call centers, diagnosing the shortfalls, and taking the correct actions in the proper areas.

5. Data analysis and results

The performance evaluation methodology based on the W-CCPI is applied to a variety of call centers located in Egypt. The call centers included in the study were properly selected to span different categories of call centers. Categories were identified based on the following parameters:

- Size of the call center expressed by the number of agents.
- Channels of Communication (voice vs. voice and data).
- Priority of services provided (real-time service vs. non-real-time service, example emergency call centers).
- Number of clients served.
- Geographic location (capital city, big cities, small cities).

The results of the research were not only confined to evaluate the performance of a specific call center, but also to study the effects of different weights for the different dimensions in the W-CCPI equation.

5.1. Performance evaluation using Linear Call Center Performance Index

In this section, performance evaluation for four call centers are calculated based on the indicators received and based on equal weights for all indicators and dimensions. The call centers selected are of medium size call centers of average 80–100 agents providing a mix of voice and data services and located in the capital city Cairo. Fig. 2 depicts the Linear Call Center Performance Index for different call centers under study, while Fig. 3 presents the percentage contribution of the six dimensions on the L-CCPI. Fig. 4 shows the distribution of the 12 indicators proposed for the System Quality dimension. Fig. 5 illustrates the distribution of the seven indicators proposed for the Information Quality dimension. Fig. 6 shows the distribution of the six indicators proposed for the Service Quality dimension. Fig. 7 shows the distribution of the eight indicators proposed for the Usage dimension. Fig. 8 illustrates the distribution of the five indicators proposed for the User Satisfaction dimension. Finally, Fig. 9 shows the distribution of the seven indicators proposed for the Net Benefits Index dimension. Equal weights for different dimensions may not reflect the real effect of the dimensions on the overall performance calculation of the call centers.

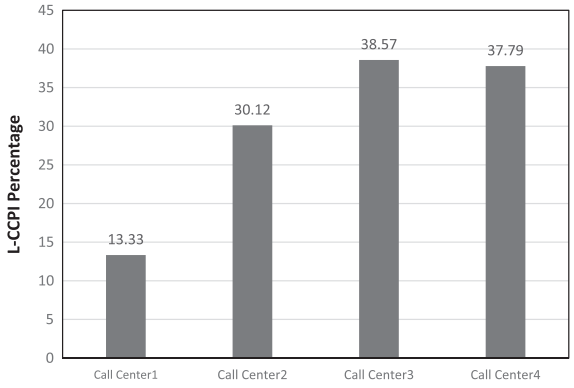

Figure 2 Results for linear call center performance index.

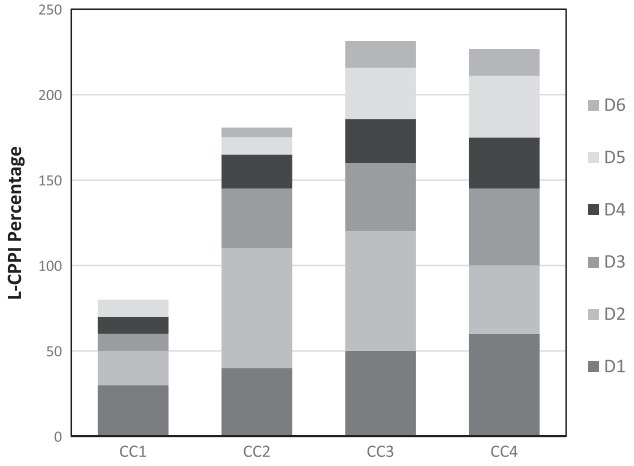

Figure 3 Dimensions indices distribution for L-CCPI.

5.2. Performance evaluation using Weighted Call Center Performance Index

This section investigates the effect of the weights for the different dimensions on the Call Center performance index calculation. Different frameworks are used in the literature to develop composite measures [19,20]: Equal-weighted, Policy-Weighted, Empirically Weighted, and multiple Hurdle composites. In the Policy-Weighted approach, the relative weight given to each of the separate indicators is based on policy judgments of their relative importance. In Empirically weighted, the component weights are empirically derived to maximize prediction of some criterion or to maximize internal consistency estimates of score reliability.

