




EXPLORING THE DIMENSIONS USING EXPLORATORY FACTOR ANALYSIS OF DISRUPTIVE FACTORS AND INVENTORY CONTROL

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ABSTRACT

Healthcare industry is directly linked with human lives and face plaguing problems. Therefore, healthcare facilities minimize risks associated with deficiency of medicines or equipment. This study was carried out to find the dimensions of disruptive factors affecting inventory control at public healthcare facilities. From different healthcare facilities of District Sahiwal and Pakpattan 100 respondents were selected by utilizing random sampling. Then, Exploratory Factor Analysis was done in accordance to congregate the study objectives with a structured questionnaire. The results of this study determined two dimensions for each construct. Lastly, a test of reliability was conducted to find the acceptance level. This study broadens the scope of inventory control to healthcare. However, the study was geographically limited and thus, should be extended to other regions as well. Further, for sustainable performance, the study results should act as an enlightening figure for government and especially the healthcare facilitators in the identification of problems.

Contribution/Originality: This study is one of very few investigating the dimensions of disruptive factors and inventory control. The study contributes, identifying the dimensions within the constructs, to the existing literature as well as the reliability of those constructs and their relevant dimensions.

1. INTRODUCTION

Inventory control system effectively stimulates and directly affects the organizational performance. When “inventory” comes to healthcare sector, it is purchased but not hitherto dispensed medicines. Therefore, hospitals purchase and hold priciest therapeutic inventory items to congregate potential future transactions by ensuring its availability (Hashmi, Amirah, & Yusof, 2020b). Whereas, stocked-out affects healthcare services (Maini et al., 2014). Healthcare providers imperatively persuade stochastic demand to avoid human mortality (McPake et al., 2013). A research in Ghana indicated 50% of all deaths happen due to non-availability of essential medicines. In budget 2015-16, Punjab Provincial Assembly provided a hefty amount of “168 billion” Pakistani Rupees (PKR) to Department of

Health for primary and secondary healthcare. Despite of having 168 billion PKR, the Health Department found expired batches of curative drugs and stock-out of medical accessories at Punjab Institute of Cardiology (PIC), Lahore. This resulted deaths of 131 heart patients and compelled the Health Department to procure medicines and accessories of worth 5.6 billion PKR only for PIC, which was a huge amount (Rashid & Amirah, 2017). It is therefore concluded that the deficiencies in stock of medicines and accessories are posing major concerns.

1.1. Research Questions and Objectives

To curtail the stated issues, the study needed to lay a considerable emphasis by finding the functions of healthcare facilities, their responsibilities, and mechanism through effective inventory control processes. Therefore, this study emphasized on following objectives:

1. To determine the dimensions of bureaucratic procedures affecting inventory control at public hospitals?
2. To determine the dimensions of information technology affecting inventory control at public hospitals?
3. To determine the dimensions of staff skills affecting inventory control at public hospitals?

2. LITERATURE REVIEW

2.1. Bureaucratic Procedures and Inventory Control

Bureaucracy is one of the most dominant counterproductive stimuli in rigid business policies. The bureaucrats enforce the employees to act for unconditional conformity on procedures, rules and policies without caring the displacement of organizational goals (Dietl, 2015). Furthermore, Udy (1959) stated that people often remain busy to address rigid rules and lose attentions from real purpose of the firm; resulting displacement of effectiveness. Moreover, inventory dysfunction or unanticipated consequences might occur due to rigid rules and policies, which ignites reluctance against environment change, limits the appliance of knowledge, and limits the collective efforts of teams (Blau, 1955; Yaver, 2016). In addition, Blau (1955) expressed that rigid structured policies and rules encourage the managers with bureaucratic personality and could be fatal. Udy (1959) added; as negative consequences of structural bureaucracy. The agile solutions are rarely anticipated by rigid organizations. For this reason, organizations suffer expensive inventories, lengthy lines, useless procedures, bribes and unfriendly bureaucrats. Moreover, it originates maladaptive, intensified intolerance, overreliance on control and provocation of uncertain situations (Moskovich, 2014). Generically, public sector organizations often facade red tape nuisances (Tummers, Weske, Bouwman, & Grimmelikhuijsen, 2016) and reducing the checks can avoid red tapes with increased effectiveness (Kaufman, 2015).

