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A study on call/contact centers' inbound and outbound management process in Mexico

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ABSTRACT

One challenge related to contact center management involves determining which process best serves customers, inbound or outbound. Such decisions impact the number of service agents available for operations, affecting costs. The size of the call centers market worldwide is estimated to reach $337 billion dollars by 2018. This industry employs 670,000 people in Mexico. A series of equations for calculating the difference in the number of service agents required by the two processes is determined using the direct demo method. Developed theorems and corollary may help simplify decision-making processes. The findings demonstrate that the number of agents required for both processes depends on the percentage of customers served at each location and on service agent occupation rates. The study recommends some best practices to the Mexican call center industry in order to improve its profits and quality within the inbound outbound services.

Keywords: Call center; inbound; outbound; scheduling; queue theory.

Introduction

Call center is the commonly used term for a telephone-based human-service operation. The call center dictionary produced by Stolletz (2012) defines a call center as a place in which high volumes of calls are placed or received for sales, marketing, customer service, telemarketing, or technical support purposes or for other specialized business activities. Contact centers are the successors of call centers. In addition to phone services, such centers interact with customers via the Internet, email, Short Message Service (SMS), chat, Multimedia Messaging Service (MMS), and social media (Menichelli & Ling, 2016).

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The world market for contact centers is valued at several million dollars. This value is expected to reach $337 billion dollars by 2018, mainly due to the increasing interest of corporations to provide an efficient service to customers (PRweb, 2012). There are more than 2.7 million agents in the United States; 2.1 million agents in Europe, the Middle East and Africa; and 1.4 million agents in Canada and Latin America. In India alone, there are more than 1 million agents working at this industry (Aksin, Armony & Mehrotra, 2007).

The results of a Deloitte (2013) survey of 300 managers of more than 560 contact centers across four continents indicate that 70% of the respondents believed the availability of human resources to be the most critical factor affecting the selection of locations for contact centers, whereas 47% reported labor costs to be the most critical factor. Contact centers house intensive labor operations in which agent costs typically account for between 60 and 80% of the overall operating budget (Aksin, Armony & Mehrotra, 2007).

Mexico employs 670,000 people at call centers. 68% worked at company owned call centers and the rest 32% at business outsourcing companies (Adame & Schwel, 2016). The inbound company owned call centers, dedicates 40% of their time to serve clients, 24% to sales, 17% to collection, and 17% to technical support and help desks (IMT, 2016a). The business outsourcing call centers in Mexico, presents similar results: 38% of time dedicates to customer service, 28% to sales, 16% to collection, and 12% to technical support and help desks. These call centers offer 100% inbound calls service and 98% outbound calls service (Arauz, 2015). Regarding call centers industry, Mexico's strength is having a same time zone in relation to the United States and is one of the countries with better workforce cost (IMT, 2016b).

Contact centers are divided into two types according to the traffic source: inbound and outbound. The former typically involve automatically assigning services to "automatic call distribution" agents, and the latter involve dialing automatic "outbound dialer" numbers (Gartner, 2015). The main difference between inbound and outbound traffic contact centers lies in who initiates the first phase of the contact process. For the present study, the two types of contact centers are defined as follows:

Inbound: This contact process originates from customers outside of a company. This type of operation, due to high labor costs involved, is usually subcontracted outside of the United States through outsourcing plans. In most cases, communication channels are created through toll-free numbers. Typical examples of incoming (inbound) traffic processes include Domino's Pizza and Pizza Hut’s channels, which provide pizza sales services (Koole, 2013; Stolletz, 2012).

Outbound: These contact processes are established within companies. Contact centers that offer such services are known as telemarketing centers. Such centers typically manage campaigns for the promotion of products or services targeted to markets (mainly in the United States, United Kingdom and Australia). Typical examples of outgoing traffic include models used by car manufacturers such as Toyota and Mazda in promoting their new models. Whereas larger companies offer these services directly, some subcontract their services through outsourcing (Gerbl, McIvor, Loane, & Humphreys, 2015; Graf & Mudambi, 2005; Gunasekaran, Irani, Choy, Filippi, & Papadopoulos, 2015).

