

The mediation effect of total quality management on the relationship between master production scheduling and blood transfusion sustainability in Uganda

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ABSTRACT

This paper seeks to examine the relationship between determinants of blood transfusion sustainability (BTS) that is master production scheduling (MPS) and total quality management (TQM) of Uganda. The study was founded on four objectives. The study looked at the direct relationship between MPS and the BTS, direct relationship between MPS and TQM, direct relationship between TQM and BTS. It also assessed how TQM mediated the direct relationship between MPS and BTS. The study used a quantitative method. A survey questionnaire was administered to collect data from 367 staff of regional blood banks and government university teaching hospital blood banks; and 213 were found to be usable. The main analysis was done using structural equation modeling. The study found that MPS had a positive and significant relationship with the BTS. The study found that the relationship between MPS and TQM was positive and significant. The study also found that the relationship between TQM and BTS was positive and significant. The study concluded that the effect of MPS on BTS was not mediated by TQM. It was recommended that blood banks seeking to achieve transfusion sustainability must invest in understanding the sector in which they operate. This includes understanding the blood demand requirement, customer focus, people involvement and timely delivery. The various stakeholders in the blood supply chain i.e. blood banks, hospital blood banks, funding agents, ministry of health, must also integrate to enhance the transfusion sustainability. Blood banks performance measures essentially timely delivery was very critical for saving lives of patients in need of blood. The study has provided a new conceptual framework that investigates the TQM mediating effect on the relationship of MPS and BTS, and thus can serve as an incentive for more research to be conducted in this regard in blood banks of different developing countries. The authors also proposed identifying the effect of other TQM factors such as process management, system management, supplier relationship and top management on BTS.

1. Introduction

Pirabán et al. (2019) informed that blood supply and demand was stochastic and prospective donors must meet some requirements to be eligible to donate. Fathian (2019) mentioned that blood supply chain (BSC) stakeholder coordination improved blood transfusion services. Blood transfusion is necessary in addressing any blood shortages, illnesses and disorders in the human body (Lestari et al., 2017; Seed et al., 2018). As such, sustainable blood transfusion remains crucial in extending and improving life for many patients (Mulcahy et al., 2017; Kruk et al., 2018). Developing countries using voluntary non-remunerated donors (VNRDs) are encouraged to pursue strategies that focus on safety, full range, timely delivery and hospital best

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use of blood products (Kajja, 2013; Jenny et al., 2017; Williamson & Devine, 2013). Safe, adequate and timely blood products are essential for both non-emergent and emergent healthcare for and during transfusion (Checkley et al., 2019; Thomas et al., 2017). However, globally blood supply and quality complaints continue to dominate scholarly works (Dixon-Woods, 2019; Yates et al., 2017; Shaer et al., 2017; Heffernan et al., 2019). In Sub-Saharan Africa, lack of safe and adequate blood products leads to about 300,000 pregnant women and 3m children below the age of 5 years dying annually (Checkley et al., 2019). Blood banks have the fundamental responsibility of ensuring transfusion sustainability in a nation while using VNRDs (Achor & Holy 2016), and the collected blood tested for the transfusion transmission infections (TTIs) (Kyeyune-Byabazaire & Hume, 2019). Pitocco and Sexton (2005) recommended efficient programs such as master production scheduling (MPS), total quality management (TQM) and blood transfusion sustainability (BTS) would help alleviate the nation's persistent blood safety and adequacy problem. This approach can assist blood banks in enhancing the overall performance, resolving problems and creating new abilities to match blood supply to demand. To ensure that a firm uses the appropriate approaches, it must organize its programs to achieve a sustainable performance. Therefore, blood banks must focus on MPS, TQM and BTS programs to accomplish their objectives. Hosseinfard and Abbasi (2018) mentioned numerous tools and programs which can help blood banks respond to demand changes and save lives of patients in need of blood. Blood banks need to understand how MPS could affect BTS (Alfonso & Xiaolan, 2015; Jonsson & Kjellsdotter, 2015; Dutta, 2019; Hosseinfard & Abbasi, 2018; Filho et al., 2013). Blood banks are expected to adapt to the environment and find unique avenues to optimize use of blood products and services (Mulcahy et al., 2017; Sibinga, 2017; Barro et al., 2018; WHO, 2011; Bloch et al., 2020). To improve the results of their businesses, managers have dedicated themselves to identifying program factors that influence performance and how to use them. Thus, this study seeks to discover the connection between MPS and BTS through TQM of Uganda. The conceptual framework of the study based on literature review is presented in Figure 1. Review of the literature reveals that no study has investigated more than one variable as predictors of BTS.