2.2. Information Technology and Inventory Control

Today is the world of Information Technology (IT). IT includes information systems, which integrate different functional units of an organization (Davenport, Quigley, Martin, Holt, & Arthington, 2000). Technologies infuse new business procedures (Christensen, 2013) and technology enforces the companies to adopt automation (Lee & Whang, 2000). Whereas, in supply chain; stock-outs are becoming pivotal problem as recognized by practitioners and researchers (Hashmi et al., 2020b; Vasconcellos & Sampaio, 2009). Stock-outs change the shopping attitude and buying behavior (Rani & Velayudhan, 2008). Therefore, technology offers new techniques of handling stock-out situations (Avlijas, Simicevic, Avlijas, & Prodanovic, 2015). In addition, being non-technological in modern businesses is a decisive challenge due to which stocked-out and inventory inaccuracies are originating huge losses (Rashid., 2016). A study found 70% inaccurate inventories in stock keeping units (Raman, 2000). Meanwhile, use of technology increase the accuracy, deliver in-time information, and fast data entry (Cakici, 2012). Hence, to gain competitive edge it is important for a firm to adopt IT and before adaptation, diffusion of knowledge is necessary to conclude their needs (Dostie, 2013).

2.3. Staff Skills and Inventory Control

For employee's growth to develop good sense of humor, the staff training has drastically grown since 1970s (Rehman, Khan, & Khan, 2011). Therefore, Complex quantities and ordering time presents challenges to inventory administration and imperatively need involvement of designated staff with adequate skills for supply chain management. Unfortunately, inventory control found skill gaps, especially in hospital pharmacies (Dias, 2011). According to American Society of Health-System Pharmacists (1995) generically, government governing hospitals require pharmacy technicians and pharmacists for drug inventories who are specifically not skilled in inventory control. Therefore, imparting knowledge for skill enhancement is important for diffusion of technology and organizational development (Dostie, 2013). Moreover, it is worthwhile challenging to educate the amateurish (Hummel, Freeland, Craft, & McKellips, 2012). Due to this reason, an increased number of organizations are formalizing and adopting the skill enhancement programs. In addition, Van der Klink and Streumer (2002) found significant improvement in staff skills between before and after On the Job Training (OJT). However, persistence of inappropriate training especially in automated inventory control applications are entrenching inventory control negatively (Hashmi, Amirah, & Yusof, 2020a). Therefore, it is certain that untrained workers are often solicited to execute tasks about which they are ignorant. In response they deny or end up (Johnson, 2015). However, relevant skills and qualification critically required (Dragoni, Oh, Vankatwyk, & Tesluk, 2011).

3. MATERIAL AND METHODS

This research used quantitative research design and carried-out EFA procedure for scales' validation of items through Statistical Package for Social Sciences (Amirah, Asma, Muda, Amin, & Him, 2019). Furthermore, Factor Analysis was examined to find the relationship between items' shared common variances and the individual item variances. Moreover, the communalities were measured to find the ratio of item's unique variance to its shared variance. Later, the study used Varimax rotation with Principle Axis Factoring (PAF) to measure the structure for the items. In Varimax rotation, the factors remain independent and the resultant factors considered as much uncorrelated as possible to each other. Lastly, factor rotation was used to interpret the underlying structures of the factors.

3.1. Data Collection

Primary data was collected through structured questionnaires from managerial staff managing inventories at healthcare facilities located at districts of Sahiwal and Pakpattan (Pakistan). Whereas, secondary data was collected from healthcare professionals, inventory management professionals, websites, business management journals, handbooks, published reports, different medical journals, and document reviews.

3.2. Target Population, Sampling Technique, and Sample Size

Selected target population was 147 healthcare facilities located at districts of Sahiwal and Pakpattan (Pakistan). To generalize the observed characteristics, a simple random sampling was used and 100 respondents were chosen for data collection (Rashid, Amirah, & Yusof, 2019).

4. RESEARCH RESULTS AND DISCUSSION

Kaiser-Meyer-Olkin (KMO) was used to measure sample size adequacy. The KMO results in Table 1 expressed that the KMO values for all constructs (bureaucratic procedures, information technology, staff skills, and inventory control) are > 0.6 which shows, the size of sample is adequate and is fit for factor analysis (Beavers, Lounsbury, Richards, & Huck, 2013). Additionally, the Bartlett test of Sphericity is < 0.000 , which is significant for each variable and is acceptable by providing realistic bases for factor analysis (Beavers et al., 2013; Hashmi et al., 2020a).

