INFORMATION VISUALIZATION AND DECISION-MAKING EFFICIENCY OF SMALL AND MEDIUM ENTERPRISES IN PORT HARCOURT METROPOLIS

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ABSTRACT

This study was inspired by the need to investigate the relationship between information visualization and decision-making efficiency of small and Medium Enterprises in Port Harcourt Metropolis. The cross-sectional survey strategy was adopted. Data was collected through structured questionnaire. The study population consisted of 80 leaders drawn from the leadership of small and medium enterprises in Port Harcourt Metropolis. 4 employees occupying leadership positions were surveyed from 20 SMEs. The study sample was 80. The hypotheses were tested using the Spearman's Rank Order of Correlation Coefficient. The tests were carried out at a 0.05 significance level. The findings revealed that there is a positive and significant relationship between information visualization and decision-making efficiency. Therefore, the study concludes that information visualization positively enhances decision making efficiency of small and medium enterprises in Port Harcourt. Hence, SMEs in Port Harcourt should consider implementing tag clouds as a part of their decision-making processes. Tag clouds can help present key information and trends visually, making it easier for decision-makers to quickly grasp essential insights. SMEs in Port Harcourt should consider adopting plot tables as a valuable tool for decision-making. Plot tables can present complex data in a concise and visually aesthetic manner, making it easier for decision-makers to understand trends and patterns. SMEs in Port Harcourt should raise awareness among decision-makers and employees about the benefits of using plot tables for decision-making. Conduct training sessions to ensure that everyone understands how to create, interpret, and utilize plot tables efficiently and effectively.

Keywords: Information Visualization, Tag Clouds, Plot Tables, Charts, Decision Making Efficiency, Informed Decision & Quality Decisions

INTRODUCTION

Decision making is integral to organisational success and it occurs virtually in all function and at all levels in an organisation be it lower, middle and upper. The types may vary but must certainly pass through a similar process. Decision making is a pervasive function of management; it on this premise Peter Drucker in his famous book; *Management, Task and Responsibility* enthused that whatever a manager does, he does through decision making. It is fundamental to management and it is the foremost function of the manager. A manager has to take a decision before he takes any action on planning, organizing, leading, controlling, etc. what manager perform involves decision making. Decision and decision making is one of the complex activities that is very difficult to conceptualize in the field of social science, behavioural and management studies. The concept is easier to be applied than to be defined. A lot have conceptualized the term in different ways and different dimension. The word decision is derived from the Latin word "deciso" and it denotes "cutting away or cutting off or come to a conclusion". The word connotes wordings such as: choice, result, conclusion,

verdict, pronouncement, resolution, outcome, ruling, will power, strength of mind, certitude, decisiveness, judgment, findings and many more.

It is the basic characteristic that differentiates human being from animal (Higher animal and lower animal), a sane from an insane, successful people from the unsuccessful people, good leaders from bad leaders. Throughout the ages the period of Homo-habilis, Austrapolicus, Erectus, heidelbergensis, sapiens down to the present era, the battle has always being the battle of the mind; a word which a French philosopher Descartes Renè called *cognito ergo sum* – I think, therefore I am. The mind is the central ground for decision. Decision sometimes is misconstrued as thinking but it is not thinking. Thinking entails reasoning, reflection, pondering, rumination, cogitation and deliberation. It is when thinking is put in action to arrive at certain result that it is decision. It is an integral part of decision making and it is the quality of thinking that determines the success of a decision. It is the quality of decision that determines the result of a phenomenon. History has demonstrated time without number that those who are made in life are those who think; Pythagoras, Aristotle, Plato, Galileo, Machiavelli, Karl Marx, Weber, Lord Denning and many others. Sharma (2003) sees decision making as the process by which an individual select a course of action among alternative to produce desired result. He went further to stress that a good decision should compose of four (4) continuous interrelated phases which he mentioned as: Exploration (searching), Speculative (Analysis), Evaluating (Weighting), and Selective (Commitment).

According to Few (2017) information visualization is the collection of methods that use visual representations to explore, make sense of and communicate quantitative data. It allows trends and patterns in quantitative data to be seen more easily. The ultimate purpose of data visualization is to facilitate better decisions and actions. With the rise in the amount of data available, it is important to be able to interpret increasingly large batches of information, and data visualization is a strong tool for the job. This is not only important for data scientists and data analysts: it is necessary to understand data visualization in any career. Anyone who works in finance, marketing, design, health monitoring or any other sector needs to visualize data. This showcases the importance of data visualization.

Campbell (2019), stresses that information visualization can be used in various phases of data analysis and communication. First, it is very helpful in the phase of data exploration. With the help of statistical analysis tools and spreadsheet programs, data can easily be analysed

through visualization. Relationships, distributions and comparisons can be discovered. Business intelligence tools are also extremely helpful for gaining insight into the data. In the phase of data exploration, the choice of chart type, side information and layout are not the most important issues: as long as the visuals give the analyst more insight, that is fine. Once a good understanding of the trends and patterns in the data has been developed, the work moves on to think of the story to be told. In this phase, data presentation comes into play. Data presentation (sometimes called data explanation) aims to report the end results. This can be in a book, a report, a presentation or on the web. When transmitting insights to a broad audience, clear and understandable communication becomes important. In this phase the chart type, side information and layout of the visuals become important. This paper is inspired to address the use of data and relevance of visualizations in this phase of the process: moving from data via information to insight for a broader audience. The visuals need to speak for themselves. Data visualization is needed because a visual summary of information makes it easier to identify patterns and trends than looking through thousands of rows on a spreadsheet. It is the way the human brain works. Since the purpose of data analysis is to provide insight, data are much more valuable when visualized. Even if a data analyst can identify the patterns and pull insight from data without visualization, it is more difficult to communicate the data findings and their meaning without charts and other dimensions of information visualization and since these charts are critical ingredients in firms' ability to figure out the trajectory of the enterprise as well as the desire to make informed decisions, information visualization becomes a necessity, since their decision making abilities hinges on information visualisation. This paper therefore examined information visualization and decision making in small and medium enterprises in Port Harcourt, specifically, the shopping malls in Port Harcourt metropolis.

