

The Self-Checkout System: Enhancement of Customer Satisfaction by Reducing Long Queuing Lines in Checkout Lanes of Convenience Stores in the Philippines

Jocelyn D. Abad, Diana Rose C. Sayo, John Ritche P. Jandayan, Cris John D. De Villa, Hilda P. Villaflores, Maricar M. Navarro

Industrial Engineering Department
Technological Institute of the Philippines, Philippines
Tel: (+63) 02-911-0964

Abstract. The Self-checkout system is the process of scanning, bagging, and paying for items in the checkout lanes of convenience stores without the need for human intervention. The aim of the study is to enhance customer satisfaction by eliminating, if not reducing long queue in the checkout lanes of convenience stores in the Philippines. The proponents evaluate the point-of-sale system and the self-checkout system using time study, stream diagnostic chart and layout simulation. The Pro model simulation software is utilized to validate the system's applicability and thus, compare results. The simulation output also shows that the average time to transact in a Point-of-Sale System is higher compared to the Self-Checkout System, thus the latter is quicker and more reliable. The self-checkout system enables customers to escape long queues, especially during peak service hours and holiday season, when the influx of shoppers increases exponentially. Likewise, the number of customers it can accommodate also increases.

Keywords: Self-checkout system, Point of sale system, Queuing time, Promodel Simulation

1. INTRODUCTION

According to Philippine Statistics Authority (PSA), on the average, the domestic economy grew by 5.2% and the main driver was the Service Sector. This indicates the need to innovate and enhance systems and technologies in the said sector to provide quick and reliable services for every customer.

The long queue in convenient stores during peak or rush hours dissatisfies most, if not all, of the customers. In the Philippines, grocery stores, convenience stores or even supermarkets use the Point-of-Sale (POS) as the checkout system. It is the point at which a customer makes a payment to the merchant in exchange for goods or after provision of a service. On a macro level, a point of sale may be a mall, market or a city but on a micro-level, retailers consider POS to be the area surrounding the counter where customers pay.

On the other hand, the Self-Checkout System is an automated process in a grocery store's checkout lane that allows customer to scan, bag, and pay for their items without the need for human interaction. This kind of system

is commonly seen in developed countries such as the United States, Canada, and Japan.

The purpose of the study is to know how the Self-Checkout System can improve the queuing line in the checkout lanes of convenience stores, and to determine its applicability in the Philippines setting.

2. METHODOLOGY

The proponents analyzed the different processes involved in a Point-of-Sale System in most convenience stores in the Metro. The process starts when the cashier gets the items from the customer and scans them until the items are put in the bag to be given back to the customer. Using Stream Diagnostic Chart, the transaction delays were caused by the following: 1.) Double scanning of items, 2.) Wrong or depleted barcodes, 3.) Limited space to put items, 3.) Customer gets additional items, and 4.) Insufficient change due to large bills. These delays cause longer queuing time and further, cause dissatisfaction among customers.

The proponents evaluate the point-of-sale system and the self-checkout system using time study, stream diagnostic chart and layout simulation. The Promodel simulation software was utilized to validate the system's applicability and thus, compare results.

3. RESULTS AND DISCUSSION

3.1 Process Analysis

The researchers conducted observations during peak hours, from 11:00 AM to 3:00 PM. In the Table 1, the range of the total average time for the process varies from 69.26 seconds to 74.17 seconds. The range of the total normal time varies from 80.39 seconds to 86.10 seconds. The total standard time varies from 86.44 seconds to 92.58 seconds.

Table 1: Summary of Time Study Data

Summary of TMS Results (in seconds)										
Process	Average Time					Normal Time				
	A	B	C	D	E	A	B	C	D	E
1. Get Items and Scan	14.21	15.78	15.43	15.31	14.47	16.91	18.77	18.36	18.22	17.22
2. Get Total Amount	13.37	14.85	13.55	14.37	13.27	15.24	16.93	15.45	16.38	15.13
3. Get Payment	13.43	13.74	13.62	13.68	13.68	15.31	15.67	15.53	15.60	15.60
4. Put Money Inside Register, Give Change & Receipt	13.91	14.60	14.36	14.23	13.30	15.85	16.65	16.37	16.22	15.16
5. Put Items in Bag and Give Customer	14.35	15.20	14.95	16.44	14.60	17.07	18.09	17.79	19.56	17.37
TOTAL	69.26	74.17	71.91	74.03	69.32	80.39	86.10	83.50	85.98	80.47
Standard Time	A		B		C		D		E	
	86.44		92.58		89.78		92.45		86.53	

3.2 Simulation

Using the ProModel software, the proponents simulate using the time study data, the processes involved in the Point-of-Sale system as well as the proposed system which is the Self-checkout system.