Outbound and inbound traffic processes differ in three main aspects: A) in the case of outbound processes, companies anticipate when customers will answer a call, whereas in inbound processes, companies do not know when customers will call. b) For outbound processes, companies cannot determine the number of attempts that it will take to locate a specific customer, whereas in inbound processes, customers are certain that they will be able to contact a specific employee if they are sufficiently patient. c) In outbound processes, the number of phone agents employed is based on the service volume and time required, whereas in inbound processes, the required number also depends on the length of time that a customer must wait on hold on average until an agent is available to attend to a call (Mehrotra, Grossman, & Samuelson, 2011; Nah & Kim, 2013; Rod & Ashill, 2013; Stolletz, 2012).

Vernez, Robert, Massey, and Driscoll (2007) identified that contact centers manage a diversity of operations due to complex processes, thus having difficulties to reach the highest levels of performance at all of them. Most inbound traffic companies create some outbound traffic, and vice versa. Depending on the process established, varying numbers of service agents are required to facilitate operations; due to varying payroll costs for operations, contact center management teams face the challenge of selecting operational processes needed to satisfy customer demand, either inbound or outbound.

Literature Review

Tan and Netessine (2014), Zhao, Jin, and Yue (2015) and Afeche (2013) studied the basic operations of contact centers and recommend three ratios that enable both agents and customers to follow homogeneous practices. These ratios are used for both inbound and outbound processes.

a) The average workload R for a time interval is defined based on the ratio between the average customer entry λ and exit μ derived from the process employed by all available agents, as expressed in equation 1.

$$R = \lambda / \mu \qquad (1)$$

b) The individual average traffic intensity ρ is defined based on the average workload with active agents N being available to serve customers, as shown in equation 2.

$$\rho = \lambda / (N \cdot \mu) \qquad (2)$$

The individual average traffic intensity ρ also represents the percentage of agents occupied at their workstations.

c) The average length of service time that an agent needs to assist a customer $E[S]$ is commonly known as the average handle time (AHT) for contact center operations and is estimated based on the average number of customers that each agent can serve within a time interval μ, as shown in equation 3.

$$E[S] = 60 / \mu \qquad (3)$$

This quantity in the numerator (60) is fixed to facilitate the development of equations in this article; this implies that transactions are completed over a standard time interval of one hour (60 minutes). When it is necessary to use the equations determined for other time intervals, it is necessary to obtain the corresponding ratio (e.g., to use 3,600 when measuring time in seconds).

From the average workload R_{in}, it uses the $M/M/N_{in}$ model of queue theory for inbound contact centers to determine the likelihood that a contact center will be busy according to the Erlang $C(N_{in}, R_{in})$ formula (Baccelli & Brémaud, 2013), which is given by equation 4.

$$C(N_{in}, R_{in}) = [\ \textstyle\sum_{k=0}^{N-1} (Rin\ k\ /\ k!)\ ]\ /\ [\ \sum_{k=0}^{N-1} (Rin\ k\ /\ k!) + (R_{in}{}^{N} / N_{in}\,!)\ (1 / (1 - R_{in} / N_{in}))] \qquad (4)$$

The model assumes the following: *a)* entrance and service rates are constant over a time interval, *b)* the entrance process is a Poisson process, *c)* the service times obey an exponential and independent distribution that *d)* assumes an order in which the first to call is the first to be served and that *e)* ignores blockades and assumes that customers do not hang up. Under these assumptions, the Erlang-C formula enables direct calculation of the probability distribution of the time that a customer must wait to access a contact center. In cases for which $\rho_{in} \leq 1$, N_{in} must be greater than R_{in}.

Janssen, van Leeuwaarden and Zwart (2008) formally analyzed the "quality and efficiency driven" value of a queuing system $M/M/N_{in}$ for which the service rate μ is fixed, whereas the probability that a contact center is busy $C(N_{in}, R_{in})$ lies within the range [0, 1]. Under such conditions, some customers must wait to receive services. If λ_{in} tends to infinity and N_{in} tends to infinity, then $\rho_{in} = \lambda_{in} / (N_{in} \cdot M)$ tends to 1. There is a service grade β, where $0 < \beta < \infty$; it is defined as $\beta = (N_{in})^{0.5} (1 - \rho)$.

