Buyer-supplier integration and logistics performance in healthcare facilities in Tanzania: the moderating effect of centralised decision control

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Abstract: This research concerns logistics performance in public purchasing relationships. It examines the effect of buyer-supplier integration on supplier logistics performance. Particularly focuses on purchasing centralisation in healthcare facilities, and examine whether centralisation of decision control exercised by the health authorities influence the effect of buyer-supplier integration on supplier logistics performance. A survey data of 164 informants from public health facilities in Tanzania was used for analysis. It reveals that buyer-supplier integration improves supplier logistics performance significantly and stronger purchasing centralisation reduces the effect of buyer-supplier integration on supplier logistics performance. It provides a broad and interesting focus on significant antecedents to supplier logistics performance. In the future, the government should focus more on supporting the individual public health facilities in developing and adapting proper governance mechanisms for supporting buyer-supplier integration. Further research in other empirical and cultural settings is desirable to test the external validity of these findings.

Keywords: supplier logistics performance; purchasing centralisation; supplier integration; Tanzania.

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1 Introduction

Today, extensive research has examined the link between supply chain integration (SCI) and performance, most scholars argues that integration improves performance (Mostaghel et al., 2015; Tsanos et al., 2014). According to the supply chain management literature SCI has two main dimensions 'internal and external' integration. In a buyer-supplier (B-S) relationship, achieving a high level of external integration with suppliers is a central issue of operations strategy (Koufteros et al., 2014; Flynn et al., 2010). However, it has been noted that, most of the companies are more comfortable with internal than external integration (Fawcett and Magnan, 2002). A limited progress made in implementing external integration has been noted, despite various efforts to encourage external integration with suppliers and customers (Richey et al., 2010). This study examines the link between B-S integration and supplier logistics performance in a healthcare setting. In the healthcare industry the role of external integration in the form of strategic alliances as a cost management model has also been acknowledged (Oumlil and Williams, 2010).

B-S integration includes interaction and collaboration between a buyer and its suppliers to ensure an effective flow of supplies. The resource-based view (RBV) theory holds B-S integration is a unique dyadic resource which synchronises the core logistics competencies and capabilities of all actors to jointly achieve improved logistics performance. However it has been noted that the proposed link between B-S integration and supplier logistic performance is not straight forward. While the majority of researchers assert that investing more in B-S integration should enhance logistic performance (Danese and Romano, 2013; Gimenez and Ventura, 2005; Stank et al., 1999), others like Das et al. (2006) are sceptical and suggest that this effect is rather modest. The observed inconsistencies in current research suggest that there are other factors influencing this association. Most of the studies have overlooked the context of a B-S exchange relationship. Gimenez et al. (2012) indicated that integration in B-S relations is only effective in yielding a higher level of performance under high supply complexity.

Other studies argued that the link between integration and performance is contingent on under contextual factors such as technological uncertainty, demand uncertainty (ibid),

supply network structure design (Danese and Romano, 2013) and supply chain dynamism (Lee et al., 2016).

This paper extends the discussion on the influence of context, and examines how the centralisation-decision control moderates the association between B-S integration and supplier logistics performance. This is also supported by the organisation theory which asserts that organisation structure is an important antecedent to organisational behaviour (Teixeira et al., 2012).

