

Measuring the items of Information Technology (IT) in the Manufacturing companies in Nigeria through the Exploratory Factor Analysis

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Abstract

This objective of this study is to carry out instrument validation for the items of Information Technology through exploratory factor analysis (EFA). The data collection instrument used is questionnaires which was administrated to employees in the manufacturing firms in Nigeria. 100 questionnaires were collected to do the EFA. The results revealed that the Bartlett's Test of Sphericity is significant ($P\text{-Value} < 0.05$). Kaiser-Meyer-Olkin (KMO) is excellent as it exceeds the require value of 0.6. These two outcomes (Bartlett's Test is significant and $KMO > 0.6$) implies that the data is adequate in size. The Cronbach's Alpha test was higher than 0.7 for all the items of the construct, this indicates that these items are all reliable. This study contributes to knowledge by investigating the items of the construct of Information Technology that could increase performances in manufacturing firms.

Keywords: Exploratory Factor Analysis, Supply Chain Management, Information Technology, Manufacturing, Companies, Firms, Employees

Introduction

Information technology abilities is organizing and using of information technology resources with additional resources as well as abilities, to achieve the objectives of the companies (Cassia, Costa, da Silva, & de Oliveira Neto, 2020). Information technology is important for improvement in the manufacturing organization. Information technology is essential for advancement of performance in the organizations (Tzokas et al., 2015). Flexibility in the system of the firms is important for information technology and it had been mainly essential with regard to allowing the process transformation necessary for the creation of efficient network and improving performance (Ivanov and Dolgui 2020b). I.T could improve different business procedures in an effective way, like on time process as well as autonomous adjustments of manufacturing operation and supply-chains operation, for instance forecast,

warehouses, distributions and information transmissions throughout the supply chains (Wiengarten, et al., 2014; Wang et al., 2018). Information technology has capability to advance the performance of organizations (Nabeel - Rehman & Nazri, 2019). Information technology has a huge possibility to enable collaborative-plans amongst S.C. partners by sharing information on demand forecast and productions schedule that command S.C. activity (Khan and Siddiqui, 2018). Flexibility in the organization pave the way for technology adoption with huge possibility to enable collaborative-planning amongst supply-chain partners by sharing information on demand forecast and productions schedule that command supply chain activity (Sagawa and Nagano, 2015). Prior researches had been conducted to investigate Information technology and flexible supply chain management. Igashi et al., (2023) carried out study to examine the effects of supply chain management practices (SCMP) on SMEs and the roles of information technology. Their results indicate that information technology has a positive impact on flexible supply chain management.

Moreover, Gunasekaran et al., (2017) carried out research on the effect of operational flexibility on performance. The results of their study show a positive association between IT and flexibility of supply chain management. Likewise, Dominguez et al. (2018) conducted a study to investigate a strategy to implement partial information sharing among supply chain retailers. Their findings indicate a positive significant impact of IT and flexible supply chain management. Additionally, Benaben and Vernadat, (2017) investigated information system agility to support collaborative organizations. The findings of their research show that IT has a positive influence on flexible supply chain management. Similarly, Singh et al., (2017) explored the interaction of factors for flexibility in supply chains. The results of their study indicate that IT has a positive impact of flexible supply chain management. In another study, Khan and Siddiqui, (2018) suggest that I.T has effect on firm flexibility and performance. Furthermore, I.T. also improves S.C. efficiency by offering on-time information with regard to products availability, inventory-level, shipment-status, and production requirement (Behaldi, 2021). The aim of this study is to carry out instrument validation for the items Information Technology through exploratory factor analysis (EFA).

Methodology

Quantitative method was employed in this research. The data for this study were gathered by using a self-administered method which is in line with many researchers. Moreover, 10 points of Likert scale was used as stated by Awang et al., (2016) that 10 points of Likert scale are more effective than 5 points of Likert scale in operating of the measurement model (Awang et al., 2016). Hence, this study applied the interval scale of 10, where the respondents select a statement amongst several statements from 1-10 which is considered to reflect the perceived quality of the subject. 100 questionnaires were distributed to the respondents. The data was analyzed by employing Exploratory Factor Analysis in order to explore and evaluate the dimensionality of items measuring the construct of Information Technology.

Findings

This construct has 6 items in the questionnaire. The E.F.A outcomes in Table 1 show the descriptive-statistics for each item that measure Information Technology. This construct was measured employing 6 items in the questionnaire with the interval-scale from 1 (strongly-disagree) to 10 (strongly-agree) with the given item statement (Awang et al., 2016; Hoque et

al., 2018). The item statement, the mean and standard deviation of the score for each item is depicted in Table 1.