Research Problem

Firms' ability to make strategic and informed decisions is critical to the overall efficiency and productivity of such enterprises; this is because of the pivotal role that information holistically plays in the lives of business entities. It becomes a concern when decisions are haphazardly made based on the findings of data analysts, without any visible evidence that clearly shows the current state of events and how such decisions would change the trajectory of the organisation either positively or negatively. Because, those saddled with the responsibilities of making decisions are mostly not vexed in data analysis which would have

enhanced their decision making skills, as such they completely rely on the interpretation and explanations of data analysts, when they can easily have a visual reality of the firm's current situation through the use of information visualization which would add the much needed value to their decision making abilities that are intended to provide visible evidence of the state of organisational affairs, so that, managers are able to make quality decisions, based on the visible evidence before them. It is against this backdrop, that this study seeks to ascertain the correlation between information visualization and decision making of small and medium enterprises in Port Harcourt Metropolis.

Study Variables

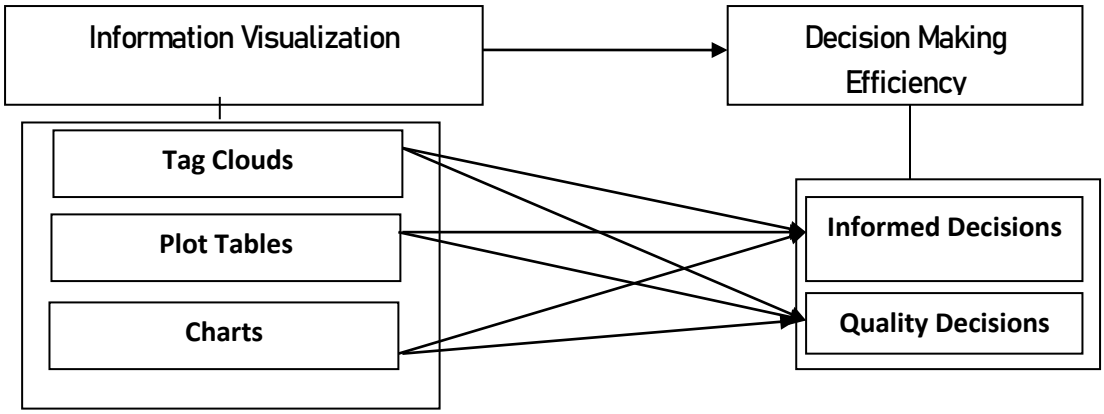


Fig. 1.1: Researchers Conceptualisation of Information Visualisation and Decision-Making Efficiency

Research Objectives/Questions

1. The role of tag clouds in enhancing decision making efficiency of small and medium enterprises in Port Harcourt Metropolis
2. How plot tables enhance decision making efficiency of small and medium enterprises in Port Harcourt Metropolis
3. The role of charts in enhancing the decision-making efficiency of small and medium enterprises in Port Harcourt Metropolis

1. To what extent do tag clouds enhance decision making efficiency of small and medium enterprises in Port Harcourt Metropolis?

2. How do plot tables enhance decision making efficiency of small and medium enterprises in Port Harcourt Metropolis?
3. How do charts enhance decision making efficiency of small and medium enterprises in Port Harcourt Metropolis?

Hypotheses

In order to provide answers to research questions proposed earlier, the following hypothesis were formulated to guide the study;

H_{o1}: There is no significant relationship between tag clouds and informed decisions of small and medium enterprises in Port Harcourt.

H_{o2}: There is no significant relationship between tag clouds and quality decisions of small and medium enterprises in Port Harcourt.

H_{o3}: There is no significant relationship between plot tables and informed decisions of small and medium enterprises in Port Harcourt.

H_{o4}: There is no significant relationship between plot tables and quality decisions of small and medium enterprises in Port Harcourt.

H_{o5}: There is no significant relationship between charts and informed decisions of small and medium enterprises in Port Harcourt.

H_{o6}: There is no significant relationship between charts and quality decisions of small and medium enterprises in Port Harcourt.

Theoretical Foundation: Decision Making Theory (Herbert A. Simon)

The underlying theory for this research effort was the decision-making theory by Herbert Simon. Simon argued that decisions are an integral and critical part of an organisation, and if they are not taken correctly and on time, they may harm the organisation's goals. Simon stresses that decision making is an essential part of a workplace where managers, leaders, and employees constantly need to make effective decisions that will cause benefits. They help in reaching the beneficial goals of the enterprise. Decision making is a process that basically includes two steps; the first is the decision itself and the second is its application. Both phases

are equally important. From the foregoing, it is noteworthy to say that, firms that are able to take advantage of information/data visualization, would ultimately be well placed to make timely and informed decisions that will positively impact the productivity and sustainability of the firms.

