EFFECTS OF AGILE SUPPLY CHAIN PRACTICES ON PERFORMANCE OF HEALTHCARE SECTOR IN TANZANIA: A CASE OF SELECTED PUBLIC HOSPITALS IN DODOMA CITY

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ABSTRACT

Despite of the importance of agile supply chain practices in health care still agile supply chain practices lagging behind in healthcare organization. This study aimed to examine the effects of agile supply chain on performance of health care in Dodoma city. This research was conducted at Dodoma Municipality in Benjamin Mkapa hospital and Dodoma general hospital. y. Data were collected by using both primary source of data and secondary source of data. Primary data was collected by using questionnaire and interview while the secondary data was collected by using documentary review and the study used the sample size of 236 respondents. Cross- sectional research design was employed and purposive sampling technique was used to select respondents of the study. Data were analyzed by using logistic regression analysis model. Results indicated that treatment conducted at reasonable time, waiting for registration, ICT uses in healthcare operations, reduction of path flows and quick medical assistance have positive significantly relationship on performance of healthcare in terms of patients satisfaction whereas time to contact medical personnel, effective communication and quick response with change number of patients has insignificant relationship towards patients satisfaction.. The study conclude that agile supply practices had positive significance influence on the performance of healthcare organization in the study area. The study recommends that the Government should employ adequate number of doctors, nurses, pharmacists and laboratory technicians in order to smoothen the daily operations of public hospitals.

Keywords; *agile; supply chain; healthcare; organization; performance*

1.0 INTRODUCTION

The rapid emerging challenge of value chain environment forced many healthcare organizations to decide on looking for better opportunities in order to improve the efficiencies of operations through reducing cost and continuity to improve of quality care (Haszlinna Mustaffa and Potter, 2009). Supply chain is more complicated in the healthcare compared to other industries especially

manufacturing industry because of the nature of service conducted in the health care (Haszlinna Mustaffa and Potter, 2009). So that there is different number of supply chain tactics which have been adopted nowadays to reduce the problems but still there are barriers to use supply chain techniques such as lean and agile techniques continue to exist (Aronsson, Abrahamsson and Spens, 2011). By considering health care service, the agile supply chain refers to the ability of being flexible in providing service to the patients without a limitation of fixed numbers of patients to be attended per day, quick response to the patient, reducing the number of process to be followed by patient in acquiring services by integrating and coordinating properly the processes, and to avoid long waiting times of services by ensuring quick delivery of the service to the patient (Aronsson, et al., 2011).

 Meijboom, Schmidt-Bakx and Westert (2011) Presence of long lead time in healthcare for waiting necessary care or treatment from the doctors, nurses influence negatively to the patient's quality of life because their condition may deteriorate significantly when waiting to receive the treatment. So that the healthcare delivery system which the elongated waiting time is just a common practice to them will actually be evaluated as low quality care because they fail to treat patients/customers in short delivery time as perceived by the patients (Meijboom, et al., 2011). Meijboom et al., (2011) revealed that the waiting time in healthcare differs from one country to another, for example in USA and Canada the sick adults were considerably less likely to report quick access and are supposed to wait at least six days for an appointment compared to patients in other countries.

In Tanzania healthcare industry both private and government hospitals was faced with the large number of patients which in turn leads into the availability of queue in waiting services from doctors/nurses/laboratory technicians. Also there is presence of too many process or procedures which the patients must follow in securing treatment because of the limited use of information communication technology (ICT) software especially to the government hospital and health centers for integration and coordination of the process together in order to reduce the number of the process. Due to the presence of large number of patients which cause queue in waiting service and the availability of many procedures or process of the pathways of patients, it leads to long lead time in many government hospitals in Tanzania to be a problem (Leshabari, and Muhondwa, 2008)

Performance of healthcare organization can be described in terms of bed occupancy, mortality rate, growth and accreditation (Kakooza and Tusiime, and Odoch, 2015). Performance measurement in hospitals as said by (Elg, Palmberg Broryd and Kollberg, 2013) includes the patient's satisfaction, financial performance and processes which involve patient safety, waiting time and length of stay. De Bloom, Kompier, Geurts, De Weerth, Taris, & Sonnentag, (2008) said that most hospitals management was poor compared to manufacturing firms, also the performance of public hospital in terms of delivering of services to the patients is very worse compared to private hospitals. De Bloom *et al*. (2008) recommend that the public hospital management must make sure that they employ strategic decisions which accelerate the highest delivering of services through good standards of patients care and achieving the overall financial performance of the hospitals.