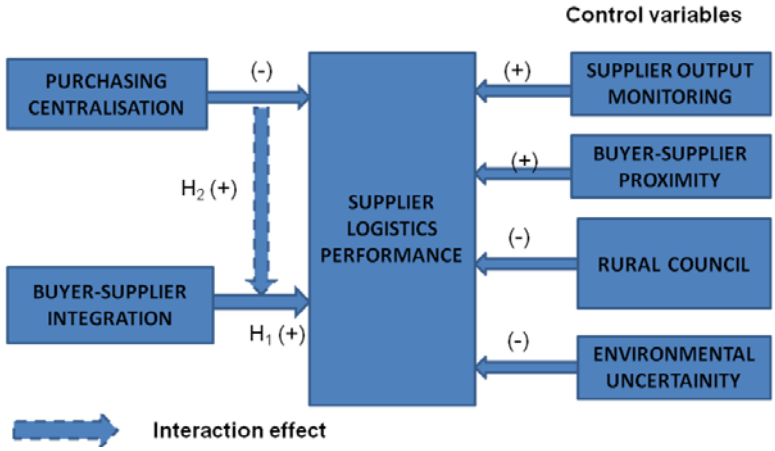
The existing literature provides evidence that structure of an organisation determines its performance. However, little attention has been paid on the performance impact of purchasing structure (Glock and Hochrein, 2011). In the purchasing organisation literature purchasing structure is considered a contextual factor (Glock and Hochrein, 2011) which plays a significant role improving supplier effectiveness in its logistical functions. Based on the purchasing organisation literature and previous contributions by Aiken and Hage (1971), this paper considers purchasing centralisation as a key moderator/contingent factor. It is believed that, substantial centralisation of decision control is negatively related to smooth organisational communication which is considered a key feature of organisational integration (ibid). Therefore this paper examines the role of purchasing centralisation as an organisational design factor that might influence the effect of B-S integration on supplier logistics performance.

Despite the importance of the association between organisation structure and integration, empirical evidence is missing on how these factors are related. Little work has been done in testing the effects of organisation structure on external relationships with suppliers and customers (Koufteros et al., 2014). It has also been noted that there is little discussion on the link between how purchasing is organised and inter organisational issues. Based on the observed gaps there are theoretical concerns as raised by Koufteros et al. (2014): is research application on organisational design theory waned? Do we still see value in organisational design theory?

Based on Vora's (1992) arguments, this paper posit that there is still value through integrating constructs and reasoning from basic organisational theory and other fields of inter-organisational theory into supply chain management research. Therefore this paper intend to introduce an empirical model which relates purchasing centralisation of decision making and B-S integration and examines the combined effects of these factors on supplier logistics performance.

Generally, this paper integrates contributions from several theoretical perspectives; the RBV theory of the firm, organisation design theory and the SCI literature: to examine the combined effects of purchasing centralisation and B-S integration on supplier logistics performance in a B-S exchange relationship. The supplier logistics performance model (Figure 1) also controls for environmental uncertainty (UNCERT), supplier's output monitoring (SUPPLMON), geographical location (rural/urban) (GEO), and distance between the sites of buyers and suppliers (PROX). The research model (Figure 1) depicts our research hypotheses and will be elaborated further in the next section.

Figure 1 Research model (see online version for colours)



2 Theoretical framework, research model and hypotheses

2.1. Theoretical contributions

This paper employed three theoretical perspectives:

1 RBV theory is used to explain the role for B-S integration

2 organisational design theory is applied to shed light on how purchasing centralisation influence the effects of B-S integration initiatives in a B-S relationships

3 the principal-agent theory will enlighten the problems of several principals influencing the decision making in public purchasing firms.

2.2 Purchasing centralisation (decision control) and the problem of several principals in B-S relationships

The principal-agency theory focuses on agency problems in bureaucratic organisations, and there are in particular two key elements of the P-A theory which are relevant for public institutions, and this concerns:

1 goal conflict between principals

2 information asymmetry (Waterman and Meier, 1998).

In the presence of goal conflicts between multiple principals and the agent, the agent tends to shirk responsibility or engage in non-sanctioned actions, while information asymmetry, on the other hand, allows agents to be less responsive to the principal and engaged in free riding behaviour.

The current study setting illustrates a situation with several principals, the buying healthcare facility that put emphasis on smooth supplier integration, and the public agencies that exercise bureaucratic control over the healthcare institutions. Such multiple governance structures enforce the organisation complexity because it is rather difficult for public bureaucracies, e.g., local government authorities (LGAs) and public health facilities to have compatible goals due to divergences in their decision focuses and responsibilities. In such a situation, the supplier becomes more uncertain about the priorities of goals and sub goals and such agency problems will also influence the behaviour of the suppliers of healthcare institutions. When a supplier (agent) is caught in a web of conflicting goals exposed by bureaucracies (LGAs) and the health facilities (the buyer), the supplier may not know the entity to respond to (Waterman and Meier, 1998), and the supplier will have an incentive to align with the principal who most closely reflects his/her basic interest.