2. Literature Review

2.1 Master Production Scheduling (MPS)

MPS is an adaptive rolling medium term strategy (3-18 months) used to match supply to demand of specific final products at minimum cost (Kohne et al., 2016; Jonsson & Kjellsdotter Ivert, 2015). Osorio et al. (2015) informed that more than a hundred different products can be derived from donated blood. Jonsson and Kjellsdotter Ivert (2015) mentioned that partner collaboration supported MPS, and increased organization response to environmental changes. Chaimae and Adil (2020) established that scheduling and planning of blood collection activities was one of the most important problems at the operational and tactical strategic levels, and has not been widely investigated. Alfonso and Xiaolan (2015) found that effective demand and capacity planning increased BTS and BSC system resiliency. Hosseinfard and Abbasi (2018) study in Australia found that centralization of hospitals blood stock, limiting the number of hospitals that held blood stock, and aggregating hospitals blood demand increased transfusion sustainability. Pirabán et al. (2019) established that only 32% of BSC published papers considered both supply and demand problems. Literature review showed that MPS and descriptive research are minimally applied in blood transfusion, more so in Africa and Uganda. This study considered MPS blood requirements of supply, demand and perishability for national transfusion services to test the suggested research hypotheses.

2.2 Total Quality Management (TQM)

TQM practices are the most applicable management philosophy used in enhancing the performance of firms (Shafiq et al., 2019; Nivasini, 2020; Sahoo & Yadav, 2018; Silva et al., 2014). TQM practices in a dynamic manufacturing environment strengthened performance for firms providing a large product range (Phan et al., 2019). Aquilani et al. (2016) mentioned that quality, value co-creation and sustainability should be achieved together. Marufu et al. (2014) found that TQM practices had a positive impact of improving clinical laboratory services efficiency in Zimbabwe. Alharbi et al. (2016) study of Saudi Arabia hotels determined a positive and significant relationship between TQM practices and organizational sustainability. TQM practices implementation substantially enhanced business improvement and sustainability (Sadikoglu & Olcay, 2014; Pradesh, 2017; Marufu et al., 2014; Sweis et al., 2019; Alharbi et al., 2016). Prajogo and Sohal (2006) determined that TQM practices partially mediated the relationship between differentiation strategy and performance improvement for manufacturing firms in Australia. Ezeani and Ibijola (2017) study in Nigerian manufacturing firms emphasized achievement of excellence with focus on people, processes and customer perspectives; the same study stated that inadequate resources affected sustainability of TQM practices. TQM publications in blood transfusion services in Africa and Uganda are few and descriptive research was minimally applied. This study considered customer focus, employee involvement and continuous improvement the least researched TQM practices in blood transfusion services to test the suggested research hypotheses.

2.2.1 Customer Focus

Customer focus is the core TQM practice because quality effort starts and ends with the customer (Chang, 2008). TQM practices implementation substantially increased customer satisfaction and resulted in enhanced business improvement and sustainability (Sadikoglu & Olcay, 2014; Pradesh, 2017; Marufu et al., 2014; Sweis et al., 2019).

