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Review

Practical documentation of qualifying research activities for the SR&ED tax credit

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The Canadian tax program for Scientific Research and Experimental Development (SR&ED) is a crucial component of Canadian economic policy as it encourages domestic companies to engage in risk-taking initiatives through tax incentives such as credits. While the SR&ED program has evolved over the decades, the SR&ED Five Questions have established the principal criteria that determine the eligibility of an SR&ED claim. The key take-away points of this paper are that the Canada Revenue Agency is progressively becoming more particular and stringent when reviewing SR&ED claims and in light of this trend, documentation is becoming ever important in the substantiation of SR&ED claims. Although not required with submission, documentation provides taxpayers with evidence to support their claims in the case of a CRA or court challenge. In the event of an audit, a taxpayer must prove that its SR&ED activities are eligible and meets the "Five Question Test." As this paper argues, recent case law has shown the importance of clear and relevant supporting evidence, especially documentation, in substantiating that an SR&ED project meets the Five Questions criteria.

Key words: Tax, taxation, research and development, accounting, incentive, tax credit, canada, scientific research and experimental development.

INTRODUCTION

The Scientific Research and Experimental Development (SR&ED) Tax Incentive Program rewards Canadian taxpayers for engaging in research and development (R&D) activities within Canada. All Canadian businesses, regardless of size and industry, are eligible for the program, provided that the R&D work conducted meets the requirements of the SR&ED definition as outlined in subsection 248(1) of the Income Tax Act. This defines SR&ED as a "systematic investigation or search that is carried out in a field of science or technology by means of experiment or analysis" (Canada Revenue Agency, 2017).

SR&ED tax incentives have historically offered extensive benefits to Canadian taxpayers, encouraging domestic innovation and business growth. However, like Australia, the U.S and the U.K, the Canadian Government is currently under pressure to increase tax revenues while maintaining constituent satisfaction and local business support. As such CRA has been cleverly using the judicial system to defend its increasingly more narrow definition of SR&ED expenditure by using the often vague and ambiguous substantiation issue. In recent years, a number of court cases have been handed down in favor of the Government on the basis that the taxpayer did not

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have sufficient documentation to substantiate an SR&ED claim. It is now generally accepted that that CRA will deny SR&ED expenditure or activities where a taxpayer has not kept clear and relevant documentation.

OVERVIEW OF SR & ED CRITERIA

To qualify as SR&ED, a research activity must satisfy the following five questions (Tax Court of Canada, 2017):

(1) Was there a technological risk or uncertainty that routine engineering or standard procedures could not remove?
(2) Did the person claiming to do SR&ED formulate hypotheses specifically aimed at reducing or eliminating that technological uncertainty?
(3) Is the procedure adopted in accordance with the total discipline of the scientific method including the formulation, testing, and modification of hypotheses?
(4) Did the process result in technological advancement?
(5) Was a detailed record of the tested hypotheses and results kept as the work progressed?

The Canada Revenue Agency (CRA) strongly emphasizes the importance of keeping supporting evidence to substantiate SR&ED claims and ensure eligibility (CRA, 2015a). As of 2013, a penalty of $1,000 per SR&ED claim was incorporated into the *Income Tax Act*, if requested information on a tax preparer's claim form was found missing, incomplete, or inaccurate (CRA, 2015b). Evidently, it is essential that tax preparers are diligent in providing the necessary documentation in support of their SR&ED claims. Taxpayers can benefit from the SR&ED Tax Incentive Program in two ways:

(1) SR&ED expenditures can be deducted from income for tax purposes
(2) Taxable income, as calculated under Part I of the *Income Tax Act*, can be reduced using the SR&ED investment tax credit and remaining credit may be refunded in some cases.