For extraction, Principal Axis Factoring (PAF) was applied to measure the divided variance among possible factors. The common criterion for factor extraction is Eigenvalue > 1.0 (Hashmi et al., 2020a). Therefore, first two factors were extracted for each construct and have been shown in Table 2; i.e., bureaucratic procedures, information technology, staff skills, and inventory control. Eigenvalue less than 1.0 tend to cause the factors with over extraction and explain less information to keep that factor (Hashmi & Tawfiq, 2020). In addition, a total of > 60 percent of the change in total variance was contributed by extracted factors for each variable (Awang, 2015).

Table-1. KMO and Bartlett's test.

		Bureaucratic Procedures	IT	Staff Skills	Inventory Control
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.855	.870	.828	.852
Bartlett's Test of Sphericity (Sig.)	Approx. Chi-Square	490.264	467.484	472.759	360.645
	Df	36	36	28	28
	Sig.	.000	.000	.000	.000

Table-2. Total variance explained.

Factor	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
Bureaucratic Procedures						
1	4.481	49.790	49.790	3.162	35.129	35.129
2	1.869	20.772	70.563	2.477	27.527	62.656
Information Technology						
1	4.293	47.696	47.696	2.984	33.152	33.152
2	2.092	23.239	70.935	2.685	29.832	62.984
Staff Skills						
1	4.263	53.282	53.282	2.824	35.303	35.303
2	1.667	20.842	74.123	2.475	30.940	66.243
Inventory Control						
1	3.899	48.731	48.731	2.567	32.087	32.087
2	1.710	21.371	70.102	2.264	28.295	60.382

Table 3 expressing the communalities score and factor loadings against each item for their respective construct. The communalities scores are greater than the cut-off value (0.2) for each item, which mean that it will not signify the additional factors (Child, 2006). Additionally, the communality loadings between 40 and 60 are taken as low to moderate (Costello & Osborne, 2005) between 50 and 60 as acceptable (MacCallum, Widaman, Zhang, & Hong, 1999) and > .70 is ideal (Beavers et al., 2013). Lastly, the Rotated Factor Matrix columns of Table 3 contained the factor loadings for each item under their respective variables. Based on Rotated Factor Matrix, the factor loadings for all items were separated into Factor 1 and Factor 2 for each construct from the one with highest loading/weight to the lowest loading.

The “bureaucratic procedures” and “information technology” both are consisting same results by having nine items for each variable (item1 to item9) and separated into two factors; namely, Factor 1 and Factor 2 in 3 iterations. Factor 1 constituted items 1, 2, 3, 4, and 5; while Factor 2 constituted items 6, 7, 8, and 9. Whereas, “staff skills” and “inventory control” comprising eight items for each variable (item1 to item8) with two factors in 3 iterations; namely, Factor 1 and Factor 2; where Factor 1 comprised items 1, 2, 3, and 4; while Factor 2 have items 5, 6, 7, and 8. Finally, the factor loadings are > 0.512 and consider as significantly stable (Hair, Black, Babin, Anderson, & Tatham, 2006; Pituch & Stevens, 2015).

Table-3. Communalities and rotated factor matrix.