Information Visualization

Few (2017) posits that information visualization is the collection of methods that use visual representations to explore, make sense of and communicate quantitative data. It allows trends and patterns in quantitative data to be seen more easily. The ultimate purpose of data visualization is to facilitate better decisions and actions. With the rise in the amount of data available, it is important to be able to interpret increasingly large batches of information, and data visualization is a strong tool for the job. Data visualization is a collection of methods that use visual representations to explore, make sense of and communicate quantitative data (Few, 2017) asserts that, it allows trends and patterns in quantitative data to be seen more easily. The ultimate purpose of data visualization is to facilitate better decisions and actions. With the rise in the amount of data available, it is important to be able to interpret increasingly large batches of information, and data visualization is a strong tool for the job. This is not only important for data scientists and data analysts: it is necessary to understand data visualization in any career. Anyone who works in finance, marketing, design, health monitoring or any other sector needs to visualize data. This showcases the importance of data visualization (Campbell, 2019).

Data visualization can be used in various phases of data analysis and communication. First, it is very helpful in the phase of data exploration. With the help of statistical analysis tools and spreadsheet programs, data can easily be analysed through visualization. Relationships, distributions and comparisons can be discovered. Business intelligence tools are also extremely helpful for gaining insight into the data. In the phase of data exploration, the choice of chart type, side information and layout are not the most important issues: as long as the visuals give the analyst more insight, that is fine. Once a good understanding of the trends and patterns in the data has been developed, the work moves on to think of the story to be told. In this phase, data presentation comes into play. Data presentation (sometimes called data explanation) aims to report the end results. This can be in a book, a report, a presentation or on the web. When transmitting insights to a broad audience, clear and understandable communication becomes important. In this phase the chart type, side information and layout

of the visuals become important. This guidance document is about the use of data visualizations in this phase of the process: moving from data via information to insight for a broader audience. The visuals need to speak for themselves.

According to Nwinyokpugi & Dumnamene (2021) data visualization involves presenting data in graphical or pictorial form which makes the information easy to understand. It helps to explain facts and determine courses of action. It benefits cut across any field of study that requires innovative ways of presenting large, complex information. The advent of computer graphics has shaped advance visualization. There has been the need for displaying massive amounts of data in a way that is easily accessible and understandable. (Sancho, 2014). Data visualization is the visual and interactive exploration and graphic representation of data of any size, type (structured and unstructured) or origin. Organizations generate data every day; as a result, the amount of data available on the web has increased dramatically. It is difficult for users to visualize, explore, and use this enormous data. The ability to visualize data is crucial to scientific research. This enables decision makers to see analytics in visual form and makes it easy for them to make sense of the data. It helps them discover patterns, comprehend information, and form an opinion. Data visualization is also regarded as information visualization or scientific visualization. Things that can be visualized include visible reality that people can see (person, world, nature), hidden reality that normally be hidden (earth core, blood, universe), invisible reality (wind, air, heat, electron, sound, smell), and abstract things (data, idea, hierarchy, process, relationship). The purposes of visualizing data are multiple, ranging from general comprehension and understanding of ideas, supporting information behaviours (analysis and decision support, information seeking, browsing, navigation), to artistic (beauty) expression and appreciation (Viégas and Wattenberg, 2007). In contrast, the goals of visualizing business data are focused on human information seeking and decision-making behaviours, particularly in two broad goals: (i) visualizing key metrics for easy and fast comprehension which directly facilitates decision-making; (ii) providing a visual and interactive way to explore data. Such visualizations often use simple, standard, and abstract charts or diagrams, and utilize data binding techniques at the backend.

Both research and practices have shown data visualization's value and contribution to the decision process. More specifically, visualization eases the cognitive load of information processing, and it helps one recall or memorize data easily because of the perceivable image, Borkin et al., (2013). Basically, business intelligence results are presented in the form of

reports, dashboards, and analytical tools. Among these, dashboards are mostly data visualization driven. Reports are traditionally static and non-interactive, and they present the information to the user in form visual graphics. Embedded visuals are visual effects embedded in another form of presentation. They are not independently presented but always used on top of other presentation forms. Embedded visuals include two major forms: conditional formatting and inline mini charts (or Sparkline). Conditional formatting refers to the direct formatting or styling of text, numbers, shapes, and other contents utilizing visual variables like colour, size, etc. (Bertin, 2010). Conditional formatting does not significantly change the layout and flow of contents, thus it is less intrusive to the content. Instead, it provides a decorative effect that reveals more meaning or high lights selected content from the data or text. Basic types of charts include line charts, bar charts, pie charts, etc., and examples of diagrams include organization structure diagrams, tree diagrams, network diagrams, workflows diagrams, etc. Other more specific types of charts are used in different business contexts for more specific purposes. These charts are based on the more generic chart types like bar charts and line charts, and add more specific visual elements, or arrange the elements in a specific way to represent domain-specific meanings.

For instance, bullet charts (based on bar charts) are used in performance measuring; perceptual maps (based on scatter plots) are used in marketing; waterfall or bridge charts (based on column charts) are used in driving factor analysis; Gantt charts (based on data tables and bar charts) are used in project management; funnel charts are used in sales; candlestick charts are used in stock technical analysis. Locations play an important role in many areas of business data analysis and decision-making. Many business activities are associated with locations. It has been gaining increased attention especially with the wide adoption of location sensors (like GPS and other location capture technologies) which generate location data. Location based visuals, commonly based on a map, provide a background or a context that is familiar to the users and make the location related data more comprehensible and perceivable. (Dresner, 2015). The term dashboard originally came from operational status monitoring on machines which provides visual display for quick reading. Its use has been expanded to visualization of digital data associated with business performance on screens (Few, 2004). A dashboard (at the frontend) is basically an integrated application of data (content), visual views, and user interface/interaction (UI). Dashboard = Data + Visualization + User Interface. The data on the dashboards primarily consists of

metrics, key performance indicators (KPIs), and textual information. Metrics (or measures, indicators) are numerical values that measure various aspects of the business activities. Personal or self-service BI: Self-service business intelligence features control in the hands of users, especially power users. This group of people is highly skilled in using technology applications in business tasks, and they often need instant results. They are able to use computer tools and languages to get what they want with little assistance from their information technology (IT) departments. Some of the tools like Tableau and Power BI have quickly risen to satisfy this need using a visualization-driven approach and gained wide recognition, (Sallam, 2017).