Canadian-controlled private and other corporations, individuals, trusts, and partnerships are all eligible for the SR&ED investment tax credits (ITC), although there are different credit rates depending on the nature of the taxpayer. For eligible SR&ED expenditures that do not exceed $3 million, Canadian-controlled private corporations are eligible for a 100% refundable ITC at a rate of 35% of expenditures. For amounts that surpass the $3 million threshold, Canadian-controlled private corporations are eligible for a non-refundable ITC at the basic rate of 15% of expenditures. In some cases, these corporations could earn a 40% refundable ITC at the basic rate of 15% of expenditure amounts that exceeded the $3 million threshold. Individual proprietorships, trusts,

and other corporations can earn an ITC at the basic rate of 15% on eligible SR&ED expenditures. For individuals and trusts, this amount is refundable whereas it is non-refundable for other corporations. Since a partnership is not a taxpayer, partnerships' ITC amounts are calculated at the level of partner and then allocated to eligible members. In sum, all business types in Canada have the potential to benefit from the SR&ED tax incentive program.

CASE LAW

The CRA uses documentation as a key means of determining and, in some cases, challenging technological eligibility of a claim for the SR&ED program. According to a Canadian Advanced Technology Alliance (CATA) report, the federal government reduced innovation funding by $4.7 billion between 2009 and 2016 (Canadian Advanced Technology Alliance, 2016). Yet, companies engaging in SR&ED should be not be discouraged by this reduction in funding since they can still access the benefits of SR&ED credits, provided they are able to properly substantiate their SR&ED claims. While the CRA does not offer strict guidelines as to what can be used as supporting evidence, recent legal cases emphasize the importance of accurately and clearly documenting SR&ED activities. If substantial evidence cannot be presented when requested, the SR&ED claim will likely be dismissed.

In 1997, a landmark ruling in *Northwest Hydraulic Consultants Limited v. The Queen* (Tax Court of Canada, 2017) stated that "technological advancement" was synonymous with "advancements in general understanding". From this ruling, the "SR&ED Five Questions" test was established to determine the eligibility of an SR&ED claim. It maintained the utility of detailed records of hypotheses, tests, and results in providing sufficient evidence of SR&ED and strengthening an SR&ED claim. Joel Theatrical Rigging (JTR) Contractors (1980) Ltd. v. and The Queen (TCC, 2017) discussed the criteria of scientific eligibility. In this case, JTR contested the CRA's refusal of its SR&ED projects. Their claim had been rejected on the basis that it did not meet the "scientific eligibility" criteria. The court sided with the CRA, finding that JTR's projects did not fall under this category. The court stated, "To constitute SR&ED, a particular project must address a problem or a type of uncertainty (typically described in the jurisprudence as 'technical risk or uncertainty' or 'technological uncertainty') that cannot be resolved by routine engineering or standard procedures (TCC, 2017)." The court provided some of the following arguments when determining scientific eligibility of SR&ED activities:

(i) The project did not appear to be carried out by

competent professionals with technical diplomas or experience in mechanical or hydraulic design. "…the research teams did not include any professional engineers or researchers who held a university degree in engineering...(TCC, 2017)"

(ii) There was a lack of testing that formed one or more hypothesis. The judge used the definition: "...a hypothesis is a statement to be tested by an experiment or a trial (TCC, 2017)."

(iii) There was a lack of a thorough experimental process. For example, during trials, the rate of the curtain's descent was not measured:

"It seems that if the scientific method had been used (that is, if there had been systematic observation, measurement and experiment), Mr. Marineau and his colleagues would have determined the precise weight used in the experiments and would have precisely measured the duration of the descent in each experiment so that they could determine whether, as they moved from one experiment to the next, the duration of the descent was increasing or decreasing (TCC, 2017)."

As such, it can be inferred that a project with an identifiable hypothesis (even if implicit) and at least some level scientific thoroughness, such as a process of measuring, can distinguish a systematic scientific investigation from a "trial and error" process. Proper record keeping could have distinguished the systematic process from random "trial and error" by clearly outlining hypotheses and potential designs, results from testing and experiments, and modifications to original designs based on testing results. In the case of JTR, the research team failed to keep records tracking the progression of work. They did not know even the exact weight of the curtain or the duration of the experiment, and the lack of documentation meant they could not prove that their work fulfilled the criterion of "scientific eligibility".

In *Jentel Manufacturing Ltd. v. The Queen* (TCC, 2011), Justice D'Arcy dismissed the case of Jentel on appeal on the grounds that their claim for the SR&ED credit did not prove technological risk or advancement. In this case, the court found that none of Jentel's activities constituted eligibility for SR&ED. Justice D'Arcy's ruling asserted two important points:

(i) Jentel had indeed provided evidence by means of sufficient documentation and records showing they had undertaken a "systematic investigation";

(i) However, although it was established that Jentel had undertaken a systematic investigation, there was no documentation or evidence to prove that it was undertaken with technological uncertainty to achieve technological advancement.

