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The Effect of Automated Spend Analysis on Supply Chain Efficiency of Telecommunication: A Case Study of MTN Rwanda

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Abstract : ***Automated spend analysis provides leverage for businesses that want a more efficient method for saving money and establishing long-term business relationships in the procurement process. The purpose of this study was to evaluatethe effect of automated spend analysis on Supply Chain Efficiency in the Rwanda Telecommunication industry; with MTN Rwanda as a case study. A combination of stratified and proportionate sampling was conducted on 265 employees of MTN Rwanda to obtain a predetermined sample size of 53 respondents from three levels including top, middle and low-level management. Primary data was collected through closed ended structured questionnaires while, Secondary data was obtained through review of relevant journals, internet and business magazines. Descriptive and inferential statistics were computed through SPSS software to perform data entry and analysis of findings; and to measure the mean, frequency, standard deviation and regression. Pearson Chi-Square was used to measure the effect of automated spend analysis on Supply Chain Efficiency. The results of the Chi Square exhibited a significant effect size of Automated Spend Analysis Software implemented by MTN Rwanda on its Supply Chain efficiency, ($\chi 2 = 96.000a$, $P = 0.00 < 0.05$). The system had effect on spend visibility, spend analytics, cost reduction, and hence improved sourcing strategies and procurement performance. However, the software is not yet integrated with other systems working in silos. The integration with e-Sourcing Software and ERP would perfectly automate the overall Supply Chain operations thus resulting in supply Chain efficiency.***

Keywords: Automated Spend Analysis, Supply Chain Efficiency, Telecommunication, e-Sourcing, e-AuctionsEnterprise Resource Planning (ERP), Software, Solution,System, Request for Information (RFI), Request for Proposal (RFP), Request for Quotation (RFQ)

1. Background of the Study

With the pressure mounting on the supply chainfunction, their operations before were viewed as a paper-based cost centres within organisations. Nowadays, different businesses understand that supply chain is a value addition for organisations to achieve their short- and long-term objectives. Thesourcing activities are now regarded as collaborative, money-saving, and efficient processes in a structured business. Therefore, supply chain teams would be well served to reconsider their organisations sourcing strategy and make sure that they are positioned for success. (Beal, 2014). Therefore, automated solutions for data management in supply chain is regarded as a strategic move for improvements and performance to achieve efficiency.

According to CIPS & NIGP, 2012, businesses should use automated spend analysis solutions to leverage their buying power, reduce costs, provide better management and oversight of suppliers, and to develop an informed supply chain strategy. Automated spend analysis should include the identification, automated collection, cleansing, grouping, categorization, and analysis of all spend data for the goods and services purchased as well as works performed almost on real time.

Without accurate data on high quality supplier and product, even the best spend analysis applications will generatedisastrous results. Therefore, misclassified item data (motor vehicle misclassified as assets) can completelylead to erroneous conclusions (considerable underestimation of the right money spend on motor vehicle). Clearly, data integrity is a prerequisite for accurate spend analytics thus a need for an automated spend analysis software (Oracle White Paper, April 2012).

An automated spend analysis system enables organisations to controltheir entire spendwhile determining whether they received the rightnumber of products and servicesin accordance with the amount of money paid(BearingPoint, 2010).

The telecommunication industry has ambitions to acquiredifferent products and services after realizing the savings possibilities of strategic sourcing. MTN Rwanda has envisioned for similar cost savings the time such products and services are identified through an automated spend analysis system.

2. Problem Statement

According to Bartolini (2015), implementing an automated spend analysis solution enables procurement department to work with the speed, agility, efficiency, and interoperability that cannot be achieved by manual processes and spreadsheet-based spend analysis.

For the last one decade MTN Rwanda has been applying an automated spend analysis system. However,since its inception no study has been conducted to evaluate the systems effect on efficiency of MTN's Supply Chain in terms of cost reduction, improved compliance, optimized purchasing process, and managing risks. Lack of study in this area provides an opportunity for research to fill in the much desired information gap.