Based on the result (see Table 2), the Self-checkout system has the lowest average waiting time of 1.58 minutes and average blocked time of 0.57 minutes compared to 10-16 minutes for average waiting time and 2 minutes average blocked time in Point-of-Sale system. The said system has also the highest percentage of utilization with 76.02 and 1428 total number of served customers compared to Point-

of-Sale system of convenient stores with around 50 percent utilization and 620 served customers.

Using normal distribution, five (5) percent margin of error, 95% confidence interval with 8.2 Million people in age group 15-64 years old, the sample size was computed roughly 400 respondents. Among surveyed, eighty six (86) percent are dissatisfied due to long queue with seventy four (74) percent of them purchased 3-5 items per transaction and wait for an average of 10 minutes.

Table 2: Summary of ProModel Simulation of Point-of-Sale System vs. Self-Checkout

Store	Total Exit	Ave. Time Waiting (min)	Ave. Time in System (min)	Ave. Time Operation (min)	Ave. Time Blocked (min)	% Utilization
Convenience Store A	613	10.77	14.81	1.16	1.88	49.38
Convenience Store B	624	21.1	25.45	1.24	2.11	53.73
Convenience Store C	613	12.93	17.1	1.2	1.97	51.08
Convenience Store D	590	11.06	15.25	1.24	1.95	50.83
Convenience Store E	639	16.29	20.43	1.16	1.98	51.49
Proposed	1428	1.58	2.91	0.77	0.57	76.02

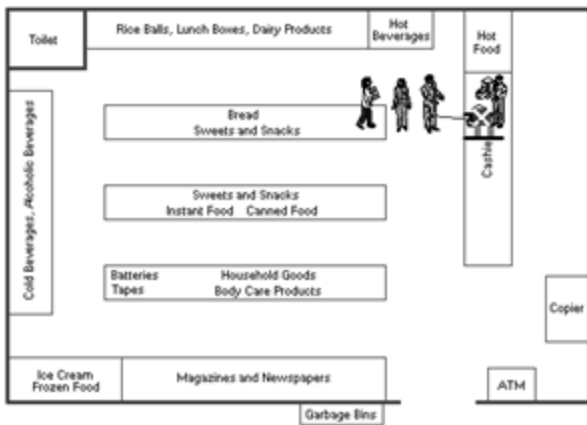


Figure 1: Point-of-Sale System of Convenient Store A

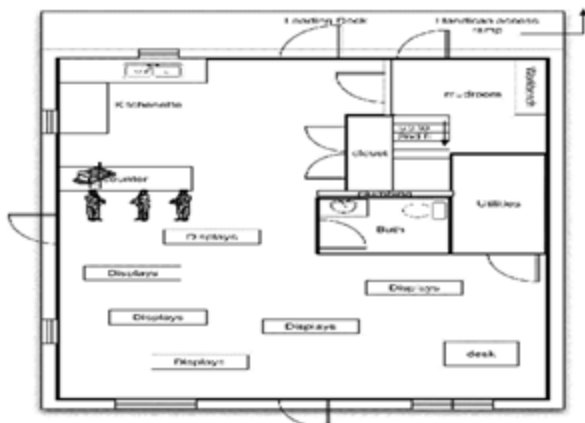


Figure 2: Self-Checkout System

The self-checkout system incurred 1.58 minutes waiting time compared to more than 10 minutes waiting time for point-to-sale. The proposed system improves

queuing time, and thus, enhances the satisfaction of customers.

4. CONCLUSION AND RECOMMENDATION

The Self-checkout system significantly reduces the queuing lines with quick turn-around time. The average waiting time was reduced to almost 89.05% or from 14.43 minutes on the average to 1.58 minutes while the average blocked time was reduced to almost 72.73% or from 2.09 minutes on the average to 0.57 seconds. The total served customers also increased by almost 42%.

Aside from convenience stores, the Self-checkout system could be simulated in bigger stores such as groceries or supermarkets. It could also include assessment using other parameters such as maintainability and functionality.