In this work, Policy-Weighted approach is applied. Two outcomes are identified the user satisfaction and the net benefits outcomes. Weights are given such that the weights for the outcome dimensions are equal to the weights of the input dimensions namely the system quality, Information quality, service quality and Usage. It is well noted that the User Satisfaction dimension is dependent on all the input dimensions with some exception for the Usage dimension. Higher weight is given to the user satisfaction dimension over the net benefits, given priority to the customers over the benefits gained by the provider of the service. Seven weights combinations are

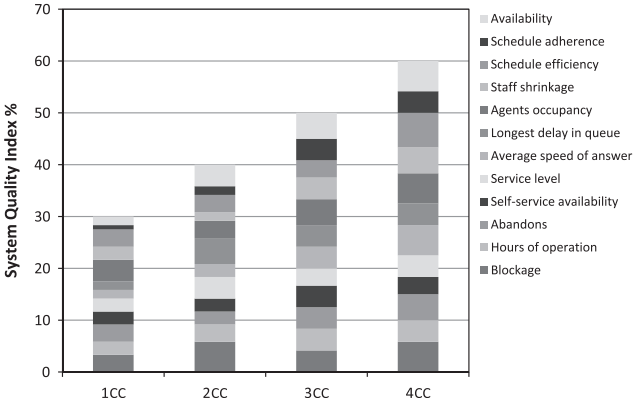

Figure 4 Distribution of system quality index indicators.

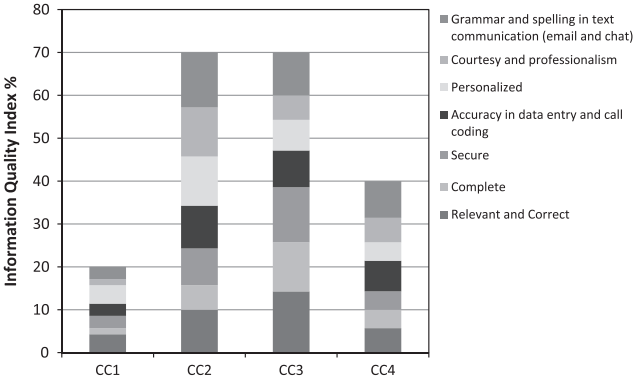

Figure 5 Distribution of information quality index indicators.

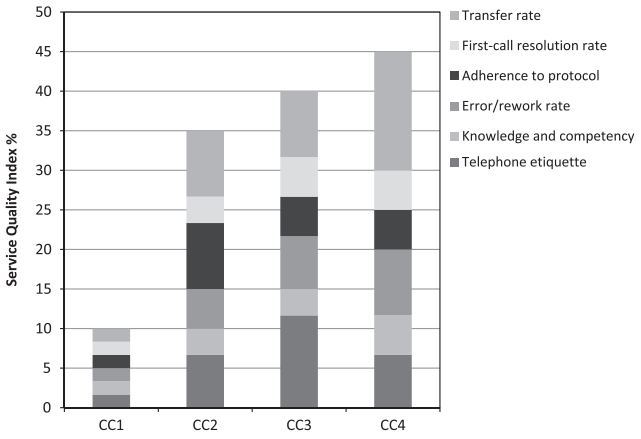

Figure 6 Distribution of service quality index indicators.