3. Literature Review

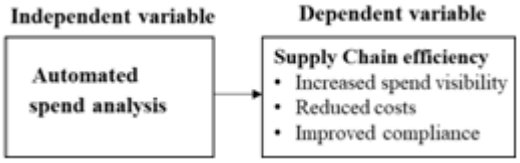
3.1 Theories

There is currently a wide variety of literature available on supply chain efficiency and the important role that an efficient supply chain fulfils in a successful organization. Some of the more common tools used to measure supply chain efficiency include the "spider" or "radar" diagram. These are used to display graphically the comparative values of multiple variables in a data set; to display values of different categories of data on a single chart; and to aid in the identification of composite performance measure elements needing improvement, and the "Z" chart, which is a combination chart that shows three perspectives in a single picture. These tools are based on gap analysis techniques and they are graphical in nature. Although the graphical nature of the techniques makes them easy to understand, it also limits them in their ability to handle complex situations. In other words, it is not feasible to measure the efficiency of a supply chain using these tools when there are multiple inputs or outputs (Goedhals-Gerber, 2010).

Efficiency is defined as the measure of effectiveness that produces the minimum waste of time, effort, and skill. it is a term that recently has come to the forefront of the scientific world. Today, the world is having difficulties to accommodate the enormous growth in population and to manage the distribution of resources; therefore, the effort to make things more efficient has become increasingly more relevant. We talk about fuel efficiency in cars and energy efficiency in our homes. We strive to learn how to efficiently collect data, use space, recycle goods, and run a business. Nevertheless, somewhere in this vast search for efficiency we seem to have overlooked the most powerful set of systems and tools we have, ourselves. If we are truly in pursuit of maximum efficiency, we need to look at how efficient we are as a social whole (Archer, 2010).

According to (CIPS & NIGP, 2012), spend management enables the whole view of the activities involved in the "procure to-pay" process within an organization to achieve the supply chain efficiency. This process includes, for instance, identification of right suppliers, sourcing of goods and services, receiving, payment settlement, and management of accounts payable, as well as general ledger accounts. In brief, spend management is the way in which organizations control their spending. Whether the money is spent on goods or services for direct inputs (raw materials used in the manufacturing of products), indirect material (office supplies), or services (temporary and contract labour), companies need a mechanism by which they are able to control and reduce costs related to procurement.
According to Bartolini (2015) in the CPOs Rising Report, automated spend analysis has become a valuable sourcing tools for organizations; however just 37% of them currently deployed an automated solution. Even though it is not like automated-digital contract tools with 16% of implementation, nearly two thirds of procurement and sourcing teams today conduct spend analysis without an automated solution. In the context of strategic supply chain, fully automated solution suites can perform much more of the heavy lifting for surrounded procurement teams who most of the times, find themselves swimming in data, processes, and tasks. They are scalable and repeatable, take most of the manual, tactical work out of the equation, and allow small procurement teams to focus on strategic planning and improvements. For instance, automated spend analysis tools can generate aggregate, categorized, and clean data. They can provide spend intelligence to procurement managers and professionals. Furthermore, they can use that spend intelligence to make more informed buying decisions. They can understand internal and external contract compliance, and suppliers' competitiveness as planned (Bartolini, 2015).

3.2 Conceptual Framework



According to Lichocik& Sadowski (2013), efficiency of supply chains is not only a task for which a Procurement department is responsible as it is a strategic decision taken by the management as regards the method of future company's operations. Decision-makers must always remember that a supply chain must first be planned in the most effective manner, considering numerous aspects influencing its operations. Disregarding the importance of the designing and strategic analysis processes will surely make a supply chain less effective. In a company aware of its importance, supply chain management may play a key role exerting the same impact on its performance as sales, marketing or production. Therefore, a need for an automated spend analysis solution to increase visibility, reduce costs, and improve compliance in the supply chain.

For many businesses, an automated spend analysis solution can be integrated with other strategic sourcing processes, like e-Sourcing, contract management, and supplier management to create a tremendous effect for the supply chain operations. Some ideas from conducting spend analysis are that it can flow downstream into supply chain to enhance supplier selection and buying decisions, to audit internal contract compliance to determine if procurement teams used existing contracts and suppliers to source goods and services, and to assess suppliers' performance on contractual agreements and delivery as agreed during the sourcing and negotiation phases. Moreover, standardizing each process. i.e., making the data formats, languages, process workflows, templates, and some features compatible with others hence enabling procurement teams and business leaders to "connect the dots" and enhance the efficiency, visibility, and value of strategic supply chain (Bartolini, 2015).

3.3 Empirical review

Businesses are focused on how they can adopt technology and automation into their organizations in order to leverage innovation and future-proof their business. The threat of lagging behind competitors and the market by failing to take advantage of opportunities for digital advancement is very

real. Digital transformation is as much about businesses bracing themselves for the future as aligning their business practices with their competitors in the present (ProcurePort, 2019).