Attributes of Information Visualization

Tag clouds

Lee et al (2010) states that tag clouds are visual representation for text data, typically used to depict keyword metadata (tags) on websites, or to visualize free form text. It can be treated as visual summary of document content. Tags are usually single words, and the importance of each tag is shown with font size or colour. More frequently word appears in the document (or on web site) more important it is. Tag clouds are very popular on personal or commercial web pages, blogs and social information sharing sites (Hearst, et al., 2008). Since they became so popular and commonly used there are a lot of web services offering tag clouds creation applications. They can work on different input data types (such as file, website, plain text etc.). Tag clouds can have different shapes and colors. Also, various fonts can be used. Tag clouds can evolve as the associated data sources change over time (Lee, et al., 2010). However classic tag cloud presents the visualization of data source in particular moment of time. When there is a change in data new cloud is created. There is a few of papers concerning the problem of taking time dimension into account on cloud of tags. Most interesting propositions involve distortions of tag shape, transparency regulation or colouring the background of tag in different tones reflecting tag frequency in particular moment of time (Nguyen, et al., 2011). The two other approaches that include time related information on tag clouds are tagline and tag clouds containing line charts for each tag (Lee, et al., 2010). In our research we decided to test second of them. However we made some examples using tagline.

Tagline is a sequence of tag clouds that are associated with time. It is created from a collection of documents. Each document must be assigned to particular time period. Dynamic

slider allows navigating through tag clouds generated for different (subsequent) time periods. Only one tag at time can be displayed.

Figure 1. Examples of tag clouds.

Plot Tables

A data table or a spreadsheet is an efficient format for comparative data analysis on categorical objects. Usually, the items being compared are placed in columns, while the categorical objects are in rows. The quantitative value is then placed at the intersection of the row and column, called the cell. Data visualization is important because it allows us to comprehend large amounts of data and make faster, data-driven decisions. With data visualization, you can efficiently explore your data, understand what your data is telling you, and quickly identify trends, patterns, and relationships. Data visualization also helps us uncover insights that would otherwise be difficult to spot in a raw data set.

Consider the example below:

	A	B	C	D	E
1	Month	Actual	Target		
2	Jan	€ 604,589	€ 542,603		
3	Feb	€ 630,125	€ 462,314		
4	Mar	€ 601,235	€ 542,369		
5	Apr	€ 548,569	€ 458,213		
6	May	€ 369,523	€ 214,896		
7	Jun	€ 425,689	€ 253,624		
8	Jul	€ 542,178	€ 425,869		
9	Aug	€ 822,356	€ 748,695		
10	Sep	€ 758,452	€ 689,523		
11	Oct	€ 702,145	€ 625,314		
12	Nov	€ 623,256	€ 665,847		
13	Dec	€ 523,642	€ 471,236		

