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ORIGINAL ARTICLE

# Information systems performance evaluation, introducing a two-level technique: Case study call centers



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**Abstract** With the emergence of Information and Communication technologies, and the relatively cheap cost of calls (voice and data), the use of call centers to provide new services to citizens has grown extensively. Evolution in call centers technologies, systems and infrastructures allowed the transformation of industries and services in big enterprises and organizations, customer support services, marketing services and after sales support are examples of such transformations.

The objective of this paper was to introduce a new technique that can support decision makers in the call centers industry to evaluate, and analyze the performance of call centers. The technique presented is derived from the research done on measuring the success or failure of information systems. Two models are mainly adopted namely: the Delone and Mclean model first introduced in 1992 and the Design Reality Gap model introduced by Heeks in 2002. Two indices are defined to calculate the performance of the call center; the success index and the Gap Index. An evaluation tool has been developed to allow call centers managers to evaluate the performance of their call centers in a systematic analytical approach; the tool was applied on 4 call centers from different areas, simple applications such as food ordering, marketing, and sales, technical support systems, to more real time services such as the example of emergency control systems. Results showed the importance of using information systems models to evaluate complex systems as call centers. The models used allow identifying the dimensions for the call centers that are facing challenges, together with an

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identification of the individual indicators in these dimensions that are causing the poor performance of the call center.

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## 1. Introduction

With the emergence of Information and Communication technologies, and the relatively cheap cost of calls (voice and data), the use of call centers to provide new services to citizens has grown extensively [1]. Evolution in call centers technologies, systems and infrastructures allowed the transformation of industries and services in big enterprises and organizations, customer support services, marketing services and after sales support are examples of such transformations. Moreover, the use of call centers in real time critical services is growing.

In Egypt, call centers have been used to improve the service of emergency control systems. Call centers have been used for call taking, dispatching and tracking of emergency calls [2]. The system monitors the overall performance and response time to guarantee the quality of service provided to the citizens. The system has successfully proved the improvement in the services provided by the ambulance system during the circumstances that Egypt has faced since the 25th of January revolution. An example of using specialized call centers in other countries is India, where first line health consultations have been provided by a specialized call center in order to reduce the referral of cases to primary care health units [3]. Outsourcing critical services to specialized call centers will definitely help in improving the quality of services provided by the government, companies and organizations to the targeted customers.

This new shift in services provisioning necessitates a thorough analysis of the design, implementation and performance evaluation of call centers. This analysis should not only include the call center system design, infrastructure, connectivity, reliability, and information systems used, but also organizational, management structures, and agents' skills should be considered. Different techniques have been used in the literature for the evaluation of the performance call centers. Due to the complexity of the system, simulation based techniques are the most commonly used [4], these techniques do not take

into consideration recent trends such as skill-based routing, electronic channels and interactive call handling. On the other hand, analytical techniques and operation research and queuing theory techniques are also adapted to model and analyze call centers.

Queuing theory approach is usually associated with assumptions in order to ease the modeling and the analytical complexity. These techniques do not reflect the reality due to the complexity of the system and the assumptions and the simplifications in the models proposed. The models are used to calculate the blocking rate, the average waiting time for the calls, the number of customer retrials [5]. A survey of the recent literature on call center operation management is provided [6]. Special focus has been given to new management challenges that have been caused by emerging technologies, to behavioral issues associated with both call center agents and customers, and to the interface between call center operations and sales and marketing.

Many researchers and call centers industry associations and institutions have proposed a number of performance indicators [7,8] 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 North American Quitline Consortium (NAQC) [7] as presented by Tables 1–3.

The objective of this paper was to introduce a new technique that can support decision makers in the call centers industry to evaluate, and analyze the performance of call centers. The technique presented in this work is derived from the research done on measuring the success or failure of information systems. Two models are mainly adopted to measure the performance of success and failures of information systems namely: the Delone and Mclean model first introduced in 1992 [9] and the Design Reality Gap model introduced by Heeks in 2002, [10]. Applying the models to include Internet

**Table 1** NAQC service indicators.

<i>Accessibility</i>	
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
<i>Speed of service</i>	
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

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