Centralisation of decision control is associated to severe information asymmetry problems due to inefficiency patterns of communication (Sorte, 2013). It is expected to limit the actual buyer's (principal) ability to establish close contacts with the supplier (agent) due to the presence of a central administrative block between the two actors, and hence enforce the problems associated to the implementation of effective supplier coordination and the prospects of improved supplier logistics performance (Waterman and Meier, 1998).

Based on contributions from basic organisational design theory, it is expected that centralisation of buying firms' purchasing management will influence supplier logistics performance negatively. This problem concerns low collaborations between personnel (Bower, 1970) and restricted information gathering and dissemination which hinder smooth adaptability in the administration of logistics activities. It is expected that firms utilising a centralised structure will hinder the suppliers' visibility due to the limitations of a centralised structure with respect to inter-firm interactions and smooth information flows. On the other hand, a decentralised structure has been positively associated with technical and productive efficiency due to fewer decision levels (Saltman et al., 2003).

Taken together, the discussion above suggest that purchasing centralisation makes suppliers more unconscious of their responsibilities (Hambleton et al., 1996), and reduces the suppliers' flexibility and abilities for quick responses. In a healthcare setting this may explain why medicines are not delivered or transported the way they ought to be (Puri and Ranjan, 2012).

2.3 B-S integration and supplier logistics performance

B-S integration supports external routines and processes which collect accurate demand and supply information essential for the coordination of tasks between buyers and suppliers (Stank et al., 1999), and such coordination enables the supplier and the buyer to anticipate and coordinate inter-firm supplies more precisely (Flynn et al., 2010). In addition, B-S integration provides the supplier with more accurate local information about the customers for the purpose of improving the quality of problem-solving solutions (Flynn and Flynn, 1999). It is expected that B-S relationship developed out of their interaction and collaboration will ensure supply consistency and alignment (Loppacher et al., 2011).

The direct information flow is expected to assist the supplier in being more responsive in the performing of logistical services, such as inventory management, order

processing and transportation planning. These arguments have been supported by Daugherty et al. (2009) who suggest that superior logistics performance can only occur when both participants work closely together, and B-S integration is the main managerial mode for value creation in a B-S relationship because it facilitates a smooth information flow by the coaching and sharing of strategic knowledge (Hammervoll, 2012).

Based on this reasoning, we propose the following refutable research hypothesis.

H_1 There is a positive association between the extent of B-S integration and supplier logistics performance.

2.4 The combined effect of purchasing centralisation and B-S integration on supplier logistics performance

The coordination of the interdependent activities and functions between buyers and suppliers requires a substantial amount of information (Galbraith, 1977). Overall, B-S integration practices facilitate coordination through information exchange and joint or collective actions between the buyer and the supplier. However the inherent features of purchasing centralisation will reduce the effect of B-S integration on supplier logistics performance because centralisation limits the quality and outcomes of inter-firm collaboration (Bower, 1970).

Furthermore, a centralised structure might reduce an open an effective information gathering and information dissemination, and we will argue that purchasing centralisation will limit a smooth and open interaction and collaboration between the buyer and the supplier, and will hence distort and erode the information flow.

In a public health system, the lack of decision making authority at the health facility level will discourage proactive problem solving because the decision authority is not located and attached to the sources of local decision problems associated to local information exchange improvements or customised transportation solutions in a specific, local buyer-seller relationship.

Accordingly, we expect that some potential benefits of improved coordination and control at the micro level is likely to be suppressed or outweighed by more standardised and centralised, institutional policies (Koufteros et al., 2014). The current literature supports those arguments and provides some evidences showing that centralisation at the micro level has negative effects on external integration (Koufteros et al., 2014). This study extends this reasoning, and considers centralisation of decision control at the micro level to erode the potential effect of B-S integration on supplier logistics performance, and we propose the following refutable hypothesis:

H_2 The association between B-S integration and supplier logistics performance decreases as the extent of buying firm's purchasing centralisation increases.