2.2.2 People Involvement

To benefit from TQM practices, people involvement, top management commitment, and supplier management must be part of organization culture (Simani et al., 2017). Sadikoglu and Olcay (2014) found that lack of employee involvement affected organizational performance in Turkish firms. Performance improvement in BSC would be achieved if all cold chain staff ensured minimal wastage and are aware of their responsibilities (WHO, 2002). Yates, et al. (2014) found that managerial changes and training had a significant impact on performance of the entire BSC. Pimenta et al. (2014) established that cross-functional teams had a significant direct and indirect impact on supply chain management (SCM) performance in Brazilian manufacturing firms. Employee involvement improved organization performance and formed the cornerstone of TQM in a Chinese firm (Chiu & Chiu, 2006). Lack of employee involvement was identified as a major reason for the non-sustainability of TQM practices in Australia (Welikala & Sohal, 2008). Alcudia and Virginia (2015) established that TQM practices facilitated organization recognition, legitimacy and international competitiveness for Mexico hotels.

2.2.3 Continuous Improvement

TQM practices continuous improvement factors enhance organization sustainable performance (Ezeani, & Ibijola, 2017; Prado-Prado, 2009). Ibrahim (2013) suggested that all stakeholders in the supply chain should participate in continued improvement activities. Automation of BSC processes and systems seem to be effective in improving productivity and promoting donor and patient safety (Hazzazi et al., 2014; Sano, Kajihara, 2017). Despite the TQM continuous improvement advantages, there is minimal related research in blood transfusion services in Africa and Uganda in particular.

2.3. Blood Transfusion Sustainability (BTS)

Researchers have recommended that all national BSC critical activities should be coordinated in order to achieve transfusion sustainability (Sibinga, 2017; Barro et al., 2018; WHO, 2011). Dhabangi et al. (2020) mentioned that leukocyte reduction improved blood transfusion safety. Studies by (Cap et al., 2018; Uyoga & Maitland, 2019) found that blood safety and sustainability were global issues and using separated blood for specific patient needs supported transfusion sustainability; and that resource constrained countries preferred unseparated blood. Thomas et al. (2017) advised that timely and safe blood units were essential during transfusion in Kenya county hospitals. Pirabán et al. (2019) informed that replenishment stock levels, assigned inventory and simple perishable inventory management practices improved timely delivery of blood units. Kyeyune-Byabazaire and Hume (2019) mentioned that lack of proper coordination between blood banks and hospital blood banks affected timely delivery of blood units in Uganda. Premised on the findings and results of earlier studies and suggested criteria, the present study uses three indicators, safety level, full range and timely delivery, to measure the BTS of Uganda.

3. Developing Hypotheses and Conceptual Framework

3.1 Master Production Scheduling and Blood Transfusion Sustainability

Alfonso and Xiaolan (2015) found that effective MPS requirements (demand and supply) increased BTS. Studies by (Osorio et al., 2015; Jonsson & Kjellsdotter Ivert, 2015) documented that MPS influenced organization successful outcomes. Mansur et al. (2019) used MPS to map Indonesia blood bank problems and improvement opportunities. The researchers find that there is a positive link between MPS and BTS. Jonsson and Kjellsdotter Ivert (2015) mentioned that partner collaboration supported MPS, and increased organization response to environmental changes. Filho et al. (2013) confirmed that aggregating blood demand forecasts increased sustainability and resilience of transfusion services. The above discussion clearly shows that there is a relationship between MPS and BTS. Therefore, the following hypothesis was proposed.

H₀₁: *Master production scheduling has a positive effect on blood transfusion sustainability.*

3.2 Master Production Scheduling and TQM Practices

Synergy of TQM practices continuously improve organization performance metrics for sustainable growth in a changing environment (Sayeda et al., 2010; Shafiq et al., 2019; Nivasini, 2020; Sahoo & Yadav, 2018; Zehir et al., 2012). TQM practices in a dynamic manufacturing environment strengthened performance for firms providing a large product range (Phan et al., 2019). Although some of the previous studies focused on TQM practices, these studies were not able to give a comprehensive answer to the question of how MPS impact TQM practices. Thus, this study will attempt to bridge this gap by linking MPS with TQM practices. The present study hopes to make a vital contribution to the MPS literature by scrutinizing the relationship between MPS and TQM practices of blood banks, and providing a deeper understanding of how MPS is able to impact TQM practices. Therefore, the author proposed the following hypothesis:

H₀₂: *Master production scheduling has a positive effect on total quality management practices.*

3.3 TQM Practices and Blood Transfusion Sustainability

Numerous studies have shown that it was possible for organizations to adopt TQM practices with a fairly high degree of success (Sayeda et al., 2010; Shafiq et al., 2019; Nivasini, 2020; Sahoo & Yadav, 2018; Zehir et al., 2012). Sahoo and Yadav (2018) study of small and medium enterprises in India established that TQM practices were positively related to manufacturing performance for sustainable productive growth. Nivasini (2020) informed that TQM practices promote corporate sustainability. The preceding discussion has shown that previous studies support the relationship between TQM practices and organization performance and sustainability. However, very little empirical studies on blood banks have been carried out in Africa and Uganda in particular. Hence, there is an urgent need to examine TQM practices in this context. Therefore, the author put forward the following hypothesis.

H₀₃: Total quality management practices have positive effect on blood transfusion sustainability.

3.4 Master Production Scheduling, TQM Practices, and Blood Transfusion Sustainability

Research on MPS carried out in the recent past was not able to provide insights as to how BTS is influenced by MPS through TQM. Studies by (Osorio et al., 2015, Jonsson & Kjellsdotter Ivert, 2015) informed that MPS has a substantial and beneficial effect on BTS. A review of the literature by (Marufu et al., 2014) confirmed that there was a beneficial effect of TQM on BTS. Studies by (Kohneh et al., 2016; Jonsson & Kjellsdotter Ivert, 2015; Mansur et al., 2019) reported a beneficial effect of MPS on organization outcome performance. Thus, TQM practices may also play an indirect significant role in enhancing BTS. In this context, MPS and TQM practices are complementary programs (Laaksonen & Peltoniemi, 2018). Few studies have examined the combined impact of MPS and TQM on the BTS. Aquilani et al. (2016) mentioned that quality planning, implementation and sustainability should be achieved together. Therefore, the effects of MPS on TQM practices could result in better BTS. Many studies have shown that the mediating role of TQM practices can affect organizational performance (Prajogo & Sohal, 2006; Simani et al., 2017). To the knowledge of the researcher, very few studies have examined the combined impact of MPS and TQM practices on the blood bank performance. In the light of the disparity in current knowledge, this research seeks to fill the gap by studying MPS and BTS in the hope of mediating them with TQM practices, thereby obtaining a better comprehension of the relationship between MPS and BTS. This has led to the following hypothesis.

H₀₄: Total quality management practices mediate the relationship between master production scheduling and blood transfusion sustainability.

The findings of related previous literature are used to develop a conceptual framework that is underpinned by the dynamic capability theory. Hence, the proposed model shows the relationship between the three variables and their impact on blood banks in Uganda. These variables are categorized as: (1) independent variable: master production scheduling blood requirements; (2) dependent variable: blood transfusion sustainability; (3) mediation variable: TQM practices (Fig. 1).

