Performance improvement strategies to increase call center service level: a literature review

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Abstract. Call centers are an increasingly important part of today’s business world, employing millions of agents across the globe and serving as a primary customer-facing channel for firms in many different industries. Call centers have been a fertile area for operations management researchers in several domains, including forecasting, capacity planning, queueing, and personnel scheduling. Also, as telecommunications and information technology have advanced over the past several years, the operational challenges faced by call center managers have become more complicated. Issues associated with human resources management, sales, and marketing have also become increasingly relevant to call center operations and associated academic research. In this paper, we provide a survey of the recent literature on call center operations management. Along with traditional research areas, we pay special attention 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. We identify a handful of broad themes for future investigation while also pointing out several very specific research opportunities.

1. Introduction

A call center is a facility designed to support the delivery of some interactive service via telephone communications, typically an office space with multiple workstations manned by the agent who places and receives calls. [1]

In a typical call center, inbound calls arrive at random according to some complicated stochastic processes, call durations are also random, waiting calls may abandon after a random patience time, some agents may fail to show up to work for any reason, and so on. Based on forecasts of call volumes, call center managers must decide (among other things) how many agents of each type (i.e., skillset) to have in the center at each time of the day, must construct working schedules for the available agents, and must decide on the call routing rules. These decisions are made under a high level of uncertainty. The goal is typically to provide the required quality of service at a minimal cost. [2]

The most common measure of the quality of service is the service level (SL), defined as the long term fraction of calls whose time in queue is no larger than a given threshold. Frequently, multiple measures of SL are of interest: for a given period of the day, for a given cell type, for a given combination of call type and period, aggregated over the whole day and all call types, and so on. For certain call centers that provide public services, SL constraints are imposed by external authorities, and violations may result in stiff penalties. Service Level Agreement (SLA) is defined as a documented agreement between the service provider and customer that identifies service and service targets. [3]
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. [4]

2. Literature review

2.1. Call center
Companies care about customer satisfaction will continue to facilitate customer access to the company. With the access channel, customers will be increasingly convinced that contact with the company is only limited to reach of the hand, limited to reaching a fixed telephone, mobile phone or limited to opening a website, internet and email. [5]

The Call Center is essentially a customer service center. Initially, 100% of customer contact using the telephone, then with the development of technology, an intelligence network emerged that one of the applications uses toll-free numbers. Seeing the development of communication technology and the interest of the public to keep abreast of and use IT tools to facilitate and accelerate the lines of communication, the public interest in call centers has also increased.

Corporate awareness of the importance of call centers has greatly increased along with increasingly fierce competition. Call Center is considered as a necessity that is available as a bridge that connects the company/product with its customers without limits. The company paradigm began to shift, where previously the call center was only considered a cost center, now some have considered it as a profit center. If previously the call center was only used to accommodate information and complaints, now the call center is also used for selling activities. [6]

2.2 Purpose of call center
The purpose of the call center is, first of all, to provide a medium for consumers or target markets to talk with the company. With this media, the company will be able to accommodate the desires and expectations of consumers of the company's products. By knowing the hopes and desires of consumers, the company is an opportunity to innovate, improve product quality. As good as the call center is, it certainly won't be meaningful if consumers are not aware of the presence of the call center number.

2.3 Service level
Service Level is a measure of the success of a service agreed upon by two entities as stated in the Service Level Agreement (SLA). The SLA is part of the overall service agreement for performance improvement that must be improved during the contract period. These two entities are usually known as service providers and clients and can involve legal agreements because they involve money or more informal contracts between internal business units. This SLA usually consists of several parts that define the responsibilities of various parties, where the service works and provides guarantees, where the guarantee is part of the SLA has an agreed level of expectation, but in the SLA there may be a level of availability, ease of service, performance, operation or level specifications for the service itself. Also, the Service Level Agreement will determine the ideal target, as well as the minimum acceptable. [7]

SLAs are needed when viewed from the service provider side as collateral for services provided to clients, so that clients can be satisfied with the services provided, another impact that will emerge from the service provider side is the traditional marketing concept of marketing by word of mouth, meaning that the client will provide recommendations to his friends / other colleagues that the service provided by the provider is good, so hope that other friends/colleagues want to subscribe to the provider/service provider. [8]