3 Research methodology, measures and validity assessments

3.1 Empirical setting and data collection

In Tanzania, supply of essential medicines in public health facilities employs an indent system through which health facilities (dispensaries, health centres and hospitals) order quantities of each supply according to their needs and within their budget. The medical

supplies department (MSD) under the Ministry of Health and social welfare has been mandated to procure and supply medicines on behalf of the facilities. There are differences between hospitals and primary health facilities (health centres and dispensaries) in terms of ordering/purchasing procedures, which indicate that health centres and dispensaries ordering processes involve other decision makers at the district level, which may not always be the case for hospitals. However, the district medical officer (DMO) and regional medical office (RMO) still has some influence on hospitals especially district hospitals when it comes to decision making.

A survey was conducted in the public medicine supply system in Tanzania. The target population was all categories of public health facilities (hospitals, health centres and dispensaries). A stratified random sampling technique was used to select 215 public health facilities. The unit of analysis was a dyadic exchange relationship between a public health facility and its focal supplier (MSD). A questionnaire was developed and used to collect data, and all measures were adapted from previous studies in inter-organisational research. The construct items were measured by a seven point Likert scale. The original questionnaire was written in English, translated into Kiswahili, and then retranslated into English to ensure data quality.

A pilot study was then carried out in 35 public health facilities, and the obtained feedback was used to modify and develop the questionnaire wordings further. Data was collected by using key informants from the purchasing departments of the sampled health facilities in Tanzania.

The average work experience of the key informants was six years, which indicates that they had sufficient experience with respect to the purchasing practices and supplier evaluations. A total of 164 questionnaires were completed and provide a response rate of counts to 77%.

3.2 Measure development

In the following section, we describe the basic contents of the constructs appearing in our research model. Table 1 provides a detailed overview of the items composing our scales which were all adapted from previous research.

- *Supplier logistics performance (SUPPLPERF)*. Six items compose this scale. The construct captures how well the buying firm perceives the performance of their zonal medical supplier with respect to on time delivery; order filling capacity, lead time and accuracy in order delivery.
- *Purchasing centralisation (CENTRAL)*. This measure describes the extent of autonomy in purchasing decision making residing with the purchasing managers and is composed by four items.
- *B-S integration (SUPPLINT)*. This construct measures the extent of inter-firm coordination and collaboration between a public health facility and its focal supplier of essential medicines, and is measured by 6 items.
- *Supplier's output monitoring (SUPPLMON)*. This construct describes the verification of the delivery based on product quality, delivery timelines, and order accuracy and is composed by 5 items.

- *Environmental uncertainty (UNCERT)*. These items measure the level of unpredictability in the exchange environment of the health facility, and the scale is composed by four items.
- *Geographical location (GEO)*. This is a dummy variable that indicates the location of the public health facility in a rural (value1.00) or urban (0) council.
- *B-S proximity (PROX)*. This is a ratio scaled variable measuring the geographical distance, assessed by the number of days spent on transportation between the public health facility and its zonal medical supplier.

Table 1 Scales and reliability measures

Scales	*Sample of items – response format: seven-point Likert-type scale with end points inaccurate description and accurate description.*	
SUPPLPER (supplier logistic performance) six items $\alpha = 0.90$	SUPPLPERF 1:	We regularly experience on timely delivery of essential drugs from the MSD
	SUPPLPERF 2:	We always experience consistency on the MSD order fill capacity
	SUPPLPERF 3:	We regularly experience satisfactory lead time from the MSD
	SUPPLPERF 4:	We always experience satisfactory lead time on the back order delivery
	SUPPLPERF 5:	We always experience high accuracy on order delivery from the MSD
	SUPPLPERF 6:	We always experience complete order delivery from the MSD
SUPPLINT (B-S integration) six items $\alpha = 0.84$	SUPPLINT 1:	Our purchasing unit and the MSD always work together as a team to solve essential drug supply-related problems.
	SUPPLINT 2:	Our purchasing unit and the MSD always work together in following up of our essential drug orders sent
	SUPPLINT 3:	Our purchasing unit always collaborates closely with the MSD on quality control of delivered essential drugs
	SUPPLINT 4:	Our purchasing unit always collaborates closely with the MSD on quality control of delivered essential drugs
	SUPPLINT 5:	Our purchasing unit and the MSD have closely integrated the supply of essential drugs and other drugs in vertical programs
	SUPPLINT 6:	Our purchasing unit and the MSD always hold periodic meetings to plan for our drug supply. MM
CENTRAL (purchasing centralisation) four items $\alpha = 0.79$	CENTRAL 1:	All decisions on supplementary funding for drug purchasing have to be made by the regional or district government authority (DMO/RMO).
	CENTRAL 2:	All decisions on purchasing from other suppliers have to be made by the regional or district government authority (DMO/RMO)
	CENTRAL 3:	All decisions we make on ordering must be approved by the regional or district government authority (DMO/RMO)
	CENTRAL 4:	All decisions on financial matters to support drug purchase must have an approval from the regional or district government authority (DMO/RMO)