Table 1

Construct Information Technology

Label	Item Statement	Mean	Std. Deviation
IT1	The company has the ability to adjust technology strategy alignment to accommodate the use of IT and manage business process reengineering	8.27	1.309
IT2	The company has the ability to acquire expertise critical for managing Internet-based supply chain activities.	7.95	1.399
IT3	The company has adequate PC for employees	8.47	1.085
IT4	The company has related infrastructure technologies in place	8.64	1.189
IT5	The company has updated information technology	7.70	1.532
IT6	The company consider information technology to be vital element	8.09	1.338

The Exploratory Factor Analysis (EFA) employing the extraction technique of Principal-Component with Varimax (Variation Maximization) Rotation was conducted on these 6 items that measure the Information Technology construct. The outcomes in Table 2 specify that the Bartlett's Test of Sphericity is significant (P-Value < 0.05). Additionally, the measure of sampling suitability by Kaiser-Meyer-Olkin (KMO) is excellent since it exceeds the required value of 0.6 (Noor et al., 2015; Muda et al., 2018, 2020; Bahkia et al., 2019; Fitriana et al., 2022; Anuar et al., 2023). These two outcomes (Bartlett's Test is significant and KMO > 0.6) specify that the data is acceptable to proceed further with the data reduction process in EFA (Awang, 2010, 2012; Noor et al., 2015; Hoque et al., 2017, 2018; and Yahaya et al., 2018).

Table 2

The KMO and Bartlett's Test Score

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.887
Bartlett's Test of Sphericity	Approx. Chi-Square	455.672
	df	15
	Sig.	.000

The Dimensions or Components and Total Variance Explained

The outcomes in Table 3 depicts that there is one dimension or component that emerge from the E.F.A. process according to the computed Eigenvalue greater than 1.0. The eigenvalue range is 3.835. The variance-explained for component 1 is 63.913%. The total-variance-explained to measure this construct is 63.913%. The total-variance-explained is adequate as it exceeds the minimum 60% (Noor et al., 2015; Muda et al., 2018, 2020; Bahkia et al., 2019; Fitriana et al., 2022; Anuar et al., 2023).

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Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.835	63.913	63.913	3.835	63.913	63.913

Extraction Method: Principal Component Analysis.

The scree plot in Figure 1 specifies one dimension or component that emerge from E.F.A. process for this latent-construct. Otherwise, the EFA. technique had grouped 6 items to 1 dimension or component. The dimension or component had its own set of to measure items. The rotated component matrix determines precisely which items belongs to which component (Awang, 2010, 2012; Muda et al., 2018, 2020).