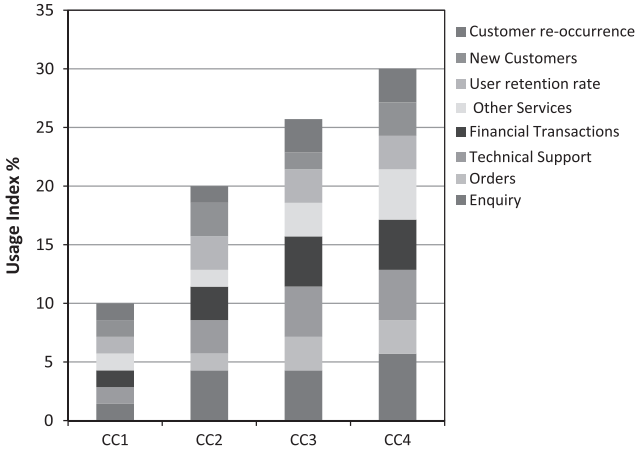

Figure 7 Distribution of usage index indicators.

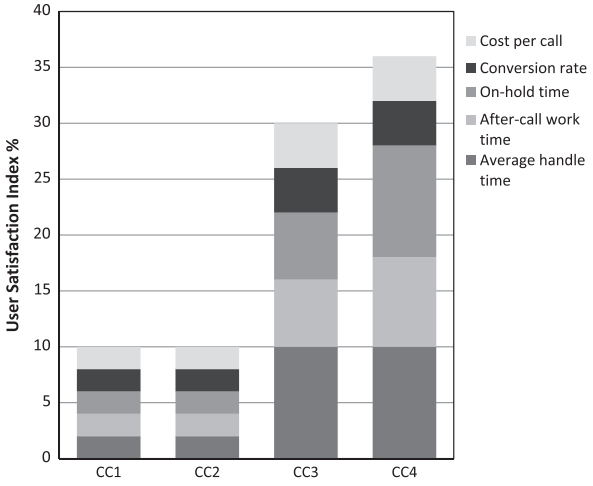

Figure 8 Distribution of user satisfaction index indicators.

considered as shown in Table 10, the first case represents the equal weight case, in the second the weights are equally divided between the two outcomes and the input dimensions, that is, 0.5 is divided equally on the four input dimensions. In the third case, higher priority is given to the system quality dimension,

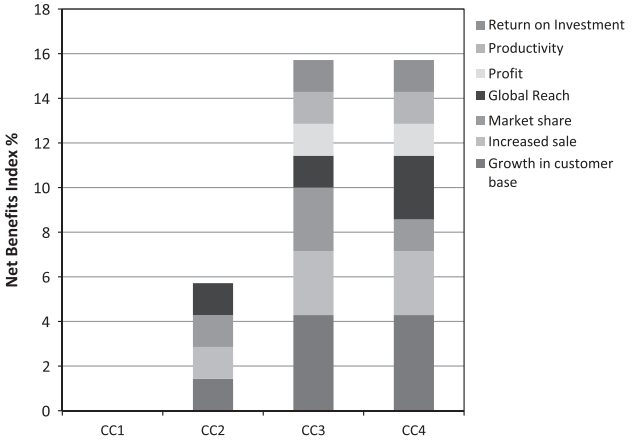

Figure 9 Distribution of net benefits index indicators.

Table 10 Cases for dimensions weights.

	D1	D2	D3	D4	D5	D6
Case 1	1/6	1/6	1/6	1/6	1/6	1/6
Case 2	0.125	0.125	0.125	0.125	0.3	0.2
Case 3	0.3	0.2/3	0.2/3	0.2/3	0.3	0.2
Case 4	0.3	0.05	0.1	0.05	0.3	0.2
Case 5	0.35	0.05	0.05	0.05	0.3	0.2
Case 6	0.4	0.03333	0.03333	0.03333	0.3	0.2
Case 7	0.4	0.03333	0.03333	0.03333	0.4	0.1

Table 11 Weighted CCPI cases.