Table 1 Scales and reliability measures (continued)

Scales	*Sample of items – response format: seven-point Likert-type scale with end points inaccurate description and accurate description.*	
SUPPLMON (supplier's output monitoring) five items $\alpha = 0.86$	SUPPLMON 1:	We frequently monitor the MSD delivery timeliness
	SUPPLMON 2:	We always monitor the MSD delivery accuracy (conformity to order)
	SUPPLMON 3:	We frequently monitor the MSD's lead time (time between ordering and delivery)
	SUPPLMON 4:	We always monitor the MSD's time on backorder delivery.
	SUPPLMON 5:	We regularly monitor the MSD's stock out rate.
UNCERT (environmental uncertainity) four items $\alpha = 0.76$	UNCER1:	Our essential drug demand fluctuates regularly from time to time
	UNCER2:	Our essential drug supply fluctuates regularly from time to time
	UNCER3:	Our essential drug prices fluctuate regularly from time to time
	UNCER4:	Our health facility always has high variation in patients mix for a particular essential drug

3.3 Validity assessments and descriptive statistics

First, an exploratory factor analysis was carried out, based on eigen values, and assigned all the items of the five constructs into five factors explaining a total of 63% of the total variance.

Table 2 Correlation matrix, AVE and descriptive statistics

Contracts		*1*	*2*	*3*	*4*	*5*	*6*	*7*
1	CENTRAL[a]	1.00	0.02	0.03	0.001	0.02	0.01	0.001
2	SUPPLINT[a]	–0.15	1.00	0.26	0.001	0.27	0.02	0.01
3	SUPPLPERF	–0.17*	0.51*	1.00	0.002	0.25	0.04	0.001
4	UNCERT	0.03	0.03	–0.04	1.00	0.001	0.001	0.01
5	SUPPLMON	–0.13	0.52*	0.50*	0.01	1.00	0.03	0.01
6	GEO	0.11	–0.13	–0.20*	0.01	–0.16*	1.00	0.06
7	PROX	–0.03	–0.08	0.01	0.09	–0.10	0.24*	1.00
Mean		0.00	0.00	3.14	4.69	3.99		1.55
S.D		1.44	1.49	1.54	1.34	1.59		0.67
AVE		**0.50**	**0.46**	**0.59**	**0.45**	**0.56**		

Notes: Values above the diagonal are the shared variances between constructs, while those below the diagonal are the inter-construct correlation estimates.
*Correlation is significant at the 0.05 level (two-tailed).
[a]Mean centred variables.

All factor-items loadings were above 0.4 for each of the constructs, and indicate satisfactory internal consistency (Hair et al., 2006). All constructs had Cronbach alpha

values above 0.7 (confer Table 1) and provide further support for satisfactory data reliability (Nunnally, 1981; Pallant, 2010).

Confirmatory factor analysis (CFA) carried out by Amos resulted into satisfactory model fit indices were; χ^2 = 352.2 df 262, p < 0.01, IFI = 0.951; TLI = 0.95; CFI = 0.95, and all indices fell within the cut-off point of 0.9 (Byrne, 2010), and the RMSEA value (0.046) was within the 0.05-limit as proposed by Byrne (2010).