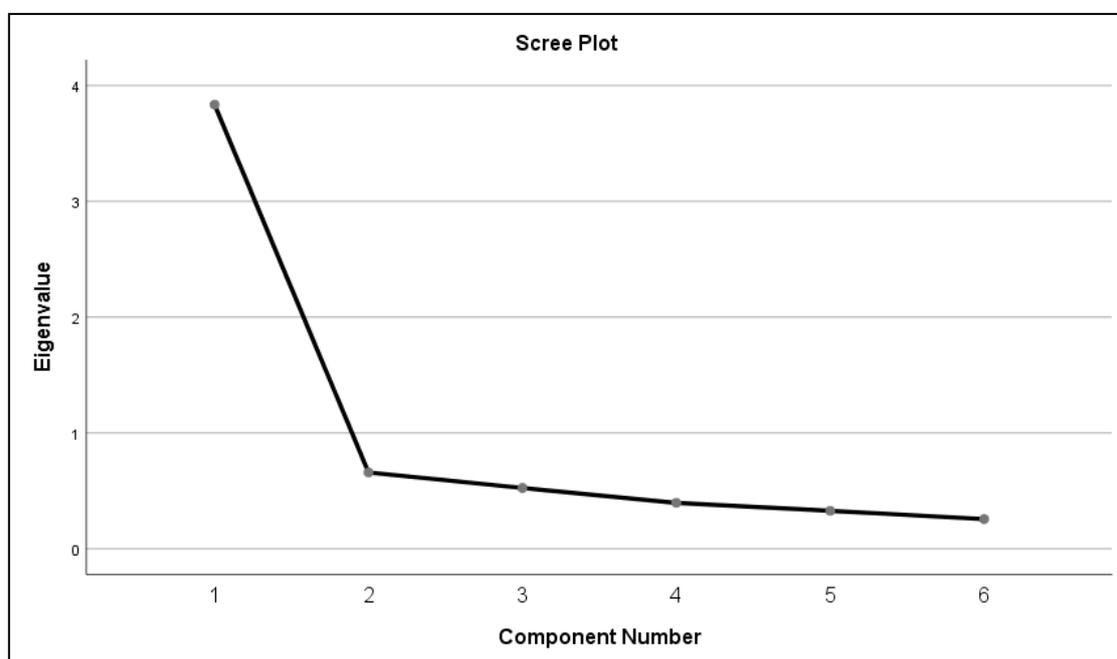


Figure 1 The Scree Plot shows one component emerged from the EFA procedure

The subsequent Table 4 depicts one dimension or component emerged and their corresponding items resulted from the EFA process. The factor loading for each item must be greater than 0.6 so as to be retained (Noor et al., 2015; Muda et al., 2018, 2020; Bahkia et al., 2019; Fitriana et al., 2022; Anuar et al., 2023) as shown in Table 4.

Table 4

The component and its respective items

Component Matrix	
	Component
Label	1
IT1	.876
IT2	.809
IT3	.756
IT4	.816
IT5	.679
IT6	.846

Extraction Method: Principal Component Analysis.

a. 1 components extracted.

Lastly, the research has to compute the value of Cronbach Alpha which reflect the Internal-reliability for the retained items to measure this latent-construct. The internal-reliability or internal-consistency specifies how stronger the corresponding items are holding together to measure the corresponding construct. The value of Cronbach Alpha must be greater than 0.7 for the items to attain the Internal Reliability (Awang, 2012; Muda et al., 2018, 2020). Table 5 presents the Cronbach's Alpha for every component. The Cronbach Alpha for component is greater than 0.7 as shown in the Table 5, which means that these items are reliable.

Table 5

The Internal Reliability for the Information Technology Construct

Name of construct	Number of Items	Cronbach Alpha
Information Technology	6	0.881

Conclusion

The results show that the Bartlett's Test of Sphericity was less than 0.05 (<0.05) which is Significant ($P\text{-value} < 0.05$). Kaiser-Meyer-Olkin (KMO), Measure of Sampling Adequacy was higher than 0.6, (> 0.6), and this suggest that the sample is adequate in size. The total-variance-explained is satisfactory since it exceeds the minimum 60%. Cronbach's Alpha test was higher than 0.7 for the items of the construct and this implies that these items are all reliable. This research found a valid and reliable instrument to measure the items of the construct of Information Technology which could enhance performance in the manufacturing companies in Nigeria.

Contribution

This research contributes to knowledge in the domain of supply chain management by Assessing and testing items that fit for examining the construct of Information Technology which could augment performances in manufacturing organizations in Nigeria. Evaluating these items of the construct of Information Technology is also a methodological contribution for the area of supply chain management.

References

- Anuar, N., Muhammad, M. M., Awang, Z. (2023). Development and Validation of Critical Reading Intention Scale (CRIS) for University Students using Exploratory and Confirmatory Factor Analysis. *Asian Journal of University Education (AJUE)* Volume 19, Number 1, January 2023.
- Awang, Z., Afthanorhan, A., & Mamat, M. (2016). The Likert scale analysis using parametric based Structural Equation Modeling (SEM). *Computational Methods in Social Sciences*, 4(1), 13.
- Awang, Z. (2010). *Research Methodology for Business and Social Sciences*. Universiti Teknologi MARA. Malaysia
- Awang, Z. (2012). *Research methodology and data analysis*: Penerbit Universiti Teknologi, MARA Press.
- Bahkia, A. S., Awang, Z., Afthanorhan, A., Ghazali, P. L., & Foziah, H. (2019). Exploratory factor analysis on occupational stress in the context of Malaysian sewerage operations. Paper presented at the AIP Conference Proceedings.
- Bahkia, A. S., Awang, Z., Rahlin, N. A., Zulkifli, A. R. (2020). The Importance of Supportive Leadership in the Sewerage Operation Industry: A case of Indahwater Konsortium Private (IWK). *Humanities & Social Science Reviews*, 8(3), 2020, 149-162. <https://doi.org/10.18510/hssr.2020.8317>.
- Behaldi, A., Kamble, S., Jabbour, C.J.C., Gunasekaran, A., Ndubisi, N.O., Venkatesh, M. (2021). Manufacturing and Service Supply Chain Resilience to the COVID-19 Outbreak: Lessons Learned from the Automobile and Airline Industries. *Technological Forecasting & Social Change*, 163
- Benaben, F. and Vernadat, F.B. (2017), "Information system agility to support collaborative organisations", *Enterprise Information Systems*, Vol. 11 No. 4, pp. 470-473.
- Cassia, A. R., Costa, I., da Silva, V. H. C., & de Oliveira Neto, G. C. (2020). Systematic literature review for the development of a conceptual model on the relationship between knowledge sharing, information technology infrastructure and innovative capability. *Technology Analysis and Strategic Management*, 32(7).
- Dominguez, R., Cannella, S., Barbosa-Póvoa, A.P., & Framinan, J.M. (2018). OVAP: A strategy to implement partial information sharing among supply chain retailers. *Transportation Research Part E: Logistics and Transportation Review*, 110, 122-136.
- Fitriana, N., Hutagalung FD., Awang Z., Zaid, SM. (2022). Happiness at work: A cross-cultural validation of happiness at work scale. *PLoS ONE* 17(1): e0261617. <https://doi.org/10.1371/journal.pone.0261617>.
- Hoque, A. S. M. M., Awang, Z., Jusoff, K., Salleh, F., and Muda, H (2017). Social Business Efficiency: Instrument Development and Validation Procedure using Structural Equation Modelling. *International Business Management*, 11(1), 222-231.
- Hoque, A. S. M. M., Siddiqui, B. A., Awang, Z. B., & Baharu, S. M. A. T. (2018). Exploratory Factor Analysis of Entrepreneurial Orientation in the Context of Bangladesh Small and Medium Enterprises (SMES). *European Journal of Management and Marketing Studies*.
- Gunasekaran, A., Subramanian, N., & Papadopoulos, T. (2017). Information technology for competitive advantage within logistics and supply chains: A review. *Transportation Research Part E: Logistics and Transportation Review*, 99, 14-33.
- Igashi, Martina, Ringim, K. J., Bugaje, I. B., Sambo, H. S. (2023). Supply chain management practices and smes performance: role of information technology capability. *Journal of Management Sciences* Vol. 24,