Despite of the importance of agile supply chain practices in health care like fast delivery of service, flexibility in meeting changing of demand, time management, cost minimization and profit achievements still agile supply chain practices lagging behind in healthcare organization (Aronsson, Abrahamsson and Spens, 2011). The study done by Simwita (2017) in Tanzania observe that agile supply chain applicability in healthcare organization can help to smoothen the operations through improving quality of service by reducing time spent of patients in hospital, flexibility on healthcare processes and improving healthcare delivery system. As discussed by many literature that lean and agile strategies nowadays become a tools for improving healthcare processes (De Vries and Huijsman, 2011)

Tanzania government through ministry of health employs many efforts to strengthening the health sector industry, example in Tanzania eHealth strategy 2012-2018 the government emphasizes using of information and communication technology in order to transform healthcare delivering by enabling information access and supporting healthcare operations, management and decision making. So that through eHealth strategy the desire of the government is to deliver high quality, efficient and sustainable health system which responds quickly to demand pressures. But still the efforts fail to achieve their objectives due to the presence of too long process which the patients must follow in acquiring services (pathway of patients to acquire treatment), absence of quick response to the patients even if in the emergency case and queue in waiting service. This motivated the researcher to conduct research on agile supply chain practices towards performance of healthcare industry.

2.0 RESEARCH METHODOLOGY

2.1 Area of study

The study used cross sectional research design. Using cross sectional research design enabled the researcher to collect data just once over a period of one month. Cross sectional design as stated by (Wakuru Magigi, 2015) data was collected in one point of time, whereby one variable was examined in different groups that are similar in other characteristics. The study was conducted in Dodoma city at Dodoma general hospital and Benjamin Mkapa. Dodoma is located at the center of Tanzania. Dodoma municipality covers 2576 km2 with a population of around 500,000 people. The rationale of selecting Dodoma municipality is because of the rapid growing population of people due to the shifting of government from Dar es Salaam to Dodoma, statistics shows that the population of Dodoma municipality increases at the growth rate of 2.8% and currently there is steady increase of the population due to the shifting of the government. In 2015 population of Dodoma municipality was estimated to be 447,097, in 2016 population was 459,616 and in 2017 the estimated population was around 500,000 (National Bureau of Statistics, 2013) .So that this shift of the government to Dodoma will increase more deficit of qualified human resource of hospital because before government shifting to Dodoma the human resource of healthcare were 58% indicating the deficit of 42% (Regional Health Management Team (RHMT), 2015). Also the selected public hospitals Benjamin Mkapa and Dodoma general hospital is because of having the largest number of the patients admitted per month compared to the other hospitals in Dodoma municipality. According to Hospital register (2018) Benjamin Mkapa hospital having an average

3800 patients admitted per month and Dodoma general hospital having an average of 6500 patients admitted per month which is large number compared to other public hospitals in Dodoma municipal. The total number of public hospitals in Dodoma municipality is three (3) which include Mirembe hospital, Benjamin Mkapa hospital, and Dodoma general hospital (Regional Health Management Team (RHMT), 2015).

2.2 Sampling method

The unit of analysis for this study was the selected public hospitals in Dodoma Municipality. The selected public hospitals include Benjamin Mkapa and Dodoma general hospital. The selected institutions are located in Dodoma Municipality. Regarding the nature of the research and the methodologies, purposive sampling was used in order to obtain a required sample purposely to meet the objectives of the study. The main rationale of adopting purposive sampling in this study is its usefulness in exploring and constructs historical reality and description of phenomenon on the knowledge concerning agile supply chain practices in healthcare. By using purposive sampling, patients, doctors, nurses, laboratory technician and procurement and supplies department were selected, in order to provide the relevant technical information a researcher is looking for to achieve the stated objectives. Saunders, Lewis, and Thornhill (2009) said that purposive sampling is the technique which gives adequate and relevant information regarding the study which requires a researcher to select units of interest depending on his knowledge and judgment. Sample size of the study was 236 respondents include doctors, nurses, laboratory technicians, procurement and supplies department and outpatients at Benjamin William Mkapa hospital and Dodoma general hospital.

2.3 Data sources and methods

Both primary data and secondary information were collected. Primary data refers to the information which is collected in the first time while secondary information refers to data collected by someone else other than user (Kothari, 2004). Primary data were collected through structured questionnaires to the key respondents specifically doctors, nurses, laboratory technicians and procurement and supply department staff purposely to collect views on the subject matter to be observed. But secondary data were collected through reviewing various documents which were applicable to the study example organization policy to see whether the policy indicated the issue of responsiveness to customer through reducing waiting time, quick response and other aspects regarding patient's satisfaction.

