An Integrated Balanced Scorecard and Simulation Approach for Measuring Call Centre Operation Performance

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Abstract: The importance of delivering world class services to customers around the globe has emerged the call centres as a strategic asset for customer-centric companies in all industries. The need for high service level and low operational cost achievements puts pressures on the companies and calls for sound decision making and accurate operation performance measurements. As a result, organisational decision making, regarding the call centre, is more and more connected to the corporate strategy influencing critical success factors, such as the customer service level. Tools like the Balanced Scorecard and Business Process Simulation are well known to assist organisations in all levels of management decision making (operational, tactical and strategic). This study proposes a joint effort, combining business process simulation and Balanced Scorecard into a powerful management tool that is capable of developing alternative dynamic scenarios subject to different parameters such as staffing needs, alternative process workflow, priority rules and desired customer service levels.

Key-Words: Balanced Scorecard, Business Process Simulation, Call Centres, Performance Measurement.

1 Introduction

Customer service using the phone has become a very important issue during the last few years. According to a report from Datamonitor (2000), which covers 26 countries across 13 industries, the number of call centres in Europe, the Middle East and Africa (EMEA) will increase by over 50% through 2008. Other surveys [Spectrum Group 2004] show that 65% of customers switch suppliers due to poor service or insufficient attention. As a result, the presence of call centres in the economic life of our society is indispensable for making business. For successful operation in the long run, the companies should link customer service strategy with the corporate mission statement. This means that call centres should be integrated within the corporation in a way that enables the unremitting and unbiased flow of information from other corporate areas and feedback relay customer issues, comments, and suggestions back to them.

Superior customer service, which can be achieved through the effective operation of call centres, and its connection with the corporate strategy calls for careful definition of the appropriate performance measures and their sound connection with the vision and the mission statement of the organisation. The most important and difficult decision that has to be made by the top management is the level of customer service that will be offered compared with the necessary resources to achieve this level of service. The high cost of the trained call centre workforce, which can be the largest proportion of the overall budget (Datamonitor 2004) makes the decision even more difficult.

In this context, the level of the goal achievement is directly affected by the call center efficiency and performance in terms of predefined performance measures. Therefore, measuring the call center performance is an issue of great importance (Anton 2002). In recent literature there is a large number of efforts towards call center performance measurement and evaluation. Most of these efforts focus on critical issues such as wait for service, duration and volume of contacts, employee work, quality of service and cost (Prosci 2004). In doing so, several management philosophies are utilised such as Balanced Scorecard, EFQM (European Foundation for Quality Management), Baldrige or Six-Sigma. Balanced Scorecard, introduced by Kaplan and Norton (1992) provides management with a carefully selected set of quantifiable measures derived from an organisation's strategy.

However, the dynamic nature of a call centre operation cannot easily be connected with a set of pre-defined performance measures in order to achieve a customer-centric strategy. Although the pre-implementation evaluation of alternative solutions is usually difficult, it is essential in order

to reduce some of the risks associated with the changing environment (Clemons 1995). One of the most wide-spread techniques for evaluating pre-implementation enterprise scenarios is simulation (Tatsiopoulos et. al. 2002). Simulation is an analytical tool used to imitate the operation of a stochastic model when it is too complex to be approximately analysed by the existing mathematical models (Lu and Guixiu 2004)

Simulation modelling techniques are by nature process-oriented (Law & Kelton 1991). A major advantage of simulation over other operational research techniques is that it allows for experimentation with any element of a business system (Tatsiopoulos et. al. 2002). Furthermore, simulation allows the decision-makers to obtain a system-wide view of the effects of local changes in a system and allows for the identification of implicit dependencies between parts of the system.

Applications of call centre simulation models have been reported in different industries: airlines (Gaballa and Pearce 1979), telecommunications (Sze 1984), the IRS (Harris et al. 1987), laboratories (Callahan and Khan 1993), hospitals (Agnihothri and Taylor 1991), retail mail-order (Andrews and Parsons 1993) and call centres (Duder and Rosenwein 2001). However, none of them combined the results generated with a coherent performance measurement strategic framework that can connect corporate strategy with the tactics and operations followed in the call centre.