- Ivanov, D., and Dolgui, A. (2020b). "A digital supply chain twin for managing the disruptions risks and resilience in the era of Industry 4.0.," *Production Planning and Control*, 2020b, DOI:10.1080/09537287.2020.1768450
- Khan, A., & Siddiqui, D. A. (2018). Information sharing and strategic supplier partnership in supply chain management: A study on pharmaceutical companies of Pakistan. *Asian Business Review*, 8(3), 117-124.
- Muda, H., Baba, Z. S., Awang, Z., Badrul, N. S., Loganathan, N., & Ali, M. H. (2020). Expert review and pretesting of behavioral supervision in higher education. *Journal of Applied Research in Higher Education*.
- Muda, H., Loganathan, N., Awang, Z., Jusoh, H., & Baba, Z.S. (2018). *Application of Theory, Methodology and Analysis in Conducting Research. A Practical Guide to Quantitative Research and Thesis Writing*, UniSZA Publisher, ISBN: 978-967-2231-11-0
- Nabeel-Rehman, R, & Nazri, M. (2019). Information technology capabilities and SMEs performance: An understanding of a multi-mediation model for the manufacturing sector. *Interdisciplinary Journal of Information, Knowledge, and Management*. <https://doi.org/10.28945/4429>
- Noor, N. M., Aziz, A. A., Mostapa, M. R., & Awang, Z. (2015). Validation of the Malay version of the Inventory of Functional Status after Childbirth questionnaire. *BioMed research international*, 2015.
- Sagawa, J.K., & Nagano, M.S. (2015). Integration, uncertainty, information quality, and performance: A review of empirical research. *The International Journal of Advanced Manufacturing Technology*, 79(1-4), 299-306.
- Singh, R.K., Koul, S. and Kumar, P. (2017), "Analyzing the interaction of factors for flexibility in supply chains", *Journal of Modelling in Management*, Vol. 12 No. 4, pp. 671-689.
- Tzokas, N., Kim, Y. A., Akbar, H., & Al-Dajani, H. (2015). Absorptive capacity and performance: The role of customer relationship and technological capabilities in high-tech smes. *Industrial Marketing Management*, 47, 134-142.
- Wang, Y.S., Wang, Y.M., Lin, H.H. & Tang, T.I. (2003). Determinants of user acceptance of Internet banking: an empirical study. *International Journal of Service Industry Management*, 14(5), 501-519.
- Wiengarten, F., Pagell, M., Ahmed, M.U. & Gimenez, C., (2014). "Do a country's logistical capabilities moderate the external integration performance relationship?", *Journal of Operations Management*, Vol. 32 No. 1, pp. 51-63. Williamson, O.E., (1979). "Transaction-cost economics.
- Yahaya, T., Idris, K., Suandi, T., & Ismail, I. (2018). Adapting instruments and modifying statements: The confirmation method for the inventory and model for information sharing behavior using social media. *Management Science Letters*, 8(5), 271-282.