	W-CPPI-C1	W-CCPI-C2	W-CCPI-C3	W-CCPI-C4
Case 1	52.67	68.5	51.87	63.51
Case 2	53.36	67	50.7	60.68
Case 3	54.87	71.04	49.82	63.07
Case 4	54.72	70.44	49.9	62.92
Case 5	55.3	72.19	49.56	63.75
Case 6	55.73	73.35	49.31	64.43
Case 7	57.93	74.52	48.91	65.03

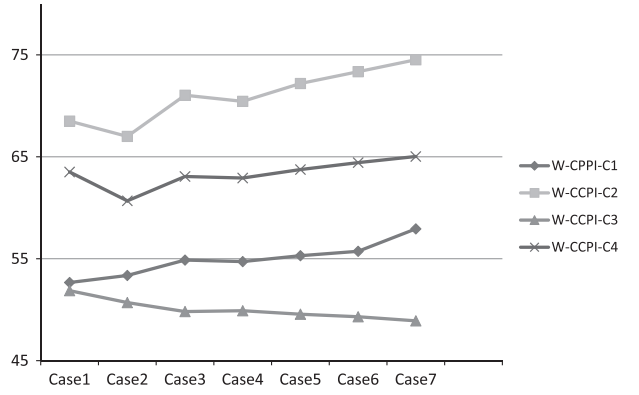

Figure 10 Policy-Weighted CPPI.

while case four gives higher weight to the system quality and the service quality dimension over the two other input dimensions. Last case increases the weight of User Satisfaction to 0.4 while setting the Net benefits weight to 0.1.

Table 12 Cases measured for different call centers.

	D1 System quality	D2 Information quality	D3 Service quality	D4 Usage	D5 User satisfaction	D6 Net benefits
C1	30	20	10	10	10	0
C2	40	70	35	20	10	5
C3	50	70	40	25	30	15
C4	60	40	45	30	35	15
C5	60	70	60	50	60	20
C6	70	20	20	20	30	10
C7	70	40	30	40	40	15
C8	70	80	70	50	60	20
C9	80	20	20	20	30	10
C10	80	40	50	40	48	12
C11	80	80	70	60	65	15
C12	80	100	75	80	75	22
C13	90	20	20	20	10	2
C14	90	40	50	40	50	20
C15	90	80	70	60	70	25
C16	90	100	75	80	80	25
C17	100	20	20	20	10	5
C18	100	40	50	40	50	20
C19	100	80	70	60	70	25
C20	100	100	100	90	90	30

Table 13 Multiple regression applied to user satisfaction – Case 1.

Net benefits	Usage	SER-Q	IQ	Sys-Q	B
1.219604	0.732748746	0.270512	−0.26167	−0.14386	8.394762
0.324933	0.170908472	0.187618	0.11606	0.086416	6.016868
0.971679	4.923412512	#N/A	#N/A	#N/A	#N/A
96.06596	14	#N/A	#N/A	#N/A	#N/A
11643.19	339.3598706	#N/A	#N/A	#N/A	#N/A

Table 11 shows the results for the Weighted Call Center Performance Index for the four call centers. Case 1 in the table is the equal weight case, while the other six cases represent the results for the Policy-Weighted as explained earlier in this section. Fig. 10 depicts the Weighted Call Center Performance Index for the four call centers. Results indicate that the maximum difference in W-CCPI is around 7.5% for the different cases; on the other hand, the maximum difference from the L-CCPI is 6%, while the standard deviation for the results for the four call centers is 1.7%, 2.64%, 0.99%, and 1.38%, respectively. Management strategy should select the case adopted (different weights) based on the relative priorities of the different dimensions to the decision makers.

5.3. Sensitivity analysis of user satisfaction and net benefits to the input dimensions

One way to analyze the measured data for different dimensions and call centers is to try to model the two main outcomes (dimensions) for the call centers, User Satisfaction, and Net Benefits as function of the input dimensions. Use of multiple regression is used in order to model the User satisfaction Dimension as function of the input dimensions System Quality, Information Quality, Service Quality, and Usage. The Net Benefits dimension is modeled as function of the four input dimensions as well as the user satisfaction dimension.

Table 14 Multiple regression – user satisfaction – Case 2.

SER-Q	IQ	Sys-Q	B
1.034134	−0.09674262	0.098632	−6.60197
0.252317	0.192382765	0.135451	9.600931
0.894951	8.869742397	#N/A	#N/A
45.43653	16	#N/A	#N/A
10723.79	1258.757283	#N/A	#N/A

Table 12 shows the results measured for different call centers during different phases of implementation. Twenty different cases are measured and used to model the outcomes measured.