The failure of the Jentel case was largely due to the taxpayer relying on a SAF (Statement of Agreed Facts), which is a record of facts agreed upon between the taxpayer and Crown, so there is no need for evidence to prove the facts later on. However, the SAF limits the amount of information that can be interpreted by a presiding judge. This heavy emphasis on the SAF as opposed to other forms of documentation cost Jentel a favourable outcome from the trial (TCC, 2011).

On the one hand, in special circumstances, oral testimony could also suffice as evidence in defending a claim when there is a noticeable absence of documentation. In 1998's *RIS Christie v Canada* (Canadian Legal Information Institute, 1998) case, Judge J.A. Robertson ruled in favour of the taxpayer on appeal, noting that while the taxpayer lacked adequate documentation, the oral evidence provided by expert witnesses in subsequent investigations was sufficient to prove the existence of technological advancement and thereby confirmed that SR&ED had taken place. Similarly, in *ACSIS EHR (Electronic Health Record) Inc. v. The Queen* (TCC, 2016), a taxpayer appealed the disallowance of the SR&ED credit and used the testimony of four witnesses in support of the appeal. The Tax Court of Canada ruled in favour of the taxpayer despite their documentation not being as detailed as generally required because of appropriate oral testimony provided.

As Justice Archambault stated in *116736 Canada Inc. v. The Queen* (TCC, 1998) stated:

"However, the Act and the Regulations do not require that such written reports be produced in order for a taxpayer to qualify for the deduction of such expenditures: it is possible to adduce evidence by way of oral testimony. Whether the Minister or a judge could conclude that the activities purported to have been carried out by the taxpayer were actually carried out then becomes a question of credibility."

These cases assert that oral testimony can offer viable support for an SR&ED claim, if the evidence meets the SR&ED Five Questions. This entails that witnesses who provide the evidence must be credible, namely either technical or scientific experts in their field, and must prove that the project encompassed technological uncertainty and resulted in advance. Moreover, to prevent the risk of an initial unfavourable claim outcome and avoid a subsequent challenge, which may be more costly than the worth of the SR&ED claim itself, taxpayers are encouraged to engage in the practice of record keeping and documentation to substantiate that they have met the SR&ED criteria. At the same time, documentation does not inherently guarantee a successful SR&ED claim. Rather, as recent case law suggests, the quality of the documentation is also important, particularly that it must be clear, eligible, and relevant in relation to the SR&ED Five Questions.

In *Maritime-Ontario Freight Lines Limited v The Queen* (TCC, 2003*)*, Justice Sarchuk ruled against the taxpayer Maritime-Ontario. He stated that not only are the

requirements of a proper and detailed scientific experimentation to be backed up by detailed records (subject to independent verification), an acceptable level of documentation should also clearly describe the processes and how the final details were arrived at. Here, Justice Sarchuk stated that the submitted documentation was unintelligible, not only to the court, but also to any party like the CRA, and thus did not constitute supporting evidence.

In *Mac & Mac Hydrodemolition Services Inc. v. The Queen* (TCC, 2017), Justice David E. Graham ruled against the taxpayer's appeal on whether the expenditures of Mac and Mac qualified as SR&ED expenditures. Although Mac and Mac kept sets of notes, which described the testing of various parameters, there were no notes confirming any mention of a scientific hypothesis and details were vague. Mac and Mac did not provide adequate documentation demonstrating a systematic process of hypothesis formulation, testing, and results analysis, thereby failing to fulfil requirements of the SR & ED Five Questions. In the appeal's ruling, Justice Graham noted, "while evidence of the outcome is important, it is critical to technological advancement that the rigours of adherence to the scientific and experimental method are kept on a detailed and concurrent basis with the conduct of the experiments (TCC, 2017)."