Image 1 – data spreadsheet

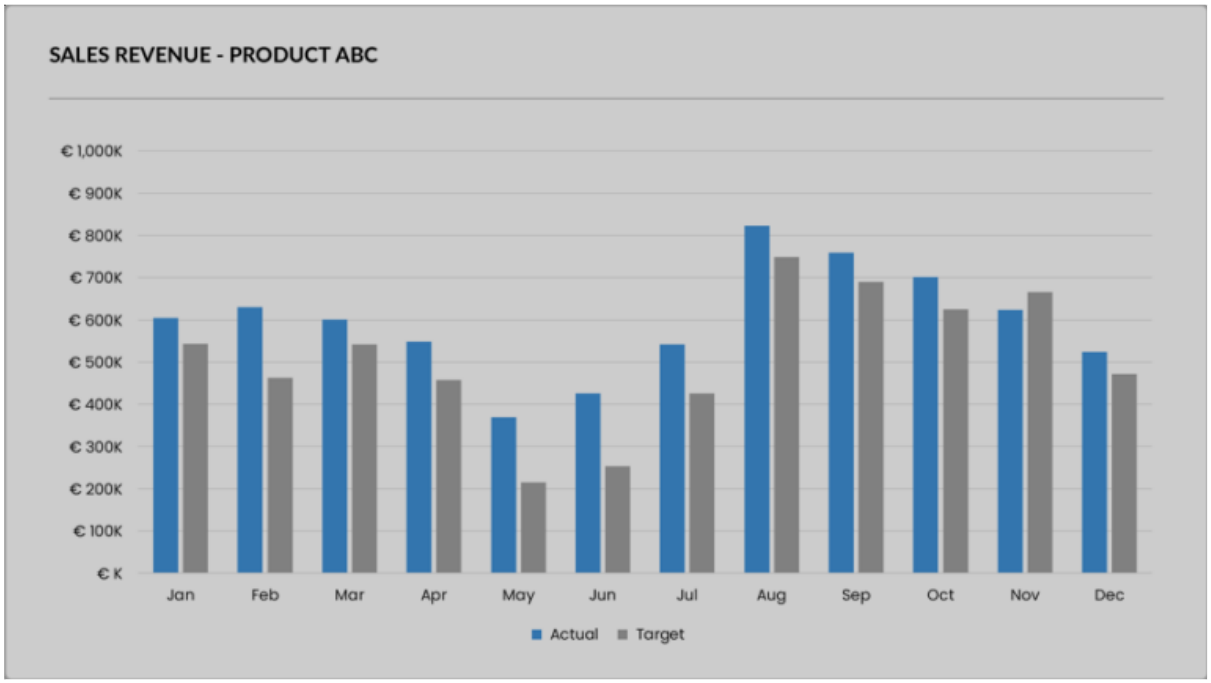
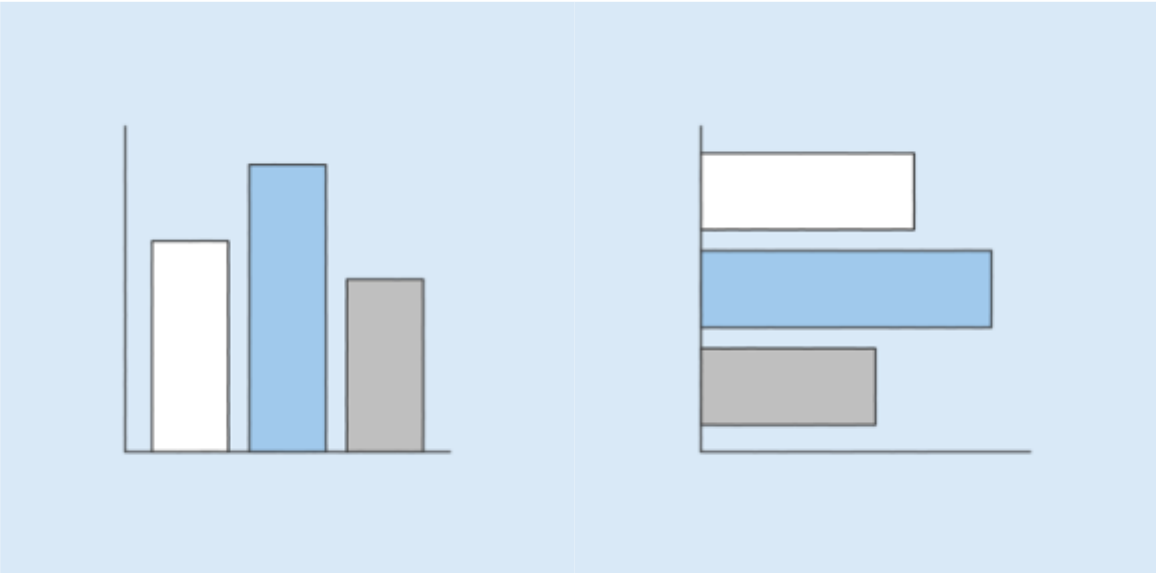


Image 2 – data visualization

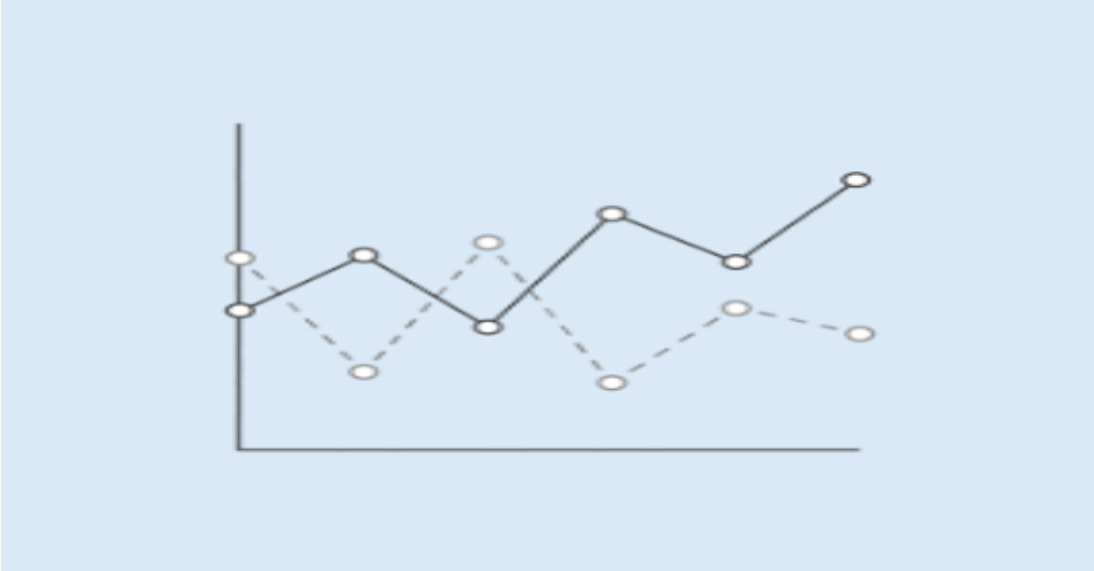
Both images present the same set of data, however, in comparison, data visualization (image 2) makes it faster and easier to understand the whole picture – overall performance throughout the year and comparison of actual vs. target for each month.

Charts

Information visualization charts are graphical representations of information/data that tells a story using symbols in order to improve the understanding of large amounts of information. Visual data metaphors such as charts effectively engage human perceptual processes and amplify human cognition more so than semantic information alone. Information visualization charts and graphs transform enormous volumes of dense, unfocused information/data into comprehensible, meaningful visuals from which valuable; otherwise, hidden insights can be revealed. Charts can illustrate noticeable differences between a few groups. It is much easier to distinguish differences in data with a bar graph. Below are some examples of charts that are commonly used in information/data visualization.