All factor loadings were significant and greater than 0.5 with t values > 2.00, and demonstrate satisfactory convergent validity for the model (Droge et al., 2004). Discriminant validity was assessed using the procedures of Fornel and Larcker (1981). The estimated average variance extracted (AVE) was greater than the percentage of variance shared by each construct (confer Table 2) except for B-S integration (SUPPLINT) and environmental uncertainty (UNCERT) which had AVE-scores below 0.5, 0.46 and 0.44 respectively. However, the validity assessments revealed that SUPPLINT and UNCERT satisfied the other criteria above and support satisfactory discriminant for the research model.

4 Data analysis and empirical findings

Several methods may be used to estimate moderation effects, however this study employed a multiple moderated regression (MMR) technique instead of others such as structural equation modelling (SEM) due to methodological limitations associated with the latter. SEM demands very large sample sizes; it mainly uses a sub-group analysis which is sensitive to sample cut-off points, has lower statistical power and may confound group variance differences with the moderation effects (Sauer and Dick, 1993). Given that the moderator was a continuous variable, MMR was preferred to retain information contained in the variable (ibid).

4.1 Regression analysis and model fit

In order to test our research hypotheses, the following OLS-regression model was estimated:

$$\begin{aligned}\text{SUPPLPERF} = {} & b_0 + b_1\ \text{UNCERT} + b_2\ \text{SUPPLMON} + b_3\ \text{PROX} + b_4\ \text{GEO} \\ & + b_5\ \text{CENTRAL} + b_6\text{SUPPLINT} + b_7\ \text{CENTRAL} \times \text{SUPPLINT} + e\end{aligned}$$

Model 3 (confer Table 3) demonstrates satisfactory goodness of fit with F (7,156) = 13.56, p < 0.01) and R^2_{Adj} = 0.35, and shows that the model provides an adequate description of our data. All constructs (SUPPLINT and CENTRAL) entering interaction term were mean-centred in order to handle possible collinearity problems (Jaccard and Turrisi, 2003), and the moderate VIF-measures in Table 3 show no signs of critical multi-collinearity problems for any constructs.

By using the approach suggested by Jaccard and Turrisi (2003), a test of the significance of the two-way interaction effect (CENTRAL x SUPPLINT) was carried out. This test assesses the significance of an interaction effect by measuring the change in R^2 when the interaction term is added to the regression model. The results demonstrated that when the interaction term (CENTRAL × SUPPLINT) was introduced into the regression model, the model's explanatory power increased by 0.02 (2%). This corresponds to an

F-value of 4.55 and exceeds the critical F-value of 3.84 for F (1,156) at a significance level of $p < 0.05$, and demonstrates that the interaction term contributes significantly to the explanatory power of our model.

Table 3 Regression analysis: dependent variable: supplier logistics performance

Models	*Constructs*	*Unstandardised coefficients (b)*	*t value*	*Sig.*	*Collinearity statistics*	*VIF*
		B			*Tolerance*	
1 Adjusted $R^2 = 0.258$	(Constant)	1.498	2.818	0.005		
	UNCERT	–0.063	–0.807	0.421	0.992	1.008
	SUPPLMON	0.471	7.097	0	0.969	1.032
	PROX	0.233	1.443	0.151	0.933	1.072
	GEO	–0.469	–2.087	0.038	0.924	1.082
2 Adjusted $R^2 = 0.331$	Constant	2.153	4.111	0		
	UNCERT	–0.07	–0.948	0.345	0.989	1.011
	SUPPLMON	0.302	4.12	0	0.714	1.401
	GEO	0.242	1.579	0.116	0.928	1.077
	PROX	–0.404	–1.89	0.061	0.914	1.094
	CENTRAL	–0.067	–0.961	0.338	0.961	1.041
	SUPPLINT	0.338	4.324	0	0.716	1.397
3 Adjusted $R^2 = 0.351$	(Constant)	$b_o = 2.238$	4.308***	0		
	UNCERT	$b_1 = –0.104$	–1.386	0.168	0.945	1.058
	SUPPLMON	$b_2 = 0.302$	4.177***	0	0.714	1.401
	PROX	$b_3 = 0.272$	1.788*	0.076	0.92	1.087
	GEO	$b_4 = –0.42$	–1.987**	0.049	0.913	1.095
	CENTRAL[a]	$b_5 = –0.033$	–0.46	0.646	0.911	1.098
	SUPPLINT[a]	$b_6 = 0.331$	4.282***	0	0.715	1.399
	CENTRAL * SUPINTEG	$b_7 = –0.101$	–2.132**	0.035	0.901	1.109

Notes: Model fit: $F(7, 156) = 13.566$ ($p < 0.01$); $R^2 = 0.38$, R^2 Adj = 0.35. *$p < 0.10$, **$p < 0.05$ and ***$p < 0.01$.
[a]Mean centred variables.