Using Multiple Linear regression, a dependent variable Y is calculated from independent measured variables as follows:

$$\mathrm{Y} = \mathrm{b}_0 + \mathrm{b}_1(x_1) + \mathrm{b}_2(x_2) + \mathrm{b}_3(x_4) + \cdots + \mathrm{b}_\mathrm{n}(x_n) \tag{9}$$

where Y is the dependent variable and x_1 to x_n are the independent variables. The variables b_1 to b_n represent the weights for corresponding independent variables.

The interdependency of User Satisfaction dimension according to the Delone model is function of System Quality, Information quality, Service Quality as three independent parameters as well as the usage and the net benefits as dependent parameters. Two cases are calculated to try to forecast the

Table 15 Multiple regression for net benefits.

User sat	Usage	SER-Q	IQ	Sys-Q	B
0.411254281	−0.26336	0.022332	0.087974	0.076202	−4.06495
0.109568321	0.13352	0.116605	0.07509	0.051008	3.567181
0.913370523	2.858986	#N/A	#N/A	#N/A	#N/A
29.52156198	14	#N/A	#N/A	#N/A	#N/A
1206.516793	114.4332	#N/A	#N/A	#N/A	#N/A

values for the User satisfaction as function of other variables. The first case is assuming that User Satisfaction is a Function (D1, D2, D3, D4, D6) as per the Delone model, while the second case will assume that User Satisfaction is only Function (D1, D2, D3) the three independent variables.

Multiple Linear regression for User Satisfaction for the first case using the LINEST function in Excel results in the following:

From Table 13, we can deduce that:

$$\begin{aligned}\text{User satisfaction} = {} & 8.34 - 0.14 * \text{System Quality} - 0.26 \\ & * \text{Information Quality} + 0.27 \\ & * \text{Service Quality} + 0.74 * \text{Usage} + 1.21 \\ & * \text{Net Benefits}.\end{aligned}$$

$F = 96.065$, $df = 14$ resulting in F distribution of the fitting data of 2.50599E−10

From Table 14, we can deduce that:

$$\begin{aligned}\text{User satisfaction} = {} & -6.6 + 0.09 * \text{System Quality} - 0.09 \\ & * \text{Information Quality} + 1.03 \\ & * \text{Service Quality}.\end{aligned}$$

$F = 45.43$, $df = 16$ resulting in F distribution of the fitting data of 6.78311E−09.

For the Net Benefits as function of (D1, D2, D3, D4, D5, D6), the LINEST function results in:

From Table 15, we can deduce that:

$$\begin{aligned}\text{Net benefits} = {} & -4.06 + 0.076 * \text{System Quality} + 0.087 \\ & * \text{Information Quality} + 0.022 \\ & * \text{Service Quality} - 0.263 * \text{Usage} + 0.411 \\ & * \text{User Satisfaction}\end{aligned}$$

$F = 29.52$ and $df = 14$ resulting in F distribution of the fitting data equal to 5.79258E−07.

6. Conclusion

This paper adopts the Delone and Mclean model to evaluate and assess information systems. The model is applied to evaluate the performance of call centers. Identification of different indicators for each dimension of the model is proposed. A call center performance index is introduced, the index is based on the weighting the different dimensions of the Delone model, and equal weights were given to the different indicators for each dimension. Policy-Weighted approach was used to assume the weights with an analysis of different weights for each dimension. The analysis of the different weights cases gave priority to the User satisfaction and net Benefits dimension as the two outcomes from the system. For the input dimensions, higher priority was given to the system quality and the service quality dimension. Call centers decision makers can use the tool to tune the different weights in order to reach the objectives set by the organization. Multiple linear regression analysis was used in order to provide a linear formula for the User Satisfaction dimension and the Net Benefits dimension in order to be able to forecast the values for these two dimensions as function of the other dimensions.

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