The SLA states that a number of terms that guide the operation of the call center, the main determinant of how the call center works are often left to its own management. The call center must determine how many servers are for staff at a certain time, how to train their staff, and how calls must
be routed in the call center. The large number of staff influences compliance with alternative SLAs. [9] Simulation training needs to be held at call centers following a three-step process, namely, pacing observation, modulated practice with feedback, and integrated practice with feedback. [10] The probability of neglect is often linearly related to the expected delay; thus, in some cases, minimizing the expected delay can be seen as a proxy for minimizing the probability of neglect for non-contract customers. [11]

Lean six sigma is a business improvement methodology that aims to maximize shareholder value by increasing quality, speed, customer satisfaction and cost. This method is used by combining tools and principles from lean and six sigma. Lean Six Sigma uses tools from both toolboxes, to get the best from both methodologies, increasing speed while also increasing accuracy. [12]

Therefore, individual call centers to estimate their respective niche markets and to build and boost their competitive advantage. In fact, the global service supply chain provides an opportunity to take off and be misleading. Call center service providers, both off shore and on land, may not fight without the aim of a service contract. They can understand their own competitive advantage so they can all allocate their limited resources to clients who are in or close to their niche. [13]

Table 1. Literature survey on service level call center.

| No | Title | Authors /Years | Purpose | Method |
|----|-------|----------------|---------|--------|
| 1 | The Modern Call Center: A Multi-Disciplinary Perspective on Operations Management Research | Zeynep Aksin, Mor Armony, Vijay Mehrotra (2007) [14] | 1. To provide a survey of the academic literature associated with traditional call centers problem areas such as forecasting, queuing, capacity planning, and agent scheduling over the past few years. 2. To identify several key emerging phenomena that affect call center managers and to catalog the academic research that has been done in response to these developments. 3. To recognize new call center operations management paradigms that consider the role of the call center in helping firms to attract, retain, and generate revenue from customers and to propose some important implications of these new paradigms on future research; 4. To chronicle research on psychological ... | 1. Call Forecasting 2. Personnel Planning: Resource Acquisition 3. Personnel Planning: Staffing, Scheduling, and Routing 4. Personnel Planning under Arrival Rate Uncertainty |
aspects of call center agent experience, survey recent operations management papers that have incorporated some of these ideas into their modeling, and suggest ways in which such work can be incorporated into future operations management research; and

5. To highlight gaps in the current literature on call center operations management and opportunities areas for future research.

2 Optimal Shift Scheduling with a Global Service Level Constraint
Ger Koole, Erik van der Sluis (2003)[7]
We study a shift scheduling problem for call centers with an overall service level objective. We prove a property of this problem, called multimodality, that ensures that a local search algorithm terminates with a globally optimal solution. We report on computations performed using real call center data.

Manpower scheduling and multimodality

3 Customer Service Information System for a Call Center
Sartika Kurnialia, Titan (2015)[5]
To design a web-based customer service information system to improve service quality and efficiency in a call center.

The proposed solution of a web-based customer service information system was then designed based on those needs and simultaneously improve its service quality and efficiency. The web-based customer service information system then was built with a prototype model approach.

4 Performability evaluation of Emergency call centers serve people in the utmost circumstances; hence they
Marcus A. de Q.V. Lima, Paulo R.M.

The methodology used for assessing the performability and
emergency call center
Maciel a, Bruno Silva a, Almir P. Guimarãesb (2014)[8] should be highly dependable. Availability and performance are key aspects of call centers. Architectural models, service policies, and redundancies are attributes for defining and evaluating the overall operation of such systems. Infrastructure costs of the emergency call center consists of four steps and its activity diagram

5 Staffing to Maximize Profit for Call Centers with Alternate Service-Level Agreements
Opher Baron, Joseph Milner (2009)[9] To ensure quality from outsourced call centers, firms sign service-level agreements (SLAs). These define service measures such as what constitutes an acceptable delay or an acceptable abandonment rate.

6 Information systems performance evaluation, introducing a two-level technique: Case study call centers
Hesham A. Baraka, Hoda A. Baraka, Islam H. EL-Gamily (2014)[4] 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. This paper is applying the Design Reality Gap model as a framework to measure the Gap Index of call centers.