In this paper, the authors suggest the combination of Balanced Scorecard methodology and Business Process Simulation to address strategic, tactical and operational issues of a call centre. The main implication of the approach described above is the elaboration of a proposed set of techniques that can allow organisations to assess the impact of controllable or uncontrollable changes on business performance, measure this impact and evaluate its feasibility, "before these changes take place in real life" (Giaglis et al 1999). The application of the suggested approach is presented in a call centre of a Greek Financial Institute.

2 Problem Definition and Approach

Robert Kaplan and David Norton argued that the exclusive use of financial indicators for the performance evaluation of an organisation is insufficient as well as misleading (Kaplan and Norton 1996). Trying to overcome this corporate management problem, they proposed the use of a scorecard, which they called "balanced scorecard", featuring performance measures capturing activities from throughout the organization—customer issues, internal business processes, employee activities, and shareholder concerns.

It can be argued that the operation performance of a call centre is a typical example of successful Balanced Scorecard application. The measures mostly used for the call centre performance evaluation are streamlined with the four views introduced by the Balanced Scorecard methodology: a) the financial view, e.g. cost of call center operation, b) the customer view e.g. customer service level, c) the process view e.g. utilization of call center's agents and d) the human resource view e.g. shift duration and overtimes.

The call centre operation is characterized by intense volatility in calling patterns and unexpected peaks in call volumes. Even more, most indications are that small call centres (<20 agents, such in our case) are more challenging to manage since call loads are often proportionally more volatile than they are for larger centres. Furthermore, managers of smaller centres are often grappling with these challenges using less sophisticated tools and technologies than those available to executives in larger organisations (Energis 2004).

Such a dynamic environment calls for an efficient tool to support decision making and flexible operation adjustment under unpredictable conditions in the most cost and service effective manner. Although the use of Balanced Scorecard has been widely reported for the alignment of call centre performance with business goals, few are the cases that balanced scorecard provides management with actual quantifiable cause and effect relationships between the indicators.

To address this gap, in this paper an integrated Balanced Scorecard and simulation approach is proposed. The role of simulation is to empower the functionality of the Balanced Scorecard by providing what-if analytical capabilities. The core function of this approach is to utilize data from all the views of the Balanced Scorecard and produce numerical results based on the causal relationships between the different measures.

More specifically, the proposed approach utilizes simulation results, such as operational data, utilization of resources, customer service levels and the related labor costs and allocates them in the four views mentioned earlier thus supporting a call centre's management in all three levels of decision making (strategic, tactical and operational). An illustrative example of a set of performance measures allocated in the Balanced Scorecard views is shown in Figure 1.

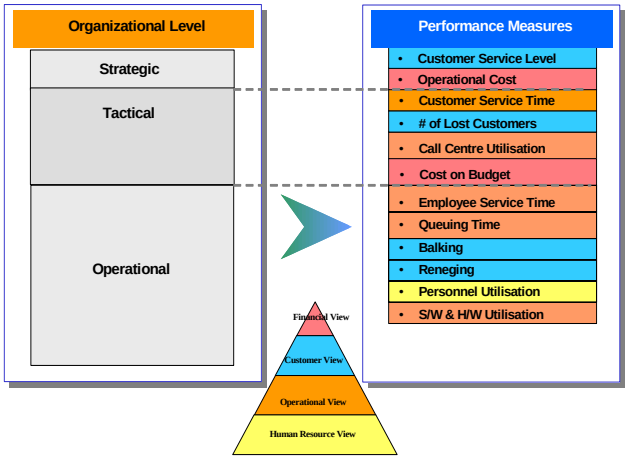

Figure 1: Measures Allocated in Views

The following chapters present a case study of a successful application of the proposed simulation-based management tool. The case study results are discussed and further research actions are suggested.

3 The Case Study

The case company is a Greek organization providing the customers with financial services. One of the areas of service is the provision of investment and portfolio related information and financial indices' status report. In order to increase the quality of provided services and customer satisfaction, the company has recently installed a call center system. The objective of this strategic investment was to help the company provide better service to its customers and give the opportunity to extend its customer base. In the past years of its operation, the company operated non-telephonic help desks at its central location in Athens.