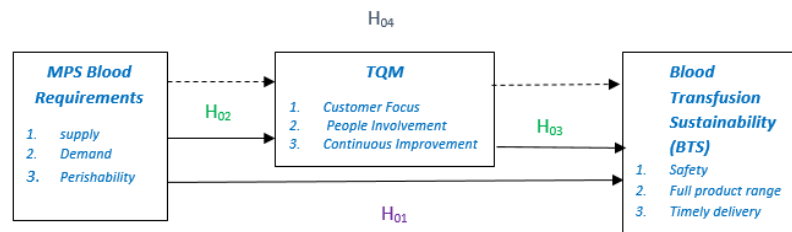


Fig. 1. Conceptual framework

4. Methodology

The current study adopted a descriptive cross sectional survey research design. This is because the study adopted a self-administered questionnaire as the data collection instrument. Again, the study adopted this research design because the study intended to examine the opinion of respondents on the relationship between MPS and BTS through TQM. In addition, this research design permits the collection and analysis of quantitative data using descriptive and inferential statistics. The target population of this research was the cold chain staff from regional blood banks and transfusing staff in government university teaching hospital blood banks, and the respondents were selected using a simple random sampling method. The questionnaire was distributed to 367 respondents and a total of 213 usable questionnaires were found to be usable. The study used three major variables for the study, that is MPS, TQM and BTS. BTS was represented by three dimensions: safety level, full range and timely delivery. MPS was based on three dimensions (supply, demand and perishability) and BP was also based on three dimensions: blood collection, blood testing and processing and blood stock management. All items for the variables were measured using a Five-Point Likert Scale which ranged from strongly disagree (1) to strongly agree (5). TQM practices items used were adapted from questionnaires of (Attakora et al., 2014; Kuo, 2016; Sadikoglu & Olcay, 2014; Rahul, Kothari, Dighe,

& Patel, 2019; Kanagasabai et al., 2018). Items used to measure MPS were adapted from the questions designed by (Hosseinifard & Abbasi, 2018; Mansur et al., 2019). Mulcahy et al. (2017) suggested criteria was used to develop BTS questionnaire items. MPS was measured using a two-item scale. TQM was measured using a four-item scale. Finally, a three-item scale was used to measure BTS. Preliminary data analysis was done using SPSS in order to address the problems of missing values, outliers and non-normality of the data. The main analysis was done using SPSS AMOS23. Assessment of the measurement model was made by considering reliability and validity values while the hypotheses were tested using bootstrapping methods to assess the significance of the claimed relationships.

5. Results and Findings

The study used SPSS AMOS23 to test the results of the hypotheses. The first step in structural equation modeling is to evaluate the measurement model. Fig. 2 presents the measurement model along with the item loadings.

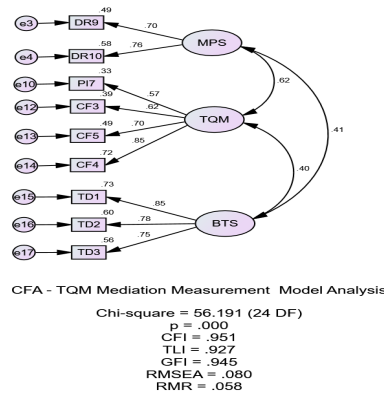


Fig. 2. CFA-TQM mediation measurement model analysis (Factor loadings)

5.1 Measurement Model Assessment

SEM was implemented to examine the validity of the constructs. Results show two types of validity: convergent and discriminant. Both validity analyses are discussed below.

5.2 Confirmatory Factor Analysis

The factor loadings were verified using Cronbach’s Alpha, Composite reliability and Average Variance Extracted. According to (Hair et al., 2014) the threshold for convergent validity measure is a standardized factor loading greater than 0.5 for each item indicating the measurement items significantly defined the proposed latent variables; the values for composite reliability should be greater than 0.7 for all the items at a 5% level of significance and the value for alpha should be greater than 0.7 indicating high internal consistency among the measurement variables. However, one can accept AVE \geq 0.4 (Fornell & Larcker, 1981) when the CR is above 0.6. All the values met the initial criteria and thus convergent validity was ensured; Table 1. As per model fit indices, CMIN/DF was 2.341, GFI was 0.945, CFI was 0.951, TLI was 0.927, RMSEA was 0.080, and SRMR was 0.061. The model fit verification was excellent on at least three measures which is a reasonable effect for analysis (Hair, et al, 2010). Figure 2, presents the diagrammatic presentation of the CFA output.