These cases reveal that supporting evidence, whether in the form of documentation or oral testimony, must corroborate the SR&ED criteria in order to ensure a successful outcome of an SR&ED claim or challenge. Supporting evidence must also be accurate, thorough, legible, and clear when substantiating a claim, particularly in demonstrating adherence to the SR&ED Five Questions.

ANALYSIS OF CRA GUIDENCE AND CASE LAW

As the RIS Christie and ACSIS EHR cases demonstrate, documentation is not required in every circumstance. It is arguable however, that clear and relevant documentation does help to solidify a SR&ED claim, the CRA or the courts should contest it. Failure to keep detailed and articulate documentation proved to be a downfall for Maritime-Ontario and Mac and Mac, as their documents were dubbed "unintelligible" and "no notes mentioning of any hypotheses." When keeping records, it is important to ensure they are clear and concise to be devoid of any such doubts.

The CRA notes that the following points are grounds for contestation if they are not addressed fully when carrying out an SR&ED project (CRA, 2015a):

(i) The scientific or technological objectives of the project are not clear.
(ii) The scientific or technological advancement is not clear, or appears to be standard practice for that industry within the claimant's business context.
(iii) A systematic investigation or search through experimentation or analysis is not apparent.
(iv) The nature and extent of the work conducted in the tax period is not clear.
(v) Some of the claimed work does not appear to be included in the definition of SR&ED in subsection 248(1) of the *Income Tax Act*.
(vi) Some of the support work claimed does not appear to be commensurate with the needs, or directly in support, of the SR&ED work.
(vii) It is not clear how the use or amount of the claimed materials relates to the claimed SR&ED.

These specific guidelines were overlooked by the taxpayer in the JTR case, who was found to have conducted minimal testing, lacked consultation with certified experts in the field, and had no detailed records or documentation to show a thorough experimentation process. The same can be said for the Jentel case, where the taxpayer could not adequately prove with documentation that there was technological uncertainty to achieve technological advancement within its SR&ED project.

CASE STUDY

Qualified Research Activities (QRAs) and Qualified Research Expenses (QREs) are the two parts that make up the SR&ED Tax Credit. The purpose of this case study, using a fictional company, LawBot, Inc., is to determine what does and does not qualify as eligible activities and expenses, in light of the CRA's "Five Question Test".

LawBot, Inc. is a developer of streamlined, business-focused solutions using data analytics and machine learning. It aims to advance the functionality, utility and efficacy of software solutions by employing Data Analytics and Artificial Intelligence (AI) strategies. In the tax year being claimed, LawBot, Inc. undertook research activities to develop a new legal search engine using machine learning. Historically, search engines used in the legal industry have been cumbersome, difficult to use, counter-intuitive and inefficient. LawBot, Inc. sought to streamline the legal research process by introducing machine learning, allowing for faster retrieval of information more accurately and reliably. The four stages of product development undertaken in this project are outlined in Table 1.

ANALYSIS OF ACTIVITIES

Figure 1 outlines the relationship between technological information (L) discovered by LawBot, Inc. over the time (T) of the project. It is also worth mentioning that Figure 1 is contrasted to Table 1.

Table 1. Software development activities for LawBot, Inc.'s projects.

S/N	Activity	Description
I	Research of existing technological information (ineligible activity)	Idea to develop a web-based, comprehensive legal search engine using machine learning and Artificial Intelligence is conceptualized. Gap in the existing legal research market is identified. This stage consists of literature reviews of machine learning methodologies, consumer surveys, and researching past technologies that may offer similar, albeit limited, functionality.
II	Economic evaluation (ineligible activity)	Before continuing with its projects, LawBot, Inc. identifies the risks associated with its developments. The company will decide whether to continue with the projects or terminate them based on its economic evaluation and risk assessment.
III	Prototyping and trialing (QRA)	LawBot, Inc. engages in a systematic process of experimentation where it undergoes an iterative development process. This involves developing one or more hypotheses drawn from academic research. As LawBot, Inc. is one of the first companies to apply machine learning for the legal industry, the company must test and trial theories developed from academia to determine if they are effective and applicable to LawBot's niche industry. From these theories, LawBot develops a model to train the algorithm to retrieve legal information quickly and accurately. The model is tested and evaluated. From testing results, it is found that there are limits to the suggestions found in academic practice. The model is modified and refined according to performance, processing speed, relevancy, and consistency. Further testing is conducted to improve the model with changes made to the algorithm and methodology. Since machine learning is under-developed and given the limitations in existing academic research, LawBot is able to advance the technological knowledgebase from its experiments.
IV	Commercial production (ineligible activity)	Latest design is accepted and the software is ready to be passed on to consumer markets. This phase also requires maintaining the software, as it is never a perfect, final product; the coding will change to keep up with new and advancing legal developments as well as long term maintenance of the database.