The call center operates twelve hours a day, divided in two six-hour long shifts. Each shift is equally manned with six operators. For each shift, the company assigns a person in charge (system supervisor) who is responsible for the smooth system operation in terms of IT functionality and personnel efficiency. The system supervisor is also responsible for confronting with situations that arise from customers with requests more complicated than the operators can handle.

The call center is supported by an Interactive Voice Response System (IVR) that provides callers with standard information about the company services. The call centre has a capacity of thirty two call lines. In addition, there is a private line for the communication of the supervisor with the operators.

3.1 Methodological Approach

The proposed approach is consisted of a series of methodological steps, utilising a number of tools and techniques in order to analyse the system under study.

The first step of the approach involved the top management of the company and included the elaboration of the strategic framework of the study. The identification of the high-level objectives of the company guaranteed the initiation of the appropriate tactical decisions taken in a medium-term horizon and the direction of the low level operational actions in the short run.

The elaboration of objectives and the top management decision on the performance measures was followed by the definition of a positive set of constraint and assumptions that would follow the project throughout its life cycle. The assumptions' definition was performed by project specific synthesis meetings. As soon as the strategic framework of the project was structured (objectives, performance measurements, constraints and assumptions) the data collection phase was initiated. Several techniques were used during this step, such as work study, interviews, process modelling and reevaluation of company's historical data.

The data gathered from the previous phase was evaluated, structured and analysed in order to give meaningful and consistent information for the elaboration of the actual process simulation model. The customer service process model was structured using the IDEFx suite of modelling tools.

The next phase was the execution of the simulation model and the generation of ready-to-run alternative scenarios. The results from the simulation runs were analysed with the use of a built-in tool in the ARENA software, called Output Analyzer. The results were further refined with the use of spreadsheet analysis (EXCEL) and custom made score sheets. The analysis results were organized in a thorough top management presentation during the management buy-in phase which concluded the project and initiated the implementation of its results in the every day business practice.

3.2 Identification of Objectives

One of the main goals of the project undertaken was the elaboration of a set of business objectives that could support the company's management in all three levels of decision making (strategic, tactical and operational). For that reason, the project team conducted top management interviews during which best practices in Call Centers were presented and actual proposals of possible course of actions were suggested. The outcome of those interviews was a matrix connecting project objectives with performance measures. More specifically:

In the strategic level, the top management identified two main objectives, these being high customer level and low cost of service.

In the tactical level, the company identified four discrete objectives, two for each one of the strategic objectives described earlier. In terms of service level, the project team identified the need for low service time and small number of departing in discontent customers. In cost terms, the company translated the low cost strategic objective in the achievement of high overall call centre utilization and cost-on-budget conformance.

The four tactical objectives described above were further decomposed in eight objectives on the operational level. These were the low employment service time, low queuing time, low balking (customers that find all lines busy), low reneging (customers that leave the system in discontent after they have engaged an available line), high personnel utilization, high software and hardware utilization, flexible employee allocation and low overtime. The decomposition of the objectives in the three decision levels and the desired value range for each objective are shown in Figure 2.

