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A Novel Model for Benchmarking the Performance of Retail Stores for Retail Operations using Lean Manufacturing Approach

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Abstract

In the present study, lean manufacturing approach has been utilized to measure and benchmark the efficiency of retail services at five different store branches belonging to the same hypermarket and supermarket retail firm at three distinct cities in United Arab Emirates. The study was conducted at three different time intervals by applying the notion of takt time and cycle time in lean manufacturing and retail stores efficiencies have been estimated. The results of the study indicated that the performance of several retail cashiers in most of the stores under study was sub – optimal while the others were inefficient, suggesting the potential for improvement which requires a managerial intervention. Therefore, a new benchmark approach were deduced for possible decrease in resources which utilized in the morning time period to lead to a significant possible savings and waste reduction.

Keywords: Retail stores, benchmarking, efficiency, lean manufacturing, cycle time, takt time

INTRODUCTION

Traditional retailing services has undergone enormous change during the past 30 years or so [1]. Over years and years, retailing stores were changed rapidly from little booths to elegant complex department stores and malls. An increased number of supermarkets, malls and retailing chains are seen in major cities across the globe. The shopping method flexibility owes much more to changing digital technology and complex hardware and software enabled latest electronic gadgets. The window shopping using hand held computers, palmtop and now mobile provides user-friendly, hustle free shopping experience for 24×7×365 [2].

In today's rapid transforming and highly competitive global, attracting and retaining customers' loyalty is one of the most vital factors for modern business organizations in order to stay competitive and sustain its position in a market for long time. In an intense competitive landscape with different organizations within the same retailing industry competing with one another to attract the same group of customers. Customer retention became a primary concern for retail managers due to the fact that satisfied customers with the product or provided services are more likely to become a loyal customer and recommend their experience to the other customers especially with the large availability of internet services which enables them to convey their experience very fast. As a consequence, managers always try their best to not lose their customers to the competitors by gaining customers satisfaction through the enhancement of the quality of the provided services and the relationship between customer satisfaction and customer retention is understandable for managers nowadays. Therefore, most retail store owners are attempting to be different with their competitors in the quality of the provided services.

The competitiveness of an organization comes from the efficiency of its departments. Porter [3] highlighted that the volume of the market share reflects the competitiveness at the organization level. Researchers and practitioners have emphasized the concept and significance of efficiency and performance assessment.

Benchmarking is a comparative methodology generally applied between competing organizations which providing similar services on the bases of identical performance measures and characteristics. Benchmarking is a well – known system that may be applied in order to assist in the development of products and services in addition to the continuous improvement process. Benchmarking has been successfully and vastly used in managerial processes of private and public sectors [4 – 9] and organization acquired considerable process improvements and cost savings by the application of benchmarking. The objective of benchmarking is to identify the gap between the organization and competitors which enables them to specify their strengths and weaknesses upon efficiency comparison [10, 11]. Hence, organizations must keep a high degree of learning through the application of benchmarking which enables firms to adopt new practices and revise current ones in order to stay competitive in the market and keep or increase the size of its market share. Learning through benchmarking

programs is a prevalent method of determining faster service practices without extra resources and getting the benefit of explaining what is realistically attainable [12]. Therefore, measuring and benchmarking the efficiency or performance of a firm is applied for comparison purposes and in particular data envelopment analysis (DEA) is one of the most well-known techniques used in benchmarking as a comparative tool of firms' relative efficiency.

Although widely applied to all services and organizational functions [13, 14], benchmarking is less used to evaluate the implementation of lean manufacturing in organizations [15 – 17]. Therefore, the application of lean manufacturing as a benchmarking tool of relative efficiency remains comparatively uninvestigated area. Consequently, this research will be the first endeavor in this territory in order to fill this gap through an investigation on retail stores in United Arab Emirates.

LITERATURE REVIEW

Retailing remains the most important business model for decades. Large business groups divert their business to retailing to benefit from huge profit potential. Many researchers have explored the research area of retailing services area to improve the quality of the provided services, attain customer satisfaction and reduce the cost [18]. Several researchers have also employed the benchmarking analysis in retail services for instance; food consumer stores [19, 20] and coffee stores [21].