Over the course of its software projects, LawBot, Inc. encountered four progressive information stages:

(1) Point L0 = LawBot, Inc.'s technological knowledge before the project commenced;
(2) Point L1 = research required before ensuing the software project;
(3) Point L2 = through a systematic process of experimentation, the knowledge gained through LawBot's prototyping and trialing activities, that is, testing, analysing, hypothesizing, modeling, simulation; and
(4) Point L3 = the information that was culled from LawBot's prototyping and trialing.

Activity I: Research of Existing Technological Information
Because this activity refers to existing technology and the building of a knowledgebase rather than the generation of new knowledge, this first activity is not considered a QRA.

As shown in Figure 1 from point L0 to L1, LawBot, Inc. gained technological insight due to its research. However, given that the nature of this research is not new or groundbreaking, it does not qualify as a QRA as outlined by the CRA. Although this activity does not qualify as a QRA, documentation may be generated, thus it can later be used to substantiate a claim should an audit be conducted by the CRA.

Activity II: Economic evaluation
As outlined in Figure 1, this activity does not qualify as a

QRA. Economic evaluation and risk assessment is not an activity that generates new technological information, but simply refers to business objectives and thus cannot be classed as R&D as it does not meet the "Five Question Test".

Activity III: Prototyping and trialing
Due to the experimental nature of the prototyping and trialing period, LawBot, Inc.'s activities during this stage meet the CRA's "Five Question Test". New knowledge is generated and technical advance is achieved. Expenses incurred during this stage of the production process can be eligible for the SR&ED tax credit.

Activity IV: Commercial production
Commercial production, the passing of the software to consumer markets, does not generate new technological information or involve experimentation, thus does not meet the CRA's "Five Question Test," and therefore cannot to be classed as a QRA.

DETAILED ANALYSIS OF THE ACTIVITIES AND MEETING THE "FIVE QUESTIONS"

Out of the four activities mentioned in Table1, only one qualifies as a QRA: Activity III, Prototyping and Trialing. This analysis will detail how LawBot, Inc. met the CRA's "Five Part Test".