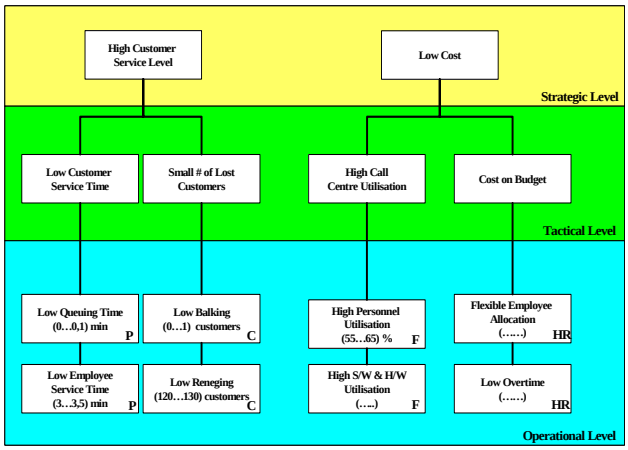

Figure 2: Management Decision Levels and Objectives

3.3 Business Process Simulation Analysis

Based on interviews carried out with the call centre manager and supervisors, the important operational parameters were recognized. The main system parameters identified are: the rate of incoming calls, the average operator service time (exponentially distributed), the average supervisor service time (exponentially distributed), the average IVR service time (exponentially distributed), the average IVR repair time (normally distributed), the average wait time until the customer decides to depart from the system in discontent (reneging) (normally distributed), the rate of reneged customers who call again (normally distributed), the average time between two successive operator or supervisor downtimes (normally distributed), the average operator or supervisor downtime time (normally distributed), the percentage of customers that request immediate service from an operator, the percentage of the customers that ask for further assistance from an operator after they have been serviced from the IVR, the percentage of the customers that have been serviced from the operator and don't need any further assistance from the supervisor, the probability of absence of an operator in one of the two shifts, the probability of the IVR system to break down, the percentage of the week calls per working day and the desired duration of the night time.

In parallel with the identification of the main parameters of the system, the project team worked out a set of system constraints and simulation assumptions. In the context of this paper, the most significant constraints and assumptions are presented:

1) Customer calls arrive to the system following a Non-Stationary Poisson (NSP) distribution. This distribution is going through a thinning process, in order to represent, more accurately, the actual arrivals of the real system.
2) The arrival rate changes every two hours.
3) The time between two successive arrivals is negatively exponentially distributed
4) Daily calls, are representing a certain fixed percentage of the sum of calls per week.
5) All operators are considered equal in terms of the service they provide.
6) The time of service in all work stations is negatively and exponentially distributed.
7) There are no downtimes for the 32 call center lines.
8) The IRV failure can only happen in the beginning of each hour of the working day in equal probabilities.
9) The repair time for the IRV is normally distributed. The type of failure is irrelevant of the repair time.
10) The reneging phenomenon happens only in the beginning of every half minute (periodic review of reneging). Furthermore, the reneging time is normally distributed.

Based on the above simulation model parameters, constraints and assumptions thirteen simulation scenarios were executed, one for each combination between the numbers of employees in the two call centre shifts. The analysis of the data produced by the execution of the simulation scenarios provided us with a number of findings:

- The call centre capacity (32 lines) is sufficient for the company's current needs (zero balking customers in all the scenarios).
- The overall wait time of the customer in the system (ws) is not seriously affected by the changes in stuffing.
- The decrease in the number of operators has a mediocre effect in the operators' utilization on the one hand but a significant effect on the number of reneged customers on the other.

In order to thoroughly study the above described situation, a sensitivity analysis took place on the simulation results and an Excel score sheet was created integrating the scenario results. This score sheet gave to each scenario a grade, depending on the significance the company assigns to service level (translated in the simulation results as lost customers) and labor cost (translated in the simulation results as number of employees). It was assumed that any scenario that gave results of more than 20% of lost customers (451) receives a zero grade while a less than 5% (112,75) lost customer scenario- receives a ten.

The two winning scenarios, were scenarios 1 (grade 8.03/ 6 employees per shift) and 6 (grade 7.55/ 5 employees per shift). Using these two scenarios (1 and 6) as the basis the company tried to explore three more business cases. Marketing studies estimated that a significant percent of reneged customers are calling again right after they depart. In addition the company's marketing department forecasted an increase of the arriving calls (due to word of mouth publicity) of a solid 20 percent.

Based on these studies, six more scenarios were executed. Scenario 14 (6.6) and 15 (5.5) assumed 20% increase of arrivals and no reneging customers calling back, scenario 16 (6.6) and 17 (5.5) assumed no increase of arrivals and a 50% reneging customers calling back, and finally scenario 18 (6.6) and 19 (5.5) assumed a 20% increase of arrivals and 50% reneging customers calling back. The results are shown in Table 1.