Benchmarking is defined as "the continuous process of measuring the company's products, services, costs, and practices against those of competitors or firms that display the "best in class" achievements" [22]. The first thorough benchmarking projects was initiated at Xerox Corporation in 1979 [23 – 27]. Management at Xerox Corporation motivated by suspicion that the photocopier machines production cost in the United States were much higher than that at Japan therefore they tried to understand the reason behind that by getting insights to the methods, process and materials used by the Japanese producers [23]. This first application form of benchmarking enabled Xerox Corporation to reduce the production cost of their photocopiers and therefore improved the market share of Xerox's Corporation and drove the evolution and improvement of the benchmarking managerial process [23, 24]. Therefore; the origin of benchmarking was in manufacturing and after that, benchmarking found its way into the managerial process in different fields and application of the service and production functions [13, 14].

Benchmarking and efficiency assessment are increasingly applied techniques in order to specify the best practices for efficiency enhancement and productivity improvement [28]. Effective management, allocation and usage of resources is a fundamental task for managers which provide a benefit for the customers and clients as more professional services and lower prices [29]. Therefore; investors and managers are highly interested in measuring and evaluating the efficiency levels of their resources [30]. Joo et al. [21] measured the performance and evaluated the comparative efficiency of a number of coffee stores through the application of data envelopment analysis (DEA) combined with benchmarking. McEachern and Paradi, [31] applied benchmarking which involved measuring the performance of financial firms and Johnes [32] employed benchmarking to investigate the efficiency of higher education in the UK. Lambert et al. [33] benchmarked and measured the comparative efficiency of emergency medical services in major US cities. Marques and Monteiro [34] applied benchmarking and calculated the efficiency and the productivity through DEA. Later on, Iyer and Banerjee [35] measured and ranked the managerial efficiency of a 57 projects and classified using alternative methods of clustering into a five category benchmarking model that enable practitioners and policy makers to implement the model.

Several researchers investigated the application of benchmarking for the assessment of lean manufacturing implementation. Gurumurthy and Kodali [15] demonstrated that managers can apply benchmarking in assessing the implementation of lean manufacturing in their firms. Cumbo et al. [16] applied benchmarking to investigate the effect of lean manufacturing implementation in rough mill and reported a significant difference in lead time between companies involved in lean manufacturing and those not involved in lean manufacturing.

METHODOLOGY

A. Understanding cycle time and takt time

In a production system, cycle time; is the maximum time required to produce a part or a sub-assembly or complete product, whereas takt time is determined based on the number of finished product that must come off the production line each day to meet the production target or customer demand. In the present study, takt time is selected as a quantitative tool to measure the efficiency of the retail stores. It is calculated by dividing the available operational time for its production with the required production volume per period:

$$Takt\ time = \frac{\text{Operational time per period}}{\text{Required production volume per period}} \quad (1)$$

Where,

$$\text{Operational time} = \text{Production time} - \text{Breaks} \quad (2)$$

Required production =

$$\text{Production volume} = \frac{\text{Annual production}}{\text{Working periods per period}} \quad (3)$$

Takt time can be used for all units in the value stream to adjust production quantities to actual demand in order to manufacture items only when needed.

B. Cycle Time and Takt Time Comparison

Cycle time is the maximum time required to produce a part or sub-assembly or a product. It includes time for the value added and non-value added activities. Cycle time relies on many factors like number of operations; number of service stations, raw material availability, manpower, etc whereas, the takt time is influenced by the changing demand of the customers. Since the mood of the customer is ever-changing. Retail managers are often found in a dilemma to gauge the customers' taste and preference. The number of customers visiting during a particular time slot or a day of the week has been bothering factor as they always find the mismatch between a number of customers and number of service stations for their smooth exit. The variation in cycle time and takt time bother the retail managers. In the case of mismatch between the cycle time and takt time, an underutilization or bottleneck in the system is surfaced out. The ideal situation prevailes, when cycle time matches the takt time. Various possible along with their profound effects are listed [36]:

- When cycle time = takt time; the production line/service line is smooth and considered to be flawless and efficient
- When cycle time < takt time: The production capacity/service capacity is underutilized that leads towards waste and inefficiencies.
- When cycle time > takt time; the presence of bottleneck in the production line/service line cannot be ruled out.

DATA COLLECTION

The study was conducted on one of the largest hypermarket and supermarket store chains in United Arab Emirates by selecting five different branches located in three different cities and distributed as follows: two stores in Abu Dhabi, two stores in Dubai and one store in Ras Al Khaimah. Therefore, a data was collected from five different branches at three different time periods; 9:00AM – 11:00, 3:00PM – 5:00PM, and 8:00PM – 10:00PM for fourteen days.