Column Chart Bar Chart



Line Chart

CONCEPT OF DECISION-MAKING EFFICIENCY

According to Wikipedia.com, decisions can be defined as activities we perform every day. Activities related to our daily life are routine actions and they are relatively well defined. However, really important decisions, such as the strategic ones can be difficult to make, as they need a lot of information and, consequently, knowledge in order to make informed decisions that will result in the success and overall efficiency of organisations. Decision making may be reviewed as the process of selecting a course of action from among several

alternatives in order to accomplish a desired result. The purpose of decision-making is to direct human behaviour and commitment towards a future goal. If there are no alternatives, if no choice is to be made, if there is no other way-out, then there would be no need for decision making. It involves committing the organization and its resources to a particular choice or course of action thought to be sufficient and capable of achieving some predetermined organizational objectives.

Managers at all organizational levels make decision and solve problems. In fact, decision-making is the process of reducing the gap between the existing situation and the desired situation through solving problems and making use of opportunities. A decision is a course of action consciously selected from available alternatives, with a view to achieving a desired goal. It is an outcome of the judgment and represents a choice and commitment to the same. It is a final resolution of a conflict of needs, means or goals made are the face of uncertainty, complexity and multiplicity. A decision is conclusion reached after consideration; it occurs when one option is selected to the exclusion of others; it is rendering of judgment.

Informed Decisions

Informed decision making refers to making business decisions based on accurate, reliable and relevant information. It involves gathering and analyzing data, considering multiple perspectives, and using critical thinking skills to evaluate options and make the best choice. Informed decision making requires decision makers to be knowledgeable about their teams and specific circumstances. It entails using sound judgement to weigh the risks and benefits of different options and consider their decisions' potential outcomes and impacts.

Quality Decisions

According to Wikipedia.com decision quality refers to the quality of a decision at the moment it was made, regardless of its outcome. Decision quality concepts permit the assurance of both effectiveness and efficiency in analysing decision problems. In that sense, decision quality can be seen as an extension to data analysis. Decision quality also describes the process that leads to a high-quality decision.

METHODS

The study population consisted of 20 small and medium enterprises operating within Port Harcourt Metropolis. Four executives occupying leadership positions were selected from each organisation, making a total of 80 participants which serve as the sample size. A cross sectional survey strategy was adopted for the study. The content validity of the instrument was established by giving a set of the draft questionnaire to four senior executives involved in daily decision-making in their organisations and four questionnaires to other researchers in the specific area of executive decision-making. These executives reviewed the content of the instrument and confirmed that the items were suitable for gathering relevant data for the research study.

Data Analysis

To empirically evaluate the relationship between the predictor and criterion variables of this study (including their dimensions and measures), the spearman's rank order of correlation coefficient (RHO) was adopted. As a tool, it is considered to be more flexible and it is not limited or confined to parameters statistical assumption such as applicable in the Pearson's product moment correlation. The analysis was executed using the scientific package for social sciences (SPSS) version 23 software.

We begin by showing evidence of a relationship between the variables.

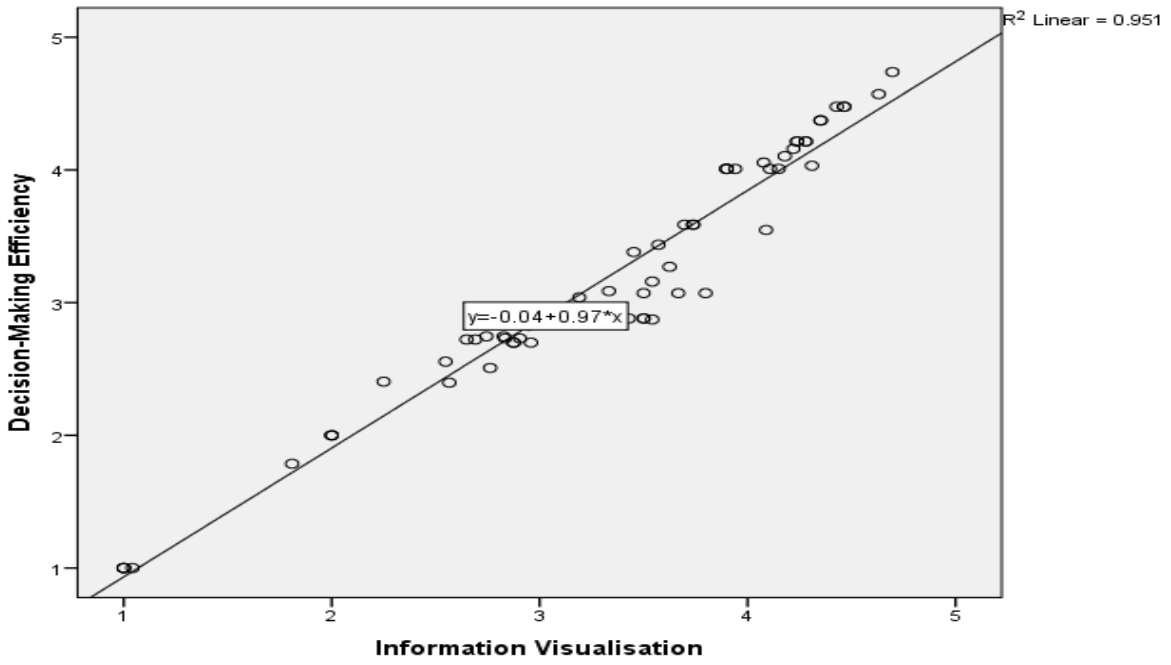


Figure 1: Scatter plot for information virtualisation and decision-making efficiency

Figure 1 shows a strong relationship between information virtualisation (independent variable) and decision-making efficiency (dependent variable). The scatter plot graph shows that the linear value of (0.951) depicting a very strong viable and positive relationship between the two constructs. The implication is that an increase in information virtualisation simultaneously brings about an increase in the level of decision-making efficiency. The scatter diagram has provided vivid evaluation of the closeness of the relationship among the pairs of variables through the nature of their concentration.