1. Was there any technological risk or uncertainty which
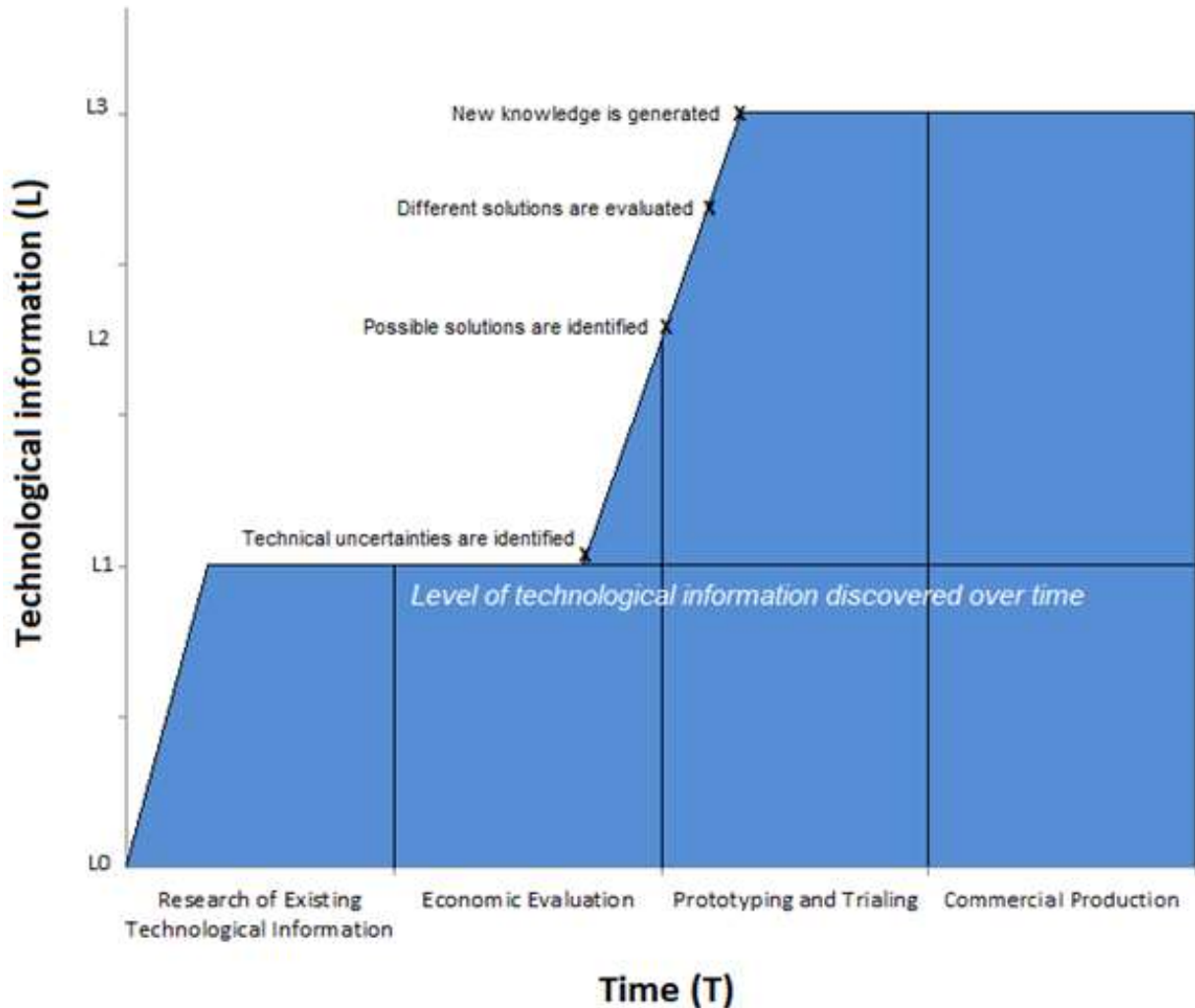
Figure 1. Progression of technological advancements vs. product development activities.

routine engineering or standard procedure could not remove? In Activity III, Prototyping and Trialing, the process of developing software solutions using data analytics and AI was not straightforward and encompassed technological risk. While a growing field, AI methodology currently exists more so in theoretical research papers than real-life business applications. Given that most of AI is theory, there was no guarantee that the outcomes suggested in theory could be applicable in real-world contexts. Routine engineering and standard procedure testing were not sufficient to eliminate the technological uncertainties surrounding LawBot's software solutions. It was determined that, to eliminate uncertainties, LawBot, Inc. had to engage in a systematic process of experimentation and testing.

Documentation

The purpose of documentation for this stage is to establish the existing industry benchmark or knowledgebase, and to substantiate how the company's activities advance or go beyond this benchmark. Documentation for this phase of software development included literature reviews, background research, and development plans to name a few. Although these forms of documentation are not related to QRAs, they could be used in the event of an audit.

2. Did the person/business claiming to do SR&ED formulate hypotheses specifically aimed at reducing or eliminating that technological uncertainty?
LawBot aimed to develop a comprehensive legal search engine that was more accurate, reliable, and intuitive than what currently exists on the market. This involved the formulation of hypotheses specifically aimed at reducing uncertainties related to feasibility, methodology, and design. From research, brainstorming, feasibility studies, and analyses, LawBot identified the best design options that will undergo testing and evaluation. During

this stage, exact technical uncertainties and risks are determined whilst potential solutions or hypotheses are developed.