In order to collect the actual data representing the actual time that makes customers to wait in the exit lane to pay for their purchased items, teams were deployed at each retail store to collect the required data. The cycle time has been measured from the moment cashier starts scanning the items and till bags get filled by Bagger, Sacker or Bag boy and customer departs the cashier area. Most of the retails operate on multi-servers, multiline, single phase system in order to provide quick service to their worthy customers.

Tables 1, 2 and 3 summarize data collected during the study periods from the five identified retail stores i.e. AD1 Store, AD2 Store, DUB1 Store, DUB2 Store, and RAK Store.

Table 1: Summary of Data Collected from Abu Dhabi Stores

	Study Periods of AD 1 Store			**Study Periods of AD 2 Store**		
	9:00–11:00 AM	**3:00–5:00 PM**	**8:00–10:00 PM**	**9:00–11:00 AM**	**3:00–5:00 PM**	**8:00–10:00 PM**
Number of Cashiers	105	203	283	109	203	288
Available Time (Sec)	756,000	1,461,600	2,037,600	784,800	1,461,600	2,109,600
Total Number of Customers	2808	6956	11923	3298	7424	12152
Takt Time	269	210	171	238	197	174
Efficiency	0.68	0.87	1.07	0.77	0.93	1.05
Average CT (Sec)	183			183		

Table 2: Summary of Data Collected from Dubai Stores

	Study Periods of DUB 1 Store			**Study Periods of DUB 2 Store**		
	9:00–11:00 AM	**3:00–5:00 PM**	**8:00–10:00 PM**	**9:00–11:00 AM**	**3:00–5:00 PM**	**8:00–10:00 PM**
Number of Cashiers	94	175	260	96	170	264
Available Time (Sec)	684,000	1,260,000	1,872,000	691,200	1224000	1900800
Total Number of Customers	2889	6641	10554	3099	6026	10348
Takt Time	236.8	189.7	177.4	223	203	183.7
Efficiency	0.77	0.97	1.04	0.82	0.9	0.995
Average CT (Sec)	184			183		

Table 3: Summary of Data Collected from RAK Store

	Study Periods of RAK Store		
	9:00–11:00 AM	**3:00–5:00 PM**	**8:00–10:00 PM**
Number of Cashiers	82	166	204
Available Time (Seconds)	590400	1195200	1468800
Total Number of Customers	1736	5379	8219
Takt Time	340	222	179
Efficiency	0.53	0.81	1.01
Average CT (Seconds)	180		

DATA ANALYSIS

We have data for five retail stores linked with a hypermarket and supermarket store chains in United Arab Emirates for fourteen days. The collected data was summarized as shown in Tables 1, 2, and 3 and the takt time, cycle time (CT) and efficiencies for the five retail stores will be tested and analyzed.

The available time at each store per study period was calculated as:

$$Available\ time/time\ period\ (sec) = (Number\ of\ cashiers)(study\ period)$$

$$Available\ time/time\ period\ (sec) = (Number\ of\ cashiers)(2 \times 60 \times 60)$$

The cycle time in this study is measured as the time period between two consecutive customers leaving the cashier area. After that the average cycle time is estimated for every retail store. In addition to that, the takt time is calculated for every time period study at every retail store. Furthermore, the store takt time is estimated based on the total available time and the total number of customers per day. Finally, the efficiency is calculated as the proportion between the cycle time and takt time. The various obtained outcomes of cycle time, takt time and efficiencies for the five different stores are tabulated in Table 4.

Table 4: Cycle time, takt time and efficiency of the five stores

	AD 1 Store	**AD 2 Store**	**DUB 1 Store**	**DUB 2 Store**	**RAK Store**
Cycle Time	183 sec	183 sec	184 sec	183 sec	180 sec
Takt Time	196	190	190	195	212
Efficiency	0.93	0.96	0.97	0.94	0.85

The obtained outcomes of data analysis are graphically represented in Figure 1 and Figure 2.