Gans, Koole and Mandelbaum (2003) recommend using a safety margin of additional agents ("Square-Root Safety Staffing Rules") for contact centers. These rules suggest that the number of agents required for an inbound process is equal to the workload plus a "safety staffing" follow-up margin of additional agents, $N_{in} = R_{in} + (\beta \cdot (R_{in})^{0.5})$. The safety staffing margin is $\Delta = \beta\ (R_{in})^{0.5}$, where $0 < \Delta < \infty$. Thus, the number of agents can be expressed as equation 5.

$$N_{in} = R_{in} + \Delta \qquad (5)$$

Additionally, Gans, Koole, and Mandelbaum (2003) noted that in contact center operations, the average time that a customer expects to wait in a queue to receive a service from an agent can be expressed as *E[WAIT]*, which is known as the "average speed answer" (ASA) (alternatively Wq "waiting in the queue"), as formulated in equation 6.

$$E[WAIT] = C(N_{in}, R_{in}) \cdot \rho_{in} \cdot 60 / [\lambda_{In} (1 - \rho_{In})] \qquad (6)$$

Brown et al. (2005) empirically showed that when $C(N_{in}, R_{in})$ decreases, *E[WAIT]* decreases because their values are monotonically related, and the lower the agent occupation percentage ρ_{in}, the shorter the customer wait time, *E[WAIT]*. (For theoretical and applied explanations of ASA, please refer to Gans, Koole & Mandelbaum, 2003)).

Gans, Koole and Mandelbaum(2003) recommend simplifying the calculations made in contact centers based on an approximation of the "Square-Root Safety Staffing Rules." This approximation is valid for large contact centers and is given by $E[WAIT] \approx 1 / \Delta$.

Borst, Mandelbaum and Reiman (2004) conducted a comprehensive study that revealed an optimal β for when waiting costs and human resource expenses are linear functions of time.

A large body of literature has addressed agent calculations for inbound contact centers. Fewer studies have focused on calculating the number of outbound contact center agents (Gans, Koole & Mandelbaum, 2003; Aksin, Armony, & Mehrotra, 2007).

Colledani and Gershwin (2013) noted that outbound processes are similar to industrial processes of continuous production and that "traffic intensity" levels are related to work volumes based on the displacement capacities for such jobs. When ongoing production processes are well configured, all entries for an interval of time λ_{out} should be equal to all exits $(N_{out}\ \mu)$ without forming wait queues. Hence, for outbound processes, traffic intensity levels should always take a value of $\rho = 1$ such that for equation 2, the number of agents N_{out} is determined from equation 7.

$$N_{out} = \lambda_{out} / \mu \qquad (7)$$

If the productivity equation 3 is substituted into equation 7, the equation for determining the number of service agents needed in an outbound process is obtained from the time of service that each agent must devote to each client, *E[s]*, and from the volume of customers estimated to be processed per hour at a contact center, λ_{out}, as determined using equation 8.

$$N_{out} = \lambda_{out} \cdot E[s] / 60 \qquad (8)$$

It is important to note that the average service time, *E[S]*, includes the time required for prior preparation and post-service administrative work.

Research Methods

To determine the difference between the number of available agents required to manage contact centers employing inbound and outbound processes, a mathematical development method of direct proof is used under three different service scenarios that are each described in the following two theorems and a corollary.

Theorem 1: If the volume of services to be processed within an inbound system is the same as the volume of services to be processed in an outbound system, i.e., $\lambda_{in} = \lambda_{out} = \lambda$, both processes have an identical service time, *E[S]*, and for inbound customers, there is a certain queuing time, *E[WAIT]*, which is defined as the "Average Speed Answer Call Factor" *(ASACF) or* as the ratio between the waiting time and service time, as shown in equation 9.

$$ASACF = E[WAIT] / E[S] \qquad (9)$$

Then, the difference between the numbers of service agents required for the two systems is given by equation 10.

$$(N_{in} - N_{out}) = C(N_{in}, R_{in}) / ASACF \qquad (10)$$

Where $C(N_{in}, R_{in})$ is defined by the Erlang-C formula, equation 4.