2.4 Measurement of agile supply chain variables

The major key variables of this study include treatment conducted at reasonable time, waiting for registration, time to contact medical personnel, response to emergency patients, quick medical assistance, quickly response with changing number of patients, ICT uses and reduction of path flows with dependent variable performance of healthcare through patient's satisfaction. Most constructs in this study were measured by existing measurements which involve various numbers of items in order to ensure reliability and validity (Mungai, 2013). All independent variables included in the model as continuous variables which were measured by using five point Likert scale

ranging from 1 to 5 in order to measure the level of agreement. So that a score of 5- strongly agree to 1-strongly disagree were used.

2.5 Performance indicators

Patient's satisfaction was used as indicator to measure the effects of agile supply chain practices on performance. In order to measure the performance of healthcare organization in terms of patient's satisfaction, dummy variables were created as 1 indicating satisfaction and 0 not satisfied.

2.6 Data analysis

Binary logistic regression model was performed in order to determine the effects of agile supply chain practices in terms treatment conducted at reasonable time, waiting for registration, time to contact with medical personnel, ICT uses reduction of path flows , effective communication quick medical assistance, and quick response with changing number of patients with dependent variable performance of healthcare. Dependent variable was treated as binary response which measure whether the patients satisfied or not satisfied. In this case dummy variable was formulated indicating that 1=satisfied and 0= not satisfied Before running the binary logistic regression analysis model the researcher tested the assumptions of multicollinearity outlier and influential cases in order to avoid the violation of assumptions. Mathematically the binary logistic regression models are as follows:-

Logit $Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \varepsilon$

Whereby;

Logit Y = is a probability of patients satisfaction ranging from 0 to 1 (0=not satisfied, 1= satisfied)

α = is the constant figure estimated in the regression model

β_1, β_2, β_3, β_4, β_5, β_6, β_7, and β_8 coefficient of independent variables showing its effect on the dependent variable
E is the estimated error in the model.

X_1= Treatment conducted at reasonable time
X_2= Waiting for registration
X_3= Time to contact medical personnel
X_4= ICT uses
X_5= Reduction of path flow
X_6= Effective communication
X_7= Quick medical assistance
X_8= Quick response with changing number of patients

3.0 RESULTS AND DISCUSSION

3.1 Testing binary logistic regression assumption

As advised by many literatures that before running regression model there must be checking of the fundamental assumptions of binary logistic regression model (Pallant, 2011). The following are the fundamental assumptions of binary logistic regression model which were checked by the researcher

3.1.1 Multicollinearity

In order to test this assumption the researcher looked at two aspects, first is to test the predictors if they are not highly correlated by looking on correlation table. As (Abbasi, 2011) argue that, the aim of multicollinearity test is to ensure that the independent variables are weakly related to each other (r <0.90). Correlation which is beyond 0.9 (r=9 and above) it indicate that there is problem on independent variables to predict the dependent variable; it is required to remove one independent variable. From the correlation matrix as indicated in table 1 the highest correlation of this data is r=0.642 which is below 0.9 which indicates that the correlation was very small among the variables which imply that there is no Multicollinearity exist.

Table 1: correlation matrix

	Constant	Treatment conducted at reasonable time	Minimal time to contact	Waiting time for registration	ICT uses	Reduction of path flow	Effective communication	Quick response with change number of patients	Quick medical assistance
Constant	1.000	-.301	-.157	.093	-.277	.110	.066	.069	-.351
Treatment conducted at reasonable time	-.301	1.000	-.594	-.347	.073	-.053	-.204	-.064	.045
Minimal time to contact	-.157	-.594	1.000	-.120	.017	-.052	.064	-.051	-.047
Waiting time for registration	.093	-.347	-.120	1.000	-.260	.065	.030	.179	-.218
ICT uses	-.277	.073	.017	-.260	1.000	.642	-.283	-.262	.286
Reduction of path flow	.110	-.053	-.052	.065	.642	1.000	-.231	.186	-.225
Effective communication	.066	-.204	.064	.030	-.283	-.231	1.000	.004	-.118
Quick response with	.069	-.064	-.051	.179	-.262	.186	.004	1.000	-.635

change number of patients									
Quick medical assistance	-.351	.045	-.047	-.218	.286	-.225	-.118	-.635	1.000

Research findings, (2018)

3.1.2 Outlier and influential case

Cook measure were used to measure the influential cases of this study. As indicated in SPSS the cook measure value was less than 1.0 which implying that there is no influential cases in the research data. Moreover the outlier in this was tested by using standardized residuals performed in the SPSS and the results show that all the standardized residual values was less than -3 and 3. (Anderson, 1982)indicates that in order the data to be free from outliers it requires the standardized residual to be within -3 and 3**.**