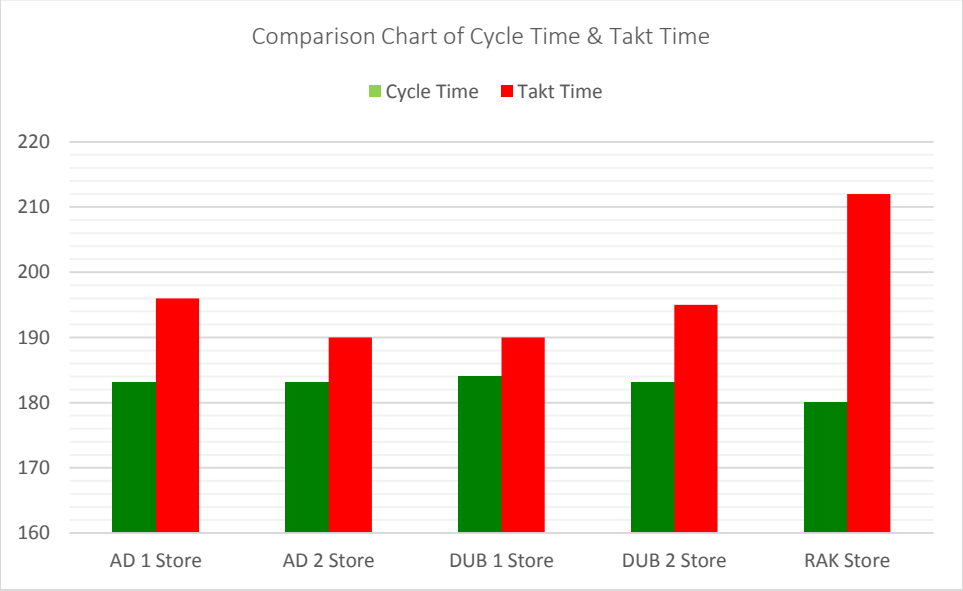

Figure 1: Comparison between cycle time and takt time of the different store

Figure 2: Efficiency comparison of the five different store

A notion of the relative efficiency $R_{A/B}$ can be introduced in order to compare the efficiencies between any two different stores or branches.

RESULTS AND DISCUSSION

In this study, two different types of comparison will be considered; a comparison within the store itself and a comparison between the different five stores. From the results obtained in Tables 1, 2 and 3, it is evident that the morning time periods (9:00 – 11:00 AM) for all of the five stores has the lowest efficiency when compared with the other two time periods. Furthermore; the cycle time for this morning time period is less than the calculated takt time hence the service capacity is underutilized which leads towards waste and inefficiencies. In conclusion, extra cashiers are used during this time period which leads to extra cost of retail services.

The outcome results for the evening time period (3:00 – 5:00 pm) indicated that the cycle time at all five stores is nearly equal to the calculated takt time except that for RAK store. Some stores in this time study period such as AD 1 store and DUB 2 store suffering from the problem of waste and inefficiencies but not to a limit that requires a management intervention. Obviously, this time period is considered to be flawless and efficient except that for RAK store.

The provided results from the tables for the night study period (8:00 PM – 10:00 PM) shows that the cycle time is almost equal to the calculated takt time at all of the five stores under study. Moreover, the cashiers' efficiencies at the different stores under study is almost equal to 100%. This gives a clear evidence that this time period is the most efficient time period. But in some retail stores, customers have to wait in the queue at the cashier area for a short time which is satisfactory and acceptable.

CONCLUSION

This study suggest a new useful approach of internal benchmarking using the lean manufacturing methodology to match the cashiers' efficiency at different branches of retail stores which belongs to the same firm. The study implies that stores management should reduce the number of cashiers used during the morning time period in order to reduce the waste and therefore reduce the cost of the provided retail service. Furthermore, the study glimpse that the evening time period for all stores except for RAK store is efficient and flawless therefore it doesn't require any action from the stores management. In addition to that, this study provide an evidence that the night time period at all stores is the most efficient time period.

A conclusion can be drawn from this study in which some cashiers can be moved from the morning time period to the night time period in all the stores under study for balancing purposes to reduce the load of the cashiers on night duty in order to comfort them which leads to employee satisfaction and consequently improves the quality of the provided retail services.

Overall, the presented cycle time and takt time in lean manufacturing approach which utilized to measure the efficiency of retail stores and provides managerial insights into

the firm. Also, the study is useful for benchmarking purposes as it provides a new approach for managers to apply the lean manufacturing concepts for comparison objectives. The present research provides the managers at retail stores with many managerial implications. Managers will be able to practice lean manufacturing in their day to day operations and become well informed about their operating efficiency. They will be in a position to understand the cycle time, takt time of their store and its implications on the customers' mood.

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