Table 1
 Loadings, Cronbach alpha, reliability and convergent validity-TQM mediation measurement model

Items	Loadings	Alpha	Composite Reliability (CR)	Average Variance Extracted (AVE)
Master Production Scheduling (MPS)		0.690	0.694	0.531
DR9	0.696			
DR10	0.760			
Blood Transfusion Sustainability (BTS)		0.775	0.784	0.481
TD1	0.854			
TD2	0.776			
TD3	0.748			
Total Quality Management (TQM)		0.830	0.836	0.630
CF3	0.622			
CF4	0.849			
CF5	0.700			
PI7	0.572			

5.3 Discriminant Validity

The study assessed discriminant validity by measuring the heterotrait – monotrait (HTMT) ratio to the respective correlation coefficients. To achieve discriminant validity, the ratios should be less than 0.85 (Henseler et al., 2015), as was the case in Table 2. Hence, the discriminant validity of the construct is assured.

Table 2
Heterotrait-Monotrait ratio

	BTS	TQM	MPS
BTS			
TQM	0.765		
MPS	0.776	0.794	

Another concern in model estimation is multicollinearity, that is, high correlation among two predicting variables. Coefficients of 0.8 are usually considered as high, which may cause a confounding effect in the model estimation. The highest coefficient score of 0.62, however, indicates multicollinearity was not a challenge to the reliability of the model estimated. Therefore, the data was valid for model estimation.

5.4 Structure Equation Modelling

After the reliability and validity checks, the main model was estimated using the SEM approach in Amos. Tables 3, 4 and figure 3 presents the results of the model estimation. The estimation was based on Bootstrap Bias-Corrected confidence interval at 95%, with 5000 bootstrap samples. Results show the direct (table 3) and indirect effects (table 4). The direct effects are used to test the direct hypotheses while the indirect effect was used to test the mediation hypothesis (Hair, Black, Babin, 2010).

5.5 Path Model (Bootstrapping Results)

Table 3
Direct effect (Hypotheses 1 to 3)

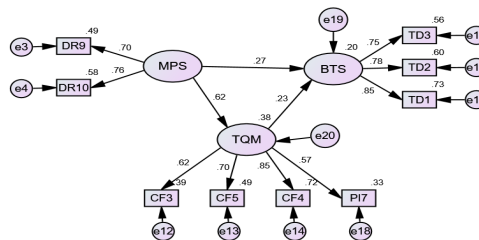
Hypothesis	Relationship	Std β	S.E	CR	P value	Remark
H ₀₂	MPS → TQM	0.616	0.146	6.032	0.000	Supported
H ₀₁	MPS → BTS	0.271	0.175	2.200	0.028	Supported
H ₀₃	TQM → BTS	0.229	0.112	2.039	0.041	Supported

The results of Table 3 show a positive and significant relationship between MPS and TQM ($\beta = 0.616, p < 0.001$), supporting H₀₂. The relationship between MPS and BTS was positive and significant ($\beta = 0.271, p = 0.028$), supporting H₀₁; while the relationship between TQM and BTS was positive and significant ($\beta = 0.229, p = 0.041$), supporting H₀₃. Hence, hypothesis H₀₁, H₀₂ and H₀₃ are supported Fig. 3 shows the path coefficients.

Table 4
Indirect effect/mediation (Hypothesis H₀₄)

Hypothesis	Relationship	Std β	SE	CR	Confidence Interval		p Value	Conclusion
					Lower Bound	Upper Bound		
H ₀₄	MPS → TQM → BTS	0.271	0.175	1.075	-0.027	0.324	0.085	H ₀₄ , No Mediation

The result for mediation shows that MPS has an insignificant indirect effect on BTS through the mediation of TQM. Hence, TQM has no mediating role between MPS and BTS ($\beta = 0.143, p = 0.085$). Hence, H₀₄ was not supported. However, the direct effect of MPS to BTS is positive and significant ($\beta = 0.271, p = 0.028$); an indication of no mediation. Therefore, TQM, has no mediation effect on the relationship between MPS and BTS.