Items	Bureaucratic Procedures Statement	Comm*	Factor	
			1	2
B1	In our organization, there are adequate standing operating procedures on inventory issues?	.807	.898	
B2	Have you experienced long bureaucratic related purchase difficulties?	.691	.807	
B3	Do the Storekeepers have full independence in performing their daily duties?	.430	.800	
B4	To what extent, do you agree that long bureaucratic practice affects inventory control/management?	.716	.708	
B5	In our organization, we have over reliance on and do adhere to inventory policies?	.566	.620	
B6	Do the Storekeepers have a power to advise the management about stock matters?	.547		.810
B7	Our organization management is involved in inventory planning with minimum red tapes.	.658		.746
B8	During Stock review, we face too much red tapes and paper work in providing feedback about good or poor performance by comparing the actual situation to the government established and documented standards and regulations.	.579		.737
B9	The entire function needs thorough improvement with least paper work.	.647		.704
Information Technology				
IT1	Information management system is better than manual systems.	.691	.812	
IT2	The use of information management system is easily understood.	.658	.811	
IT3	Information management system is more reliable.	.640	.782	
IT4	In our organization, we use computerized system in managing inventories (such as EDI, EPOS & ERP)?	.570	.719	
IT5	The use of information management system helps to achieve proper inventory control.	.430	.628	
IT6	Due to integrated systems, order fulfillment generation reduces the uncertainties.	.697		.823
IT7	Due to collaboration with stakeholders, we are able to forecast accurately.	.679		.822
IT8	Our organization has close integrated communication with stakeholders.	.636		.778
IT9	The made promises are reliable due to automated systems.	.667		.760
Staff Skills				
SS1	Do the Storekeepers have the required competence in performing their duties?	.960	.968	
SS2	With professionalism in stock control, Storekeepers can help the client to diagnose problems and come up with practical/workable solution.	.676	.812	
SS3	Inventory control plans are being affected by the involvement of incompetent staff.	.642	.738	
SS4	Storekeeper or (stock controller) has achieved their purposes for which they were established.	.621	.725	
SS5	Do you think professional pre /post employment training on inventory control/Supply Chain Management is purposeful at Ministry?	.685		.816
SS6	To what extent, do you agree that staff skills in inventory management affect inventory control?	.674		.793
SS7	In future, the healthcare facility is planning to pay more attention on; how to use existing opportunities to upgrade skills and knowledge to perform better and have more benefits from it.	.591		.727
SS8	Staff and managers focus on educating workers about inventory control and enhancing workers' attitude towards their jobs to an extent where improvement becomes a natural process.	.451		.646
Inventory Control				
Inv1	We often face stocked-out of crucial items.	.742	.825	
Inv2	To cater uncertainties we always have buffer stock of inventory.	.656	.808	
Inv3	Determining inventory order size is crucial at our part.	.661	.791	
Inv4	In our organization, most of the needed inventories are not being delivered on time.	.493	.655	
Inv5	Have you experienced discrepancies stock balances?	.606		.778
Inv6	Inventory inaccuracy could be improved by exploring new opportunities.	.592		.727
Inv7	Physical inventory varies from the system stock.	.532		.713
Inv8	In our organization inventory, accuracy is preferably being handled.	.551		.678

Notes: Comm, Communalities.

On the bases of EFA, the factors were renamed with appropriate names. For construct “Bureaucratic Procedures”, Factor 1 and Factor 2 were renamed as “Rigid Rules” and “Red Tapes,” respectively. However, the two factors of “Information Technology” were renamed as “Information Management Systems” and “Collaboration”.

Meanwhile, “Professional Qualification” and “Staff Training” were renamed in place of Factor 1 and Factor 2 of construct “Staff Skills”. Lastly, the factors of construct “Inventory Control” were renamed as “Inventory Stocks” and “Inventory Accuracy”.

4.1. Reliability test

Table 4 expressed the summarized results of Cronbach’s Alpha for each construct and their respective dimension. The Cronbach’s Alpha value for the “Bureaucratic Procedures” is (0.87); for “Information Technology” and “Staff Skills” expressing ($>.86$) and (>0.87) respectively; meanwhile, “Inventory Control” indicating (>0.84). The values are demonstrating realistic internal higher degree of reliability. According to Cronbach (1951) Cronbach’s Alpha values greater than 0.70 express consistent, reliable, and acceptable results.

Table-4. Test of reliability.

Variables	N of Items	Cronbach's Alpha (N=100)
Bureaucratic Procedures	9	.871
Factor 1: Rigid Rules	5	.889
Factor 2: Red Tapes	4	.852
Information Technology	9	.862
Factor 1: Management Information Systems	5	.875
Factor 2: Collaboration	4	.884
Staff Skills	8	.871
Factor 1: Professional Qualification	4	.869
Factor 2: Staff Training	4	.822
Inventory Control	8	.841
Factor 1: Inventory Stocks	4	.853
Factor 2: Inventory Accuracy	4	.899

5. CONCLUSION AND RECOMMENDATIONS

The study empirically measured the variables and found within the prescribed cut-off limits. While analyzing the constructs in EFA, the study found two factors for each variable and all the used items were retained due to fulfillment of criterions. Thus, the factors suggested by Rotated Factor Matrix were renamed appropriately. Lastly, analysis of reliability was conducted which ascertained higher degree of realistic internal reliability and consistency by expressing Cronbach’s Alpha values greater than 0.70 for all construct and the dimensions. The study recommends; the Ministry should integrate their functions for enhanced collaboration with inventory management. Furthermore, there is a need to avoid red tapes by standardizing the procedures; and necessarily educating their staff by special emphasizes On the Job Training programs. Finally, the study will be advantageous for Provincial Ministries, Federal Government, Supply Chain Professionals, Private healthcare facilities, and pharmaceutical industry.

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