ACKNOWLEDGMENTS

The proponents would like to express their grateful acknowledgement first and foremost to the Almighty God, for His continuous grace, blessings and strength, to our families who willingly support us, to Technological Institute of the Philippines for its support and encouragement.

REFERENCES

- Akbar, M., Parvez, N., 2009. *Impact of service quality, trust, and customer on satisfaction on customers' loyalty*. *ABAC Journal* 29 (1), 24–38.
- Anderson, J.C., Gerbing, D.W., 1988. *Structural equation modeling in practice: a review and recommended two-step approach*. *Psychological Bulletin* 103(3), 411–423.
- Anitsal, I., Flint, D.J., 2006. *Exploring customers' perceptions in creating and delivering value technology-based self-service*. *Services Marketing Quarterly* 27, 57–72.
- Athanassopoulos, A., Gounaris, S., Stathakopoulos, V., 2000. *Behavioral responses to customer satisfaction: an empirical study*. *European Journal of Marketing* 35(5/6), 687–707.
- Babakus, E., Boller, G.W., 1992. *An empirical assessment of the SERVQUAL scale*. *Journal of Business Research* 24, 253–268.
- Barnes, S., Vidgen, R., 2001. *An evaluation of cyber bookshops: the WebQual method*. *International Journal of Electronic Commerce* 6 (1), 11–30.
- Bauer, H.H., Falk, T., Hammerschmidt, M., 2006. *eTransQual: a transaction process-based approach for capturing service quality in online shopping*. *Journal of Business Research* 59(7), 866–875.
- Bearden, W.O., Teel, J.E., 1983. *Selected determinants of consumer satisfaction and complaint behavior*. *Journal of Marketing Research* 20, 21–28.
- Bloemer, J., Ruyter, K.D., 1998. *On the relationship between store image, store satisfaction and store loyalty*. *European Journal of Marketing* 32(5/6), 499–513.
- Bloemer, J., Ruyter, K., Wetzels, M., 1999. *Linking perceived service quality and Service loyalty: a multi-dimensional perspective*. *European Journal of Marketing* 33(11/12), 1082–1106.
- Bloemer, J.M., Kasper, H.D., 1995. *The complex relationship between consumer satisfaction and brand loyalty*. *Journal of Economic Psychology* 16(2), 311–329.
- Bolton, R.N., Lemon, K.N., 1999. *A dynamic model of customers' usage of services: usage as an antecedent and consequence of satisfaction*. *Journal of Marketing Research* 36(2), 171–186.
- Bolton, R.N., Drew, J.H., 1991. *A longitudinal analysis of the impact of service changes on customer attitudes*. *Journal of Marketing* 55(1), 1–9.
- Lee, J., Lee, J., Feick, F., 2001. *The impact of the switching costs on the customer satisfaction–loyalty link: mobile phone service in France*. *Journal of Services Marketing* 15(1), 35–48.
- Lee, H.J., Fairhurst, A.E., Lee, M.Y., 2009. *The importance of self-service kiosks in developing consumers' retail patronage intentions*. *Managing Service Quality* 19(6), 687–701.
- Lin, J.S.C., Hsieh, P.L., 2011. *Assessing the self-service technology encounters: development and validation of SSTQUAL scale*. *Journal of Retailing* 87(2), 194–206.
- Lukas, B.A., Tan, J.J., Hult, G.T.M., 2003. *Strategic fit in transitional economies: the case of China's electronics industry*. *Journal of Management* 27, 409–429.
- Parasuraman, A., Zeithaml, V.A., Berry, L.L., 1988. *SERVQUAL: a multiple-item scale for measuring consumer perceptions of service quality*. *Journal of Retailing* 6 (1), 12–40.
- Woodruff, R.B., Cadotte, E.R., Jenkins, R.L., 1983. *Modeling consumer satisfaction process using experience-based norms*. *Journal of Marketing Research* 20, 296–304.
- Wolfinbarger, M., Gilly, M.C., 2003. *eTailQ: dimensionalizing, measuring and predicting retail quality*. *Journal of Retailing* 79(3), 183–198.
- Wu, K.W., 2011. *Customer loyalty explained by electronic recovery service quality: implications of the customer relationship re-establishment for consumer electronics e-tailers*. *Contemporary Management Research* 7(1), 21–44.
- Yang, Z., Jun, M., Peterson, R.T., 2004. *Measuring customer perceived online service quality scale development and managerial implications*. *International Journal of Operations & Production Management* 24(11), 1149–1174.