3. Is the procedure adopted in accordance with the total discipline of the scientific method including the formulation, testing and modification of hypotheses?
The projects that were undertaken by LawBot, Inc. did meet the requirements of the scientific method, that is, formulation, testing and modification of hypotheses. The company's formulation of hypotheses was spurred from its research of already existing, but limited, technologies (Activity I). The company, from the outset, wanted to develop a legal search engine, and had to implement the elements of the scientific method since no comparable software existed anywhere in the market. In order to create tangible software products, hypotheses were formulated based on the academic and theoretical research. Once the projects were dubbed as financially sound (Activity II), testing of the hypotheses then ensued. This included testing and retesting codes and algorithms, which ultimately lead to the modification of the hypotheses in order to produce products (Activity III) that were to an acceptable industry standard before they could be released to a mass market (Activity IV).

Documentation

Documentation for this phase is imperative to substantiating the SR&ED claim. Documents must be able to demonstrate the existence of technological uncertainties and risks and the progression of work to eliminate these uncertainties. The exact documents will vary from industry to industry. For example, tangible evidence of SR&ED activities could include conceptual sketches, various screenshots over time, images of prototypes during testing, email correspondence between technical personnel, meeting notes, and others. To substantiate QREs, timesheets, invoices, general ledgers, and other accounting information may be used, provided the personnel and supplies are directly related to the experiments.

4. Did the process result in technological advancement?
In reference to Activities I to III, the generation of new knowledge increases as time progresses, thus LawBot, Inc.'s project lead to technological advancement. To develop its software solution, the company had to start with researching technological information that already exists. Upon discovering that AI is mostly theoretical and is a new concept, very few examples of comparable products existed in the market, especially for legal research. The limitations of existing technologies and gaps in the technological knowledgebase were therefore identified. This progressed to Activity II, whereby the company considered the economic risk, viability, and potential profitability before committing to the project.

Once the project passed the company's economic evaluation, LawBot proceeded to Activity III during which hypotheses were formulated, tested, and modified. Advance was achieved at this stage since new knowledge was generated from experimentation and testing. The technological advancement relied on the principles of the hard sciences, particularly engineering and computer science. After the experimentation process is complete, commercial production of the legal search engine is carried out.

Documentation

Technological advance can be substantiated from records that describe the project's objectives and the experimentation process. This includes electronic project boards showing progress at all stages of work, design documents of source code, testing protocols, and other project records. Documentation is key to identifying technological advance because it can prove and confirm the existence of progress and new knowledge gained from experimentation, including failures and successes.

5. Was a detailed record of the tested hypotheses and results kept as the work progressed?
As work progressed on its software projects, LawBot, Inc. was able to keep various detailed records of the hypotheses that were tested, as well as the results of its testing. This information is critical, particularly if the company were to be audited by the CRA. For example, as the work progressed, the company saved the following: literature reviews, background research, project records, design documents for system architecture and source code, conceptual sketches, testing protocols, results or analysis from testing/trial runs, development plans, screenshots of various build versions/final version, records of resource allocation, invoices, and electronic project boards showing progress at all stages of LawBot, Inc.'s software development. As shown by various examples throughout this paper, culling various project documents can be critical to the survival of an R&D project in the event of an audit to substantiate that the projects carried out do qualify as SR&ED.

CONCLUSION

The SR&ED tax incentive program is an enduring part of the Canadian government's commitment to fostering innovation and economic growth. To ensure a taxpayer can reap the benefits of the program, it is highly recommended that proactive steps are taken to collect clear and detailed records of any SR&ED project. Although the CRA does not provide explicit guidelines in regards to supporting evidence required for an SR&ED claim, it is evident that sufficient documentation can provide invaluable assistance in the case of an audit

review or challenge in court. Notably, the supporting documentation must be clear, relevant, and eligible to demonstrate that the Five Questions criteria had been fulfilled. As some of the cases within this paper have demonstrated, documentation that is too generic, disorganized, or illegible can endanger the validity of an SR&ED claim. It is therefore imperative that proper record-keeping and documentation – such as project planning documents, design plans, project records, test protocols, invoices, and prototypes – is maintained to ensure taxpayers can substantiate their claim and procure the many rewards of the SR&ED credit.