The supply chain profession is no exception to digital transformation, as procurement departments everywhere are digitalizing their processes and procedures. The aim is not to automate procurement, but to automate supply chain processes and transactions, allowing for supply chain professionals to take on an increasingly strategic role within the business that is more about adding value than simply cutting costs. Cost-reduction is still the heart of the supply chain function, but it is understanding how this function fits into the organization across every single department and business process, from manufacturing to logistics to facilities management, to deliver maximum cost-savings and minimize profit erosion (Capgemini Report, 2018).

A robust spend management solution enables companies to identify savings opportunities but also achieve greater efficiency and save valuable resources such as money and time. These are improvements which have a direct impact on any business financials and performance (ProcurePort, 2019).

Automated spend analysis solutions can aggregate scattered current and historical spend data from suppliers as well as within the company. These data are from either supplier or third-party, and the system can pool them in a database where they are categorized, cleaned, and sorted into business intelligence tool for decision making. Most of automated spend analysis systems provide dashboards with analytics and data visualization tools hence enabling users to interact with the data in informative ways. Therefore, they enable procurement teams to generate automated and aggregated spend reports that provide insight on spending, category management behaviors and supplier performance to make informed decisions (Bartolini, 2015).

4. Methodology

The population comprised of 265 employees of MTN Rwanda. Hence, due to finance and time constraints against the short period of carrying out the research, a representative sample of 20% of total employees were selected randomly. In its report of 2017, RURA states that the Rwanda telecommunications industry is made of three main telecom operators, six Internet Service Providers (ISPs), one wholesale network service provider, two network facility providers and fourteen Retail Internet Service Providers. The main telecom operators include MTN Rwanda, Airtel-Tigo, Korean Telecom Rwanda Network (KTRN), Broadband Systems Corporation (BSC), Liquid Telecom, and MANGO 4G. The study targeted only MTN Rwanda to assess the effect of automated spend analysison supply chain among the leading telecoms in Rwanda.

The sample used is 20% representative of the total population of 265 employees of MTN Rwanda. The sample was selected randomly using stratified classes. That is from top level management, through middle management to lower level operations of the company.

Table 1-1: Determining the Sample size

N	Department	Number of Employees	Sample Size
1	Procurement	8	8
2	ICT	20	4
3	Operations	75	15
4	Sales &Marketing	75	15
5	Other	86	11
	Total	265	53

Primary data is information gathered directly from respondents and for this study the researcher used a questionnaire. The questionnaire had both closed-ended and open questions. Secondary data was collected for this study; therefore, these data were collected and analysed from published materials and information from other sources such as journals, annual reports and internet. The researcher administered the questionnaire individually to all respondents of the study using a drop and pick later method. Since the data collected was quantitative in nature, the researcher analysed them using descriptive analysis techniques. The descriptive statistical tools such as Statistical Package for Social Sciences (SPSS) and MS Excel was used by the researcher to describe the data and determine the extent used.

The research used the Pearson Chi Square Test to establish the validity and reliability of data through the current version of SPSS software, IBM SPSS Statistics 24. The study further used frequencies, percentages, means and other central tendencies. Tables and charts were adopted to summarize responses for further analysis and facilitate comparison and correlation of variables.

5. Results and Findings

a) Response rate

Results in table1; reveal that a response rate of 90.6% was achieved.

Table 1 : Response rate

Questionnaire type		Frequency	Percent	Valid Percent	Cumulative Percent
	Filled	48	90.6	90.6	90.6
	Unfilled	5	9.4	9.4	100.0
	Total	53	100.0	100.0	

Dessel (2013) states that the sample of 10% to 20% of the target population is often used in descriptive research.

5.1 Implementation of Automated Spend Analysis Software in supply chain

As seen on the table 2,most of the respondent believe that MTN Rwanda has been using Automated Spend Analysis Software between 5 and 10 years ago. This is indicated by 89.6% response rate whereas the remaining 6.3% of respondents agreed to that MTN has adopted the software between 10 and 15 years ago. Whereas 2.1% agreed that the software was adopted in less than 5 years and in 20 years ago respectively. Therefore, the researcher concluded that the Automated Spend AnalysisSoftware was implemented and applied in supply chain activities by MTN Rwanda ten (10) years ago.