7 Optimizing Daily Agent Scheduling in a Multiskill Call Center
Athanassios N. Avramidis (2010)[2] Examine and compare simulation-based algorithms for solving the agent scheduling problem in a multi-skill call center. This problem consists in minimizing the total costs of agents under constraints on the expected service level per call type, per period, and aggregated. Combines simulation with integer or linear programming, with the cut generation
| 8 | The Impact of Simulation Training on Call Center Agent Performance: A Field-Based Investigation | Nagesh N. Murthy, Goutam N. Challagalla, Leslie H. Vincent, Tasadduq A. Shervani (2008)[10] | The most prevalent form of training call center agents is via classroom instruction coupled with roleplays. Role-play training has a theoretical base in behavior modeling that entails observation, practice, and feedback. This study evaluates the effectiveness of simulation-based training (henceforth, simulation training) as a behavior modeling technique vis-à-vis role-play training in a real-world call center environment across tasks of different levels of complexity. |
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| 9 | New Project Staffing for Outsourced Call Centers with Global Service Level Agreements | Thomas R. Robbins, Terry P. Harrison (2011)[1] | Consider the issue of new project staffing in an outsourced call center required to meet a monthly Service Level Agreement. Throughout this analysis evaluate the models using three test problems based on specific outsourcing projects. 1. Project J is a corporate help desk for a large industrial company averaging about 750 calls a day where the volatility of call volume is relatively low. 2. Project S is a help desk that provides support to workers in a large national retail chain. Call volume on this desk is about 2,000 calls a day. Because this desk supports users in retail stores, as opposed to a corporate office, the daily seasonality of call volume is quite different. 3. Project O is a help desk that provides support to corporate and retail site users of another retail chain. This is a smaller desk with about 500 calls a day, where call volume is fairly volatile and shocks |
| No. | Title                                                                 | Authors                                      | Abstract                                                                                       |
|-----|-----------------------------------------------------------------------|----------------------------------------------|------------------------------------------------------------------------------------------------|
| 10  | Service-Level Agreements in Call Centers: Perils and Prescriptions    | Joseph M. Milner, Tava Lennon Olsen (2008)[11]| Investigate whether this is rational behavior on the part of the call center and what the implications are for customers. Compare the performance of the different contracts in terms of mean, variance, and outer percentiles of delay for both customer types using both numerical and asymptotic heavy-traffic analyses. |
| 11  | Lean six sigma in a call centre: a case study                         | Alessandro Laurean, and Jiju Antony (2010)[12]| To illustrate the application of lean six sigma in the call center of a service industry corporation. Design/methodology/approach. The study describes improvements in the operation of the call center attributable to lean six sigma: increase in first-call resolution ratio, reduction in operator turnover and streamlining of processes. |
| 12  | Competition and market segmentation of the call center service supply chain | Yu Xia, Bintong Chen, Jayaraman, Charles L. Munson (2015)[13]| Construct a theoretical model to study the competition of call center service supply chain. The study consists of multiple competing call centers and many clients searching for out-sourcing partners to answer their customers’ phone calls. The model set up and cost analysis. |
| 13  | A Survey and Experimental Comparison of Service-Level-Approximation Methods for Nonstationary M(t)/M/s(t) Queueing Systems with Exhaustive Discipline | Armann Ingolfsson, Elvira Akhmetshina, Susan Budge, Yongyue Li, Xudong Wu (2007)[3]| Compare the performance of seven methods in computing or approximating service levels for nonstationary M(t)/M/s(t) queueing systems. The randomization method was almost as accurate as of the exact method and used about half the computational time. The closure approximation was less accurate and usually slower than the randomization method. The two infinite-server-based approximations, the effective-arrival-rate approximation, and the lagged stationary approximation were less accurate but had computation times that were far shorter and less |
problem-dependent than the other three methods.

3. Conclusion
Call centers are increasingly important for many businesses and are consistently struggling with the pressure of delivering better service at a lower cost. This paper tried to address the issue of whether lean six sigma can be useful in a call center environment: by means of a case study, it was found that lean six sigma can improve the operation of a call center, through an increase in first-call resolution (that reduces failure created by failing to answer the query in the first place), a reduction in call center operators' turnover (leveraging on training and experience) and streamlining the underlying processes by eliminating unnecessary operations.

The case study illustrated within this paper has used a certain number of the tools available in the lean six sigma toolbox, while omitting some other important tools (e.g. stakeholder analysis and measurement system analysis): however, despite this, it managed to improve the first-call resolution, and hence the customer service levels, of its operation.

Given the large scale of many call center operations, even a relatively small improvement in the sigma value of the process can dramatically reduce the defect rate, increase customer satisfaction and deliver financial benefits to the bottom-line.

By focusing on eliminating waste, identifying the true value-adding activities and using the DMAIC tools for problem-solving, it is possible to achieve significant improvements in costs and the levels of customer service provided.

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