Scenario No	14	15	16	17	18	19
1st / 2nd Shift # of Operators	6,,6	5,,5	6,,6	5,5	6,,6	5,5
Operators Utilisation (%)	29,6	34,5	26	30,7	30,8	35,9
Supervisor Utilisation (%)	24,5	23,9	22	21,7	25,2	24,9
IVR Utilisation (%)	0,0607	0,0611	0,0546	0,0561	0,0638	0,0652
Ws (min)	3,53	3,54	3,56	3,54	3,55	3,54
Operators Wq (min)	0,0189	0,0379	0,0106	0,0271	0,0232	0,0463
Spervisors Wq (min)	0,0454	0,0441	0,0377	0,039	0,0487	0,0434
Ls (#)	2,68	2,64	2,33	2,32	2,79	2,77
Operators Lq (#)	0,0198	0,0436	0,01	0,0282	0,0256	0,0568
Supervisor Lq (#)	0,0291	0,0278	0,0235	0,0224	0,0317	0,0299
Balked # of Customers	0	0	0	0	0	0
Reneged # of Customers - Employees Queue	54,4	131	80,8	133	140	235
Reneged # of Customers - Supervisor Queue	127	121	51,6	49,5	69,7	67,2
Sum of Reneged Customers	181,4	252	132,4	182,5	209,7	302,2

Table 1: Extended Scenarios Simulation Results

The translation of the results showed that in all three business cases the scenario with the 6 employees per shift (scenario 16) received the best grade, because it achieved the highest service level without posing too much weight on the operators' utilization.

3.4 Project Results

The results of the simulation scenarios and the correspondent balanced scorecard results were presented to top management in the shape of a formal presentation. After a short project management presentation a real time simulation running took place visually demonstrating the workflow in the call centre and the selection of alternative values for key variables such as the headcount of the call centre, the rate of the incoming calls or the time needed for the agents to solve customers' problems. However, the most meaningful result of the project for the top management was the exchange curve demonstrated in Figure 3.

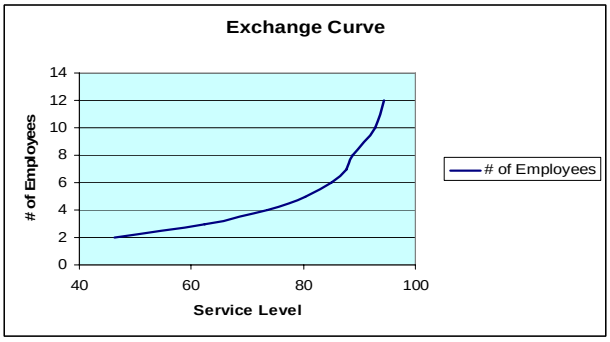

Figure 3: Service Level Exchange Curve

This exchange curve was based on the values of alternative scenarios for two very important variables: the percentage of customer service level (deriving by the sum of all "lost customers") and the number of employees (representing the operational cost of the call centre). These two indicators, resulting from data gathered from all the views of the Balanced Scorecard, produce a very accurate representation of the management decision effects on cost and service level. The difficulty of the decision making on the operation of a call centre lies on the contradictory nature of these two objectives: high customer service level with the lowest possible cost. The exchange curve translates in cost terms the achievement of a desired service level. The company has to decide on how it wishes to move along this curve. It is even possible to achieve these results by altering different controllable variables. It is even more important that it can decide on certain actions for the achievement of specific targets in

case uncontrollable variables (such as the number of incoming customers) change over time. The exchange curve enabled a successful buy-in of the applied methodology and the toolset used in the project and persuaded the company for on-going use of it for decision making.

4 Conclusions

The financial institute of the case study presented in this paper decided to become more customer-centric by introducing a two-shift call centre for customer service. A project was undertaken concerning the operation, management and control of the call centre. During the first months of operation, the management of the call centre realized the need for sound quantitative techniques/ tools for the determination of the appropriate actions to be taken for the efficient and effective operations of the call centre. The complexity of the system under study prevented the elaboration of mathematical models that could represent all the different hypothetical cases that were of importance for the organization. Moreover, the management wished to check different operation scenarios, based on changes taking place in real time, unknown beforehand. The creation of a parametric simulation model was perceived to be the ideal solution.

The experience gained by the project was that business process simulation can help the management of call centres in decision making. The dynamic nature of the problems faced in the operation of call centres urges the management to use scientific approach to make and justify its decisions. The proactive testing of actions before these takes place in real time in an easy and fast manner can prevent an organization from unnecessary costs or hurtful actions.

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