Taxpayers who want to claim the SR&ED tax credit should add besides their conducted proprietary research documentation a summary document based on the review of the cases in this paper prior to filing a tax return. The articulation of processes and events via documentation is best to ensure no delays or gaps occur in the SR&ED tax credit process.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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Accounting information and dividend payout prediction in Nigerian listed manufacturing firms

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Investors' curiosity on the worth of their investment could be resolved with the availability of sufficient information in predicting their returns and security. Several studies linked dividend payout to the performance of manufacturing firms in Nigeria but a few considered information as a signal to performance not necessarily to dividend. This paper examined the usefulness of accounting information in predicting the investors return especially dividend payout. Ex-post facto design was adopted using secondary data obtained from annual reports and accounts of 36 selected manufacturing firms for a period of 20 years (1997-2016). The results of the regression (fixed effects) analysis carried out revealed that lagged dividend, leverage and sales growth have significant positive effect on dividend payout while earnings per share, operating cash-flow and firm size influences dividend payout ratio negatively with the exemption of asset utilization ratio with insignificant effect. It is evident that accounting information is useful to investors' in predicting the returns on their investment and dividend payout. Investors should look beyond past dividend in forecasting expected returns but several factors as presented in the financial statements in taking informed investment decisions.

Key words: Accounting information, lagged dividend, asset utilization, returns prediction, investment.

INTRODUCTION

The two key fundamental qualities of good accounting information are to be relevant and faithfully presented. Information is said to be relevant when it possesses predictive and confirmatory features. Relevant and well-presented information enables the users to make crucial decision by examining the past, present and able to forecast the future occurrences through it (ICAN, 2014). One of the key users of financial statements is the investors; they are keen on information relating to their principal and the yearly yielded returns. However, accounting information is expected to serve as a guide in predicting the returns on their investment in a firm.

Prior to 1968, at early development of modern corporations, investors were not driven by the returns (Scott, 1912). Dividend was introduced by East India Company in 1700 and it became pronounced due to its effect on the market price of stocks (Frankfurter et al., 2003). Nwidobie (2016) asserted that, investors perceived dividend as an indication of good corporate performance and thus encourages potential investors to invest in highly-dividend paying firms.

The board of directors is saddled with the responsibility

of determining the proportion of earnings to be paid as dividend viz-a-viz the portion to plough back. It is a crucial decision and several factors as investors' expectation, availability of liquid fund, growth and investment opportunities, perception of general public in respect to firm size and its long existence, as well as ability to generate fund through other source aside plough back profit, are paramount in determining the dividend payout ratio in a firm.

Several propositions have been made on dividend ranging from dividend irrelevance theory to dividend supremacy theory. Dividend was proclaimed to be the only reason for firm's existence (Graham and Dodd, 1934). Walter (1963) and Gordon (1963) asserted that, in an environment with economic and political instability coupled with fluctuating exchange rate, hyper-inflation, high interest rate, and market deregulations, investors would prefer having their returns in form of immediate cash than capital gains. According to Lintner (1956) signaling model, dwindling returns is a signal of firm's unproductivity to the investors; therefore, managers tend to sustain dividend payment once it is initiated. On the contrary, Miller and Modigliani (1961) propounded that in a perfect capital market where rational investors operate, investors should be indifferent to dividend policy when corporate and individual taxes are the same.

Appropriation of earnings to returns and retained profit has been the major challenge faced by the firms. Ozoani (1998) proposed that dividend should be least to consider in earnings appropriation; that firms should focus on funding viable growth and investment opportunities and distribute the residuals, if any, as returns to investors. Investors see dividend as a link to hidden information about firm's prospective profit and stability. Due to several controversies on dividend among various theorists on the investors' response to dividend policy, the policy cannot assume to rest on dividend theories but on firm's overall system behaviour.

However, looking at the dividend patterns of Nigerian firms, it still reflects the puzzle model of Black (1976) without specific pattern of dividend payment. There has been inconsistency in the pattern of dividend payment, thus the researcher is curious to know how the decision about the dividend payout ratio is derived by listed manufacturing firms in Nigeria.

REVIEW OF LITERATURE

Underpinning theories

This paper is anchored on Lintner's signaling theory, agency cost of free cash-flow hypothesis, Marris growth model, pecking order theory and normative stakeholders' theory.

Lintner (1956) propounded signaling hypothesis which stated that managers are often unwilling to cut dividend when it is introduced with the notion that it is an avenue of conveying hidden information of the firm