The assumption of equal volumes to be processed in both systems holds in only exceptional cases, and Theorem 2 is designed to violate this equality because outbound process require more time than inbound processes owing to the difficulty of reaching customers in the former.

Proof. For the proof, it is necessary to find an equation that determines the difference between $(N_{in} - N_{out})$ based on equal volumes of customers to process, λ. If equation 2 uses the value of μ employed in equation 3, for inbound conditions, equation 11 is obtained.

$$\rho_{in} = \lambda_{in} \cdot E[S] / (N_{in} \cdot 60) \qquad (11)$$

If equation 6 uses the value obtained from ρ_{in} of equation 11, it is then equation 12.

$$N_{in} = C(N_{in}, R_{in}) (E[S] / E[WAIT]) + (\lambda_{in} \cdot E[S] / 60) \qquad (12)$$

If the value of $(\lambda_{out} \cdot E[s] / 60)$, from equation 8, is substituted into equation 12, when $\lambda_{out} = \lambda_{in}$ and based on the $E[WAIT] / E[S]$ value for equation 9, it obtained equation 10.

Theorem 2: If the volume of services to be processed by agents within an inbound system, λ_{in}, is less than the volume of services to be processed by agents in an outbound system, λ_{out}, (because in the latter process, the target contact is not always reached) and $E(L)$ is the average rate of target contact location for outbound processes according to equation 13, then:

$$\lambda_{In} = \lambda_{out} \cdot E(L) \qquad (13)$$

For both processes, agents produce a same time of service value, $E[S]$, regardless of whether the target contact was reached, and there is a time that inbound customers must wait in the queue, $E[WAIT]$. The difference between the numbers of service agents required for both systems is given by equation 14.

$$N_{in} = E(L)\, N_{out} + C(N_{in}, R_{in}) / ASACF \qquad (14)$$

Where $C(N_{in}, R_{in})$ is defined by the Erlang-C formula, equation 4, and where $ASACF$ is the "Average Speed Answer Call Factor" defined by equation 9.

Proof: For the proof, it is necessary to find an equation that determines the difference between $(N_{in} - N_{out})$ given different customer volumes, which are related by $\lambda_{in} = \lambda_{out} \cdot E(L)$ according to equation 13. If the μ value for equation 3 for an inbound process is input into equation 2, equation 15 is obtained.

$$\rho_{in} = \lambda_{in} \cdot E[S] / (N_{in}. 60) \qquad (15)$$

When the μ value of equation 3 for an inbound process is used in equation 1, it obtained equation 16.

$$R_{in} = \lambda_{in} \cdot E[S] / 60 \qquad (16)$$

If the λ_{in} value included in equation 13 and the $\lambda_{out} \cdot E[s] / 60$ value from equation 8 are used in equation 16, equation 17 is obtained.

$$R_{in} = E(L)\, N_{out} \qquad (17)$$

When the ρ_{in} value for equation 15 is used in equation 6, equation 18 is obtained.

$$E[WAIT] = C(N_{in}, R_{in})\, E[S] / [\, N_{in} - (\lambda_{in} \cdot E[S] / 60)\,] \qquad (18)$$

When the $(\lambda_{out} \cdot E[s] / 60)$ value of equation 16 and the $E[WAIT]$ of equation 9 are used in equation 18, equation 19 is obtained.

$$N_{in} - R_{in} = C(N_{in}, R_{in}) / ASACF \qquad (19)$$

When the R_{in} term of equation 17 is used in equation 19, equation 14 is obtained.

Corollary 1: The difference between the services volume required for inbound and outbound processes depends on the average target contact location *E(L)* rate, and if both systems have the same service time *E[S]*, the ratio between the number of service agents for both processes is given by equation 20.

$$N_{out} = (\rho_{in} / E(L))\, N_{in} \qquad (20)$$

Proof: When the λ_{in} value for equation 13 is used in equation 15, equation 21 is obtained.

$$N_{in} = (E(L) / \rho_{in})\, [\lambda_{out} \cdot E[S] / 60] \qquad (21)$$

When the $\lambda_{out} \cdot E[s] / 60$ value for equation 8 is used in equation 21, equation 20 is obtained.