CFA - TQM Mediation Structural Model Analysis

Fig. 3. Path model (Coefficients and model fit values)

6. Discussion

The first hypothesis (H_{01}) suggested the positive impact of MPS and BTS, and the results support the hypothesis. Alfonso and Xiaolan, (2015) found that effective MPS elements (demand and supply) increased BTS. The direct relationship of MPS with BTS have not yet been conclusively demonstrated. The current study has attempted to bridge the gap and have provided empirical evidence on MPS with BTS. Hence, the first hypothesis (H_{01}) of this study is well-substantiated by previous works. The second hypothesis (H_{02}) suggested the positive effect of MPS on TQM. Results of the data analysis reveal that MPS had a positive significant influence on TQM. The outcomes of this study were congruent with those obtained by (Alfonso and Xiaolan, 2015; Phan, Nguyen, Nguyen, & Matsui, 2019). Alfonso and Xiaolan (2015) found that effective demand and capacity planning increased BSC system resiliency. Phan et al., (2019) found that TQM practices in a dynamic manufacturing environment strengthened performance for firms providing a large product range. Hence, the second hypothesis (H_{02}) of this study is well-substantiated by previous works. The third hypothesis (H_{03}) proposed a positive effect of TQM on BTS, and the study has demonstrated a positive and significant relationship between the two variables. However, in none related studies (Nivasini, 2020) found that TQM practices promote corporate sustainability and (Sahoo & Yadav, 2018) in a different study found that TQM is positively related to manufacturing performance. Hence, H_{03} is in agreement with the existing literature. The fourth hypothesis (H_{04}) suggested the mediating role of TQM and results indicate a no mediating role of TQM between MPS and BTS at 95% confidence interval. The suggestion was based on non-related studies that TQM partially mediated the relationship between strategy and performance improvement for manufacturing firms (Prajogo & Sohal, 2006; Simani et al., 2017). The current study has empirically demonstrated the no mediating role of TQM in the MPS relationship with BTS; and suggest a direct relationship between the two variables.

7. Conclusion

The study was founded on four main objectives. Firstly, the study looked at the direct relationship between MPS and the BTS. Secondly, the study assessed the relationship between MPS and TQM. Thirdly, it assessed the relationship between TQM and BTS. Lastly, the study assessed the mediating effect of TQM on the relationship between MPS and the BTS. The study concluded that MPS had a positive and insignificant effect on BTS, such that high levels of MPS blood demand requirement lead to higher BTS. Further, it was concluded that the effect of MPS on BTS was not mediated by TQM. Finally, the study concluded that the effect of MPS on TQM and effect of TQM on BTS was positive and significant.

As with other studies, the present study has made theoretical and empirical contributions to the existing body of knowledge. The study has provided a new conceptual framework that investigates the TQM mediating effect on the relationship of MPS and BTS. This effect has been demonstrated by the present study, and thus can serve as an incentive for more research to be conducted in this regard in blood banks of different developing countries. It was recommended that blood banks seeking to achieve BTS must invest in the MPS and TQM programs. This includes MPS blood demand requirement and TQM customer focus, people involvement, and continuous improvement. Furthermore, the findings of this study may be useful in helping blood banks, business owners, practitioners, and decision makers ensure a good organizational performance. Put simply, MPS and TQM can help blood banks in attaining BTS. Finally, the various national units of the blood supply chain must coordinate and collaborate to enhance smooth blood transfusion services.

Blood banks performance measures such as timely delivery is very critical for saving lives of patients in need of blood. Blood banks must also invest in process and system management, supplier relationship, and top management to help them achieve the safety levels and full range of blood products needed for transfusion.

8. Limitation of the Study and Future Research

This study has developed a model which focuses on the blood banks in Uganda, and therefore there is a need for future studies to examine the framework of this study in the context of other countries and in different industries, in order to be able to generalize the results. The authors also proposed identifying the effect of other TQM factors such as process management, system management, top management, and supplier relationship on BTS.

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