Table 2: Period of Use of AutomatedSpend Analysis Software by MTN Rwanda

Period	Frequency	Percent	Valid Percent	Cumulative Percent
Less than 5 years	1	2.1	2.1	2.1
Between 5 and 10 years	43	89.6	89.6	91.7
Between 10 and 15 years	3	6.3	6.3	97.9
Between 15 and 20 years	1	2.1	2.1	100.0
Total	48	100.0	100.0	

In order to understand the extent to which MTN uses an Automated Spend Analysis Software in Supply Chain operations, the researcher used Mean and Standard Deviation to measure the validity of the response rate. Therefore, answers were derived from question 6 of Section B in the questionnaire. The findings of the study showed that in all 48 respondents felt that the adopted the Automated Spend Analysis Software is currently used at very large extent in MTN Rwanda.

The results in Table 3 show that the Automated Spend Analysis Software is used in most activities of Supply Chain at a very large extent where the average score was 3.8 out of 5 with a Mean of 3.26 and Standard Deviation of 0.42. The activities with high average score represented by a Mean of 4.92 are Planning and Risk Assessment, while Reverse Auction, Suppliers Identification, Negotiations, Opening of Bids, Prequalification of bidders are represented by a Mean of 4.85, 4.75, 4.75, 4.85, 4.69 and 4.65 respectively. However, Evaluation of bids, Award and Signing of contract, Contract Administration, and Risk Assessment have a Mean below 2. Meaning that their average score is below 2 out of 5. Henceforth, this brings the research to the conclusion that the system is used at no extent for Needs Assessment, Preparation of Bidding Document, Design Specifications, Selection of procurement method, Award and Signing of contract, Contract Administration, and Invitation for bid represented by a Mean of 2.66. The explanations are that MTN Rwanda is performing these activities manually or using other software such as e-Sourcing (See Table 1-5).

Table 3: Extent of Automated Spend Analysis Software application in Supply Chain

Activity	N	Min	Max	Mean	Std. Deviation
Planning	48	4	5	4.92	0.279
Needs Assessment	48	1	2	1.04	0.202
Suppliers Identification	48	4	5	4.75	0.438
Preparation of Bidding Document	48	1	2	1.27	0.449
Design Specifications	48	1	3	1.75	0.887
Invitation for bid	48	4	2	1.02	0.279
Opening of Bids	48	4	5	4.85	0.357
Prequalification of bidders	48	3	5	4.69	0.589
Evaluation of bids	48	3	5	4.65	0.601
Negotiations	48	4	5	4.75	0.438
Award and Signing of contract	48	1	3	1.17	0.476
Contract Administration	48	1	2	1.06	0.245
Reverse Auction	48	3	5	4.85	0.461
Risk Assessment	48	1	5	4.92	0.144
Valid N (listwise)	48	2.5	3.8	3.26	0.418

5.2 Effect of Automated Spend Analysis on supply chain efficiency

At a rate of 56%, the respondents agreed that supply chain operations were moderate before introduction of Automated Spend Analysis Software, and 27.1% agreed that the operations were poor and 14.5% said they were good. However, none of the respondents agreed that the operations were excellent by that time.

As seen in the table 4, the effect of Automated Spend Analysis on Supply Chain operations was measured by extent (a score of 1-5) of activities performed by the supply chain team of MTN Rwanda. This was evident in the table above, where the respondents agreed that after application Automated Spend Analysis Software by MTN, the system had an effect by reducing the paper work (automating process) with Mean of 4.56 and Standard Deviation of 0.58, reduced costs with Mean of 4.10 and Standard Deviation of 1.036, increased spend visibility with Mean of 4.40 and Standard Deviation of 0.70, managed risks with Mean of 4.60 and Standard Deviation of 0.64, reduced cycle times with Mean of 4.60 and Standard Deviation of 0.57, improved compliance of the company with Mean of 4.50 and Standard Deviation of 0.62, and finally increased performance with Mean of 4.48 and Standard Deviation of 0.62.

Table 4: Effects of automated spend analysis on supply chain activities

Activity	N	Mini	Max	Mean	Std. Deviation	Variance
Reduced the paperwork	48	3	5	4.56	0.580	0.336
Increased spend visibility	48	3	5	4.40	0.707	0.414
Reduced costs	48	2	5	4.10	1.036	1.074
Improvedcompliance	48	3	5	4.50	0.619	0.383
Reduced cycle times	48	3	5	4.60	0.574	0.329
Managed risks	48	3	5	4.60	0.644	0.500
Increased performance	48	3	5	4.48	0.618	0.383
Valid N (listwise)	48					

5.3 Correlation of tests

A Pearson Chi Square correlation test was computed to evaluate the relationship between the effect of automated spend analysis and the supply chain efficiency and the results were presented in the table 1-10. The results of the Chi Square exhibited a significant effect size of Automated Spend Analysis Software application by MTN Rwanda on its Supply Chain efficiency, ($\chi 2 = 96.000^{a}$, $P = 0.00 < 0.05$). This means that change in Automated Spend Analysis would significantly affect the supply Chain efficiency of telecommunication industry. Therefore, Automated Spend Analysis Software, when embraced by organisations, it can be a pillar of Supply Chain transformation towards achieving organizational goals.