Simulation Example.

Table 1 illustrates Theorem 1. For this example, suppose that a contact center is expected to receive λ = 600 calls in one hour that are assisted by N_{in} = 40 agents with an average time of service of *E(S)* = 3 minutes. Table 1 presents the key parameters for this example.

Table 1: Theoretical Example of Theorem 1.

	Equation	Variable	Value
Calls estimated over 1 hour in an inbound process setting	Data	$\lambda_{in} = \lambda_{out} = \lambda$	600
Available inbound agents	Data	N_{in}	40
Average Service Time	Data	$E(S)$	3 minutes
Workload	1	R_{in}	30
Traffic Intensity	2	ρ_{in}	0.7500
Assistance or Service Rate of Individual Customers	3	μ	20
Probability that the contact center will be busy	4	$C(N_{in}, R_{in})$	0.0552
Average customer waiting time	6	$E[WAIT]$	0.0166
Outbound agents	7	N_{out}	30
ASA Call Factor	9	$ASACF$	0.0055
Theorem $(N_{in} - N_{out}) = C(N_{in}, R_{in}) / ASACF$	10	$(N_{in}-N_{out})$	10

Table 2 illustrates Theorem 2 and Corollary 1. Assume the same contact center data used to exemplify Theorem 1 in addition to a localization rate for outbound processes of 0.50.

Table 2: Theoretical Example of Theorem 2 and Corollary 1.

	Equation	Variable	Value
Mean of the customer location distribution for the outbound process	Data	$E(L)$	0.5000
Calls per hour for an outbound process	11	λ_{out}	1,200
Theorem $Nin = E(L)\ Nout + C(Nin, Rin) / ASACF$	12.	$(N_{in}-N_{out})$	- 20
Corollary $Nout = (\rho in / E(L))\ Nin$	13.	N_{out}	60

Conclusions and future work

Equation 10 from Theorem 1 is a particular case of equation 14 of Theorem 2 when the probability of finding effective contacts is $E(L) = 1$. Equation 20 of Corollary 1 determines the difference between the numbers of service agents required for inbound and outbound processes, and this difference depends on the location rate, $E(L)$, and the individual average occupancy rate, ρ_{in}. In particular, if $E(L) > \rho_{in}$, for a fixed volume of effective customer contacts for the same average service time, fewer agents are needed in an outbound process than in an inbound process, and vice versa.

Regarding previous research, the equations of Theorem 1 confirm the existence of the "Safety Staffing" Δ margin proposed by Gans et al. (2003) for calculating the number of agents employed in a contact center. If the N_{in} - R_{in} value for equation 5 is used in equation 19, the value is determined by the margin Δ according to equation 22.

$$\Delta = C(N_{in}, R_{in}) / ASACF \qquad (22)$$

In summary, the use of inbound or outbound contact center processes is dependent on two variables: (a) the probability of effective contact locations, $E(L)$, in outbound processes and (b) the projected workload for inbound processes, ρ_{in}.

The results of the present study suggest two lines of future research: a) developing a formula for determining safety margins when $E(L)$ obeys a probability distribution for which the average and standard deviation are known and b) modifying the assumption that the service time, E[S], is the same for inbound and outbound processes.

In spite of the strength that low human resources cost brings to the Mexican call center industry, the use of quantitative methods, as the ones developed in this article, will allow call center managers to optimize the balance of inbound and outbound calls cost composition.

Declarations

Competing Interests

The author declares that they have no competing interests.

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Authors' Contribution

Llanos, L.F. confirms that this work is original and has not been published elsewhere nor is it currently under consideration for publication elsewhere. He was the only writer of this article, reviewing all possible literature available for this study, framing the proposition and designing the methodology, collecting the data along with executing the data analysis for assessing the hypotheses and proposition as well as reaching to a conclusion.

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