Table 1: Correlations for Tag Clouds and Efficient Decision-Making Measures

			Tag Clouds	Informed Decisions	Quality Decisions
Spearman's rho	Tag Clouds	Correlation Coefficient	1.000	.957**	.956**
		Sig. (2-tailed)	.	.000	.000
		N	64	64	64
	Informed Decisions	Correlation Coefficient	.957**	1.000	.941**
		Sig. (2-tailed)	.000	.	.000
		N	64	64	64
	Quality Decisions	Correlation Coefficient	.956**	.941**	1.000
		Sig. (2-tailed)	.000	.000	.
		N	64	64	64

**. Correlation is significant at the 0.01 level (2-tailed).

Source: SPSS Output

Ho_1: There is no significant relationship between tag clouds and informed decisions of small and medium enterprises in Port Harcourt.

Table 1 shows a Spearman Rank Order Correlation Coefficient (rho) of 0.957 on the relationship between tag clouds and informed decisions. This value implies that a very strong relationship exists between the variables. The direction of the relationship indicates that the correlation is positive; implying that an increase in informed decisions s was as a result of the tag clouds. Table 1 also shows the statistical test of significance (p-value) which makes possible the generalization of our findings to the study population. From the result obtained the sig- calculated is less than significant level ($p = 0.000 < 0.05$). Therefore, based on this finding the null hypothesis earlier stated is hereby rejected and the alternate upheld. Thus, there is a significant relationship between tag clouds and informed decisions of small and medium enterprises in Port Harcourt.

Ho2: There is no significant relationship between tag clouds and quality decisions of small and medium enterprises in Port Harcourt.

Table 1 shows a Spearman Rank Order Correlation Coefficient (rho) of 0.956 on the relationship between tag clouds and quality decisions. This value implies that a very strong relationship exists between the variables. The direction of the relationship indicates that the correlation is positive; implying that an increase in quality decisions s was as a result of the tag clouds. Table 1 also shows the statistical test of significance (p-value) which makes possible the generalization of our findings to the study population. From the result obtained the sig- calculated is less than significant level ($p = 0.000 < 0.05$). Therefore, based on this finding the null hypothesis earlier stated is hereby rejected and the alternate upheld. Thus, there is a significant relationship between tag clouds and quality decisions of small and medium enterprises in Port Harcourt.

Table 2: Correlations for Plot Tables and Efficient Decision-Making Measures

			Plot Tables	Informed Decisions	Quality Decisions
Spearman's rho	Plot Tables	Correlation Coefficient	1.000	.850**	.843**
		Sig. (2-tailed)	.	.000	.000
		N	64	64	64
	Informed Decisions	Correlation Coefficient	.850**	1.000	.941**
		Sig. (2-tailed)	.000	.	.000
		N	64	64	64
	Quality Decisions	Correlation Coefficient	.843**	.941**	1.000
		Sig. (2-tailed)	.000	.000	.
		N	64	64	64

**. Correlation is significant at the 0.01 level (2-tailed).

Source: SPSS Output

Ho3: There is no significant relationship between plot tables and informed decisions of small and medium enterprises in Port Harcourt.

Table 2 shows a Spearman Rank Order Correlation Coefficient (rho) of 0.850 on the relationship between plot tables and informed decisions. This value implies that a very strong relationship exists between the variables. The direction of the relationship indicates that the correlation is positive; implying that an increase in informed decisions s was as a result of the tag clouds. Table 2 also shows the statistical test of significance (p-value) which makes

possible the generalization of our findings to the study population. From the result obtained the sig- calculated is less than significant level ($p = 0.000 < 0.05$). Therefore, based on this finding the null hypothesis earlier stated is hereby rejected and the alternate upheld. Thus, there is a significant relationship between plot tables and informed decisions of small and medium enterprises in Port Harcourt.

Ho_4: There is no significant relationship between plot tables and quality decisions of small and medium enterprises in Port Harcourt.

Table 2 shows a Spearman Rank Order Correlation Coefficient (rho) of 0.843 on the relationship between plot tables and quality decisions. This value implies that a very strong relationship exists between the variables. The direction of the relationship indicates that the correlation is positive; implying that an increase in quality decisions s was as a result of the t plot tables. Table 2 also shows the statistical test of significance (p-value) which makes possible the generalization of our findings to the study population. From the result obtained the sig- calculated is less than significant level ($p = 0.000 < 0.05$). Therefore, based on this finding the null hypothesis earlier stated is hereby rejected and the alternate upheld. Thus, there is a significant relationship between plot tables and quality decisions of small and medium enterprises in Port Harcourt.