4.2 Empirical findings

According to Jaccard and Turissi (2003), the main effects of each of the variables entering interaction terms express their effect on the dependent variable when the value of the variable with which they interact is zero. H_1 corresponds to the main effect of B-S integration on supplier logistic performance when the level of centralisation (CENTRAL) is zero. This corresponds to the mean level of centralisation as the variables entering the interaction term were mean-centred. The regression output supports H_1 ($b_6 = 0.33$; $t = 4.282$, $p<0.01$), and the findings demonstrate that buyer-buyer integration on its own has a direct influence on supplier logistics performance.

H_2 expresses the combined effect of centralisation of decision control in buying firms (CENTRAL) and B-S integration (SUPPLINT) on supplier logistic performance (SUPPLPERF). The regression results support H_2 in the sense that the interaction effect (CENTRAL x SUPPLINT) is negative and significant ($b_7 = –0.10$, $t = –2.132$, $p < 0.05$).

An elaboration of this interaction effect was carried out by estimating the effects of B-S integration on supplier logistic performance at different levels of purchasing centralisation as recommended by Aiken and West (1991) and Schoonhoven (1981)[1].

$$\delta\text{SUPPLPERF}/\delta\text{SUPPLINT} = b_6 + b_7\,\text{CENTRAL} \quad (1)$$

By inserting the data from the regression outputs, we get:

$$\delta\text{SUPPLPERF}/\delta\text{SUPPLINT} = 0.33 - 0.10 * \text{CENTRAL} \quad (2)$$

The analysis below demonstrates that the effect of B-S integration on supplier logistics performance was significantly weakened as the extent of centralisation of the decision control in the buying firm increased.

Table 4 The effect of supplier integration on supplier performance for different levels of centralisation

Value of centralisation (CENTRAL)	*Low (-2 s.u)*	*Mean*	*High (+2 s.u)*
δSUPLPERF/δSUPPLINT:	0.5	0.33	0.13
Significance: t-values	4.31	4.30	1.06

The figures in Table 4 demonstrate that at low and medium levels of centralisation (CENTRAL), the effect of B-S integration (SUPPLINT) on supplier logistics performance (SUPPLPERF) is significant and high (the slope is 0.53, $p < 0.01$ and 0.33, $p < 0.01$ for these levels). This effect vanishes when centralisation increases to a 'high' level where the slope is 0.13 ($p > 0.10$), and demonstrates how substantial centralisation of decision control erodes the effect of supplier integration on supplier logistics performance.

4.3 The effects of control variables

The geographical location of the health facility (GEO) has a significant and negative effect on supplier logistics performance ($b_4 = –0.42$, $t = –1.99$, $p < 0.05$), which implies that public health facilities in rural district councils experience lower supplier logistics performance than those in urban councils.

Supplier output monitoring (SUPPLMON) has a strong positive effect on supplier logistics performance ($b_2 = 0.30$, $t = 4.18$, $p < 0.01$). This finding is in line with basic principal-agent reasoning, and demonstrates that the more the health facilities enforce their monitoring verification of their suppliers, the higher is the supplier logistics performance.

The regression coefficient for Environmental uncertainty (UNCERT; b_1) was not significant at $p < 0.05$ Finally, the empirical findings also demonstrate that the distance between the public health facilities and their zonal supplier (PROX) has a slight negative effect on supplier logistics performance ($b_3 = –0.27$, $t = –1.79$, $p < 0.10$). This finding indicates that those health facilities residing far away from their focal supplier experience

lower supplier logistics performance than closer ones due to practical problems associated to the implementation of activities aiming at improving logistics activities.