3.1.3 Evaluating of the model

The goodness fit of the model was shown by looking omnibus test of model coefficients in table 2 which show all predictors in the model explain a significant amount of the original variability with X^2 (8) of 24.517 and significant at p value less than 5% (p<0.05), which implies that the model fitted the data well. Another measure which are used to test the goodness fit of the model was Hosmer and Lemeshow test, in table 4.16 all predictors in the model produced X^2 (8) of 4.166 which was not significant because p value is greater than 5% (P=0.842) which implies that, there is good fit of the data into the model. (Pallant, 2011) indicating that for Hosmer and Lemeshow test a significance value less than 0.05 show poor fit of the data in the model.

Moreover the usefulness of the model was shown by looking Nagelkerke R^2 and Cox and Snell R square. In this study the Cox and Snell R square value are 0.155 and Nagelkerke R^2 0.240 implying that independent variable in the model explain 15.5% and 24% variance in dependent variable (patients satisfaction). So that the amount of Cox and Snell R square and Nagelkerke R^2 (Pseudo R^2) show the amount of variation explained in the model.

Table 2: Omnibus tests of model coefficients and Hosmer and Lemeshow test

		Chi-square	Df	Sig.
Step 1	Step	24.517	8	.002
	Block	24.517	8	.002
	Model	24.517	8	.002

Hosmer and Lemeshow test		
Chi-square	Df	Sig
4.166	8	.842

Research findings, (2018)

3.2 Binary logistic regression results analysis of agile supply chain practices on patient's satisfaction.

Table 3 presents the results of binary logistic regression analysis model between performance of healthcare as dependent variable with the independent variables; treatment conducted at reasonable time, waiting for registration, time to contact with medical personnel, ICT uses reduction of path flows , effective communication quick medical assistance, and quick response with changing number of patients.

The results show that treatment conducted at reasonable time has positive significant with the performance of healthcare in terms of patients satisfaction because p value is less than 5% (p<0.05) and beta value was 0.721. Implying that the unit change in treatment conducted at reasonable time will increase 72% of patient's satisfaction. These results supported the study done by Anderson, Camacho, and Balkrishnan (2007) which found that waiting time in hospital is a major contributor towards patients satisfaction and dissatisfaction, the study indicated that the presence of long waiting time of treatment leads to decrease of the hope of patients to improve their health while short waiting time encourages more hope to the patients to improve their health hence satisfied.

The coefficient of waiting time for registration was positively (0.725) related to patients satisfaction and significant because p value is less than 5% (p <0.05), also it indicates that the unit improvement of waiting for registration will result into the 72.5% increase of patients satisfaction. This implies that the patients spend a lot of time in registration or on reception point before receiving treatment which causes the whole process of receiving treatment to be for long waiting time. This supported the study by Chiu, Tsai, Chang, Koh, & Lin, (2007) who found that the time which the patients spent on registration before receiving treatment as impact to the patients towards staying in hospital for a long time. Moreover minimal time conduct of medical personnel

has negative significant relationship with patients satisfaction because of having the beta value of -0.99 and p value of greater than 5% (p >0.05).

Also the coefficient of ICT uses in healthcare operations was positively 0.835 related to patients satisfaction and significant because the p value is less than 5% (p<0.05), suggesting that the unit increase of ICT uses in healthcare operations will increase 83.5% of patients satisfaction. The findings are consistent with the study done by Lee, and Schniederjans (2011) which indicates that the smooth healthcare operation towards achieving better performance such as reduction of waiting time was influenced by using information technology (IT) in daily operation of healthcare. Also the findings was aligned with the study done by Ruxwana, Herselman, and Conradie (2010) which indicates that ICT application as e-health contributes towards the performance of hospital. On other hand the findings indicated that there is positive significant relationship between reduction of path flow and patients satisfaction as coefficient beta value was positive 0.790 and significant at p values is less than 5% (p<0,05), which indicates that the patients satisfaction will increase by 79% through the increase unit of reduction of paths flow. These findings supported by the study of de Vries and Huijsman (2011) which indicates that reduction of procedures to be followed by patients when securing treatment in healthcare increases the rate of patient's satisfaction through reducing time for stay in hospitals.