However, it is important to note that MTN Rwanda uses other systems apart from Automated Spend Analysis

Software, such as where they use a separate e-Sourcing system, specific to certain activities such as preparation of bids, RFI, RFP, RFQ, e-Auctions. An ERP Sage X3 for purchase requests, order processing, stock management and logistics, a third party using a Vendor Management System (VMS) for warehouse operations, and a Customer Relationship Management (CRM) System called Technotree. The problem is that these systems work in silos and an integration of the supply chain systems is recommended for the company to reach the efficiency.

Table 5 Pearson Chi-Square Tests

Test	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	96.000[a]	94	.000
Likelihood Ratio	92.861	94	1.000
Linear-by-Linear Association	37.155	1	.000
N of Valid Cases	48		
a. 144 cells (100.0%) have expected count less than 5. The minimum expected count is .02.			

6. Discussions

The objective of the study was to assess the effect of automated spend analysis on Sspply Chain efficiency of Telecommunication industry. Consequently, the independent variable was automated spend analysis whereas the dependent variable of the study was the Supply Chain efficiency, which was assessed in the study based on the rating on Supply Chain operations improvement and performance.

As stated by Limberakis (2012), compared to other solution areas in spend management and supply chain management, spend analysis exclusively rely on technology for its use. Therefore, the study evaluated the effect of automated spend analysis implementation on MTN Rwanda's supply chain efficiency. The system has enabled the company to automate (digitize) several processes through analyzing the current, past and forecasted expenditures thus allowing the visibility of data by supplier, by commodity or service, and by department within the organization.

According to Bartolini (2015), the automated spend analysis solutions enable supply chain teams to generate automated and aggregated spend reports that provide insight on spending, category management behaviors and supplier performance to make informed decisions. This was a result of the study as evidenced in Table 1-2, where responded favourably that it reduced the paperwork, increased spend visibility, reduced costs, improved compliance, and reduced cycle times. It also facilitated in the management of supply chain risksrisks thus increased the performance of the function.

It is evidenced from the study that telecommunication companies leveraging on automated spend analysis in supply chain as part of their spend analytics initiatives, have reduced their entire supply chain costs by 7 to 15 percent. The automated spend analysis solutions achieved a 2% to 12% reduction in material costs through informed sourcing, a 50% reduction in off-contract spending, a 20% to 70% reduction in inventory levels, and a 5% to 50% reduction in inventory costs.

7. Conclusion and Recommendation

From the study, it was concluded that an automated spend analysis solution enables to map expenditure on products inclusive of all peripheral costs, thereby sourcing better quality and cheaper products, services, and works. For instance, the software enabled MTN to take critical decisions such as sourcing products from Europe at a lower rate might turn out to be more expensive due to shipping costs than purchasing from local suppliers in Rwanda.

Apart from finding the best prices and deals from their suppliers, the solution has improved MTN's spend visibility in terms of planning and maintaining the optimal inventory level. By placing orders at the right time, MTN was able to lock in low prices during periods of little to no demand, rather than paying higher prices because suppliers are dealing with increased demand in seasons.

Once an automated spend analysis solution is implemented, it becomes much easier to trace, collate, and document expenditures that improve spend visibility. This, in turn, helps in complying with major regulatory requirements. Best spend management practices require companies to maintain accurate reports of spend data across all departments, for audit hence comply with multiple regulatory bodies. A clear example is where, a thorough audit through expenditures could reveal duplicate payments for a single invoice.

An automated spend analysis system enables to monitor transactions to keep a track on a vendor's financial performance and credibility. Since most projects are majorly dependent on suppliers, this analysis helps identify risk beforehand, which enables procurement to make alternative plans.

Lastly, spend management helps take effective and efficient expense decisions, thereby improving all internal systems. Recognizing the possible benefits of spend management, organizations could automate their procurement processes and bring about visibility in the spending environment.

To summarize, spend management is a process that every organization needs to inculcate and execute if they mean to achieve their cost-saving objectives year-on-year. A simple four-step process (i) collecting, ii) cleansing, iii) classifying, and iv) analyzing expenditure data should get one on track for improved internal systems and processes.

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