Table 3: Correlations for Charts and Efficient Decision-Making Measures

			Charts	Informed Decisions	Quality Decisions
Spearman's rho	Charts	Correlation Coefficient	1.000	.742**	.773**
		Sig. (2-tailed)	.	.000	.000
		N	64	64	64
	Informed Decisions	Correlation Coefficient	.742**	1.000	.941**
		Sig. (2-tailed)	.000	.	.000
		N	64	64	64
	Quality Decisions	Correlation Coefficient	.773**	.941**	1.000
		Sig. (2-tailed)	.000	.000	.
		N	64	64	64

**. Correlation is significant at the 0.01 level (2-tailed).

Source: SPSS Output

Ho_5: There is no significant relationship between charts and informed decisions of small and medium enterprises in Port Harcourt.

Table 3 shows a Spearman Rank Order Correlation Coefficient (rho) of 0.742 on the relationship between charts and informed decisions. This value implies that a strong relationship exists between the variables. The direction of the relationship indicates that the correlation is positive; implying that an increase in informed decisions s was as a result of the charts. Table 3 also shows the statistical test of significance (p-value) which makes possible the generalization of our findings to the study population. From the result obtained the sig- calculated is less than significant level ($p = 0.000 < 0.05$). Therefore, based on this finding the null hypothesis earlier stated is hereby rejected and the alternate upheld. Thus, there is a significant relationship between charts and informed decisions of small and medium enterprises in Port Harcourt.

Ho_6: There is no significant relationship between charts and quality decisions of small and medium enterprises in Port Harcourt.

Table 3 shows a Spearman Rank Order Correlation Coefficient (rho) of 0.773 on the relationship between charts and quality decisions. This value implies that a strong relationship exists between the variables. The direction of the relationship indicates that the correlation is positive; implying that an increase in quality decisions s was as a result of the t plot tables. Table 3 also shows the statistical test of significance (p-value) which makes possible the generalization of our findings to the study population. From the result obtained the sig- calculated is less than significant level ($p = 0.000 < 0.05$). Therefore, based on this finding the null hypothesis earlier stated is hereby rejected and the alternate upheld. Thus, there is a significant relationship between charts and quality decisions of small and medium enterprises in Port Harcourt.

DISCUSSION OF FINDINGS

The result revealed that there is a positive significant relationship between information virtualisation and efficient decision-making of small and medium enterprises in Port Harcourt. Information virtualization is a concept that has gained significant attention and recognition in recent years, particularly in the context of small and medium-sized enterprises (SMEs) in Port Harcourt. Okoye (2017) contend that information virtualization refers to the process of abstracting and encapsulating data from multiple sources into a single, unified

view that can be accessed and manipulated by users. This technology allows SMEs to integrate and manage their data from various sources, such as databases, applications, and systems, without the need for physical or geographical constraints. The benefits of information virtualization for SMEs in Port Harcourt are numerous. Firstly, it enables SMEs to have a holistic view of their data, which enhances decision-making processes. By consolidating data from different sources into a unified view, SMEs can gain valuable insights and make informed decisions based on a comprehensive understanding of their data. Additionally, information virtualization enables SMEs to improve data quality and consistency. By integrating data from multiple sources, SMEs can identify and rectify inconsistencies, redundancies, and errors, leading to improved data accuracy and reliability. Furthermore, information virtualization enhances the scalability and flexibility of SMEs' data infrastructure. As Okoye (2017) suggests, this technology allows SMEs to easily expand their data sources and integrate new systems without the need for extensive modifications or disruptions to their existing infrastructure. This scalability and flexibility enable SMEs to adapt to changing business requirements and effectively manage their growing data volumes. In conclusion, information virtualization offers significant concepts and benefits for SMEs in Port Harcourt, including a holistic view of data, improved data quality, and scalability and flexibility of data infrastructure (Okoye, 2017).

Information visualization has become increasingly important in decision-making processes within small and medium-sized enterprises (SMEs) in Port Harcourt, Nigeria. According to Okoye (2017), the implementation of information virtualization technologies has had a profound impact on the decision-making capabilities of SMEs in this region. Information visualization refers to the process of integrating and consolidating data from multiple sources into a unified virtual view. This allows decision-makers to access and analyze information from various systems and databases, enabling them to make more informed and timely decisions. The use of information virtualization in Port Harcourt SMEs has improved their ability to gather, store, and analyze vast amounts of data, leading to more effective decision-making. By providing decision-makers with a comprehensive view of their business operations, information visualization enables them to identify patterns, trends, and insights that were previously hidden within the data. This enhanced visibility not only improves the accuracy of decision-making but also enables SMEs to respond more quickly to market changes and opportunities. Moreover, information visualization also facilitates collaboration

and knowledge sharing among different departments and stakeholders within SMEs, thereby enhancing the overall decision-making process. In conclusion, the impact of information visualization on decision-making processes in Port Harcourt SMEs has been significant, leading to improved efficiency, accuracy, and responsiveness in their operations (Okoye, 2017).

CONCLUSION AND RECOMMENDATIONS

The study concludes information virtualisation positively enhances efficient decision-making of small and medium enterprises in Port Harcourt. It suggests that implementing information virtualization technologies in these businesses has a beneficial impact on their decision-making processes.

Therefore, based on the foregoing conclusion, the following recommendations were made:

i. SMEs in Port Harcourt should consider implementing tag clouds as a part of their decision-making processes. Tag clouds can help present key information and trends visually, making it easier for decision-makers to quickly grasp essential insights.

ii. SMEs in Port Harcourt should consider adopting plot tables as a valuable tool for decision-making. Plot tables can present complex data in a concise and visually appealing manner, making it easier for decision-makers to understand trends and patterns.

iii. SMEs in Port Harcourt should raise awareness among decision-makers and employees about the benefits of using plot tables for decision-making. Conduct training sessions to ensure that everyone understands how to create, interpret, and utilize plot tables effectively.

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