Furthermore the coefficient of effective communication was negatively 0.233 related to performance of healthcare and statistically not significant because the p value is greater than 5% (p > 0.05), indicating that the performance of healthcare will decrease by 23.3% through the increase of unit of response to the emergency patients. These findings were contrary to the study of Aronsson et al. (2011) which indicates that the smooth communication and better flow of information in healthcare from workers to patients influences the high rate of patient's satisfaction. The alternative hypothesis was rejected and null hypothesis was accepted due to the negative contribution of response to emergency patients towards performance of healthcare.

Concerning quick medical assistance, the coefficient beta was positively 0.814 related to patients satisfaction and statistically significantly at p value was less than 5% (p<0.05), suggesting that the increase of unit of quick medical assistance will increase 81.4% of patients satisfaction. The alternative hypothesis was accepted because the findings indicate the positive relationship between quick medical assistance and performance of healthcare in terms of patient's satisfaction. The findings were consistent with that study done by Van der Geer, Van Tuijl and Rutte (2009) which indicates that responsiveness to the patients in terms of medical assistance contribute towards the patient's satisfaction, hence the hospitals performance will increase due to the goodwill spoken by the patients after receiving the hospital treatment. Also the findings indicate that there was negative relationship between quick response with change number of patients and performance of healthcare as coefficient beta value was negative 0.346 and not statistically significant because p value is greater than 0.05 indicating that the performance of healthcare will decrease by 34.6% through increasing the unit of change of number of patient within time frame. The null hypothesis was accepted because the findings show negative contribution of quick response with change number of patients towards performance of healthcare.

Table 3: Effects of agile supply chain practices on patient's satisfaction

	B	S.E.	Wald	Sig.
Treatment conducted at reasonable time	.724	.428	6.264	.012***
Minimal time to contact	-.993	.398	.062	.804**NS**
Waiting time for registration	.725	.292	6.149	.013***
ICT uses	.835	.355	5.531	.019***
Reduction of path flow	.790	.344	5.261	.022***
Effective communication	-.233	.272	.734	.392**NS**
Quick response with change number of patients	-.346	.254	1.855	.173**NS**
Quick medical assistance	.814	.346	5.555	.018***
Constant	3.693	1.048	12.409	.000
Chi-square	24.517			
Hosmer & Lemeshow X^2	4.166(8) (P=0.842)			
Cox & Snell R^2	0.155			
Nagelkerke R^2	0.240			

Dependent variable; patients satisfaction (Dummy variable, 1=satisfied and 0 = Not satisfied)
*** denote the significance level at 5% and NS denote not significant

4.0 CONCLUSION AND RECOMMENDATIONS
The main objective of the study is to assess agile supply chain practices on performance of health care industry in Dodoma, Tanzania. In order to achieve this objective the Binary logistic regression model were used to assess the agile supply chain practices in terms of reasonable time, minimal time to contact medical personnel, waiting time for registration, ICT uses, reduction of path flows, effective communication, quick response with change number of patients, and quick medical assistance included in the model as independent variables while patients satisfaction represent dependent variable. The study concludes that healthcare organization practicing agile supply chain in their operations is much better towards patient's satisfactions. The findings indicate that treatment conducted at reasonable time, waiting time for registration, ICT uses in healthcare operations, reduction of path flows and quick medical assistance have shown significant contribution on patient's satisfactions. Generally the study concludes that agile supply chain practices improves performance of healthcare organization through patient's satisfactions.

4.1 Recommendations

Basing on the study findings, the following are the recommendations which the researcher managed to formulate.

The government must ensure there is adequate number of doctors, nurses, laboratory technicians and pharmacists through frequent employment in public hospitals in order to make the public hospitals to have adequate numbers of treatment providers. Through having adequate number of treatment providers will enable to have reasonable ratio of balance between patients entering in secure treatment and treatment providers which will enhance the efficiency and effectiveness operations of hospitals. Agile supply chain practices it requires the organization to have adequate number of workers in order to smoothen the operations.

The hospitals must make sure that they have adequate facilities such as equipment's and buildings in order to accommodate the large number of patients who enter to secure treatment within appropriate time frame. Because the agile supply chains requires the organization to meet any changes of demand very quickly and efficiently, so that having resources will enable the organization to meet all changes of number of patients entering into the hospitals at required time frame

Also the hospitals through management should encourage or motivate the employees to work hard and efficiently in order to reduce numbers of claims like lead time or delaying of treatment. So that the management should motivates workers through incentives, extra duty allowances and good environment to work. Hence the motivation to workers will encourage the employees to use much of their efforts in provision of treatment to the patients which leads to high responsiveness

The policy maker of the healthcare industry should make sure that, they develop good policy which emphasizes much on the issue of responsiveness in healthcare industry in order to ensure the concepts of agility is properly applied in healthcare operations.

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