5 Discussion, implications and future research

The main objective of this paper was to examine the combined effect of purchasing centralisation of decision control and B-S integration on supplier logistics performance. The empirical findings show that substantial centralisation of purchasing decisions in public institutions weakens the effects of B-S integration on supplier logistics performance. This supports previous scholars (Koufteros et al., 2014) who assert that there is a negative association between purchasing centralisation and customer integration, indicating that extensive supplier integration should not be paired with substantial centralisation of buying firms' decision control. Similarly, others scholars like Aiken and Hage (1971) argue that substantial centralisation of decision control erodes organisation communications and information flows.

These arguments are strongly relevant in studies of B-S relationships because substantial centralisation of decision control at the firm level seems to impair B-S interactions and collaborations which are key factors in improving the logistical operations at the supplier side. Most of the daily inter-organisational contact points in business operations reside at lower organisational levels and line managers who are local experts on purchasing requirements, and hence they are in a better position to mediate relevant information and demands to suppliers in order to improve logistics activities. If they are denied such an autonomy option, the information gaps between the two actors will be enforced with successive reduction of the potentials for improved supplier's performance.

The findings of this study provide some evidence for a strong and positive effect of B-S integration on supplier logistics performance and support previous research contributions by Devaraj et al. (2007) who examined the effect of supplier integration on operational performance, and demonstrated that supplier integration is a key factor for improving supplier logistics performance. This also supports the healthcare supply chain literature which indicates that to improve performance integration is key (Charu, 2008). It also supports the supplier development literature which emphasise on intensive information exchange and collaboration between a buyer and supplier as key activities to improve supplier performance (Sillanpää et al., 2014).

However, on the effect of centralisation of decision control it contradicts with other scholars like Swink et al. (2007) in the sense that our study did not observe any main effect of purchasing centralisation on supplier logistics performance.

Theoretically, this research provides important knowledge to the administration elements of the supply chain management literature, and extends Vora's (1992) arguments concerning the fruitfulness of integrating constructs and reasoning from basic organisational theory and other fields of inter-organisational theory into supply chain management research. The organisation design theory has a relatively long and strong tenure in management research even if its research applications in recent years has somewhat waned (Koufteros et al., 2014). The contribution from this paper on the combined effect supports (Koufteros et al., 2014), who claimed that there is a still substantial value in organisational design theory. Generally, on the RBV theory this

paper contributes on the existing debate on the effects of SCI on logistics performance (Fabbes-Costes and Jahre, 2008). Based on the RBV perspectives it acknowledges B-S integration as an important resource/capability (Fantazy et al., 2011) in improving logistics performance. Despite of the observed direct effect, this paper further shows that the effectiveness of a resource in improving performance is influenced by contextual factors such as organisational structure. It should be understood that resources do not exist in isolation, they can bundle with other factors the extent that their effect on performance may be enhanced or weakened.

For managers and policy makers, our findings demonstrate the importance of looking into the interplay of several organisational factors. It should be noted that, based on the organisational design approach, in the search for improved logistics performance in a B-S exchange, the marginal effects of logistics decision making control might weaken the role of B-S interaction and collaboration on logistics performance. Therefore, this paper advocates the need to decentralise tactical and operational decision making to operations managers at the buying firm level in order to improve supplier logistics operations and logistics performance. It is expected that if more autonomy in decision making will be devolved to the operations managers of the procurement unit, effective communication between buyer and supplier firms will develop, and lead to continuous logistics performance improvement.

This study is based on a cross-sectional survey design with data collected only from the buyer's side. However, relational variables such as B-S integration may require time to realise their potential effects, and therefore future studies should consider a longitudinal approach based on data from both sides of business relationships in order to explore this further.

Furthermore, public health institutions in Tanzania are highly regulated and controlled by public authorities, and this might limit the external validity of this study. Possible effects of opportunistic behaviour among public agents might also influence the outcome of the analysis, and further research in other organisational settings and cultural settings is desirable to test the external validity of the empirical findings further.

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Notes

1 Estimated effects of buyer-supplier integration on supplier logistics performance at different levels of purchasing centralization (+/–2 scale units, s.u). Recall that CENTRAL and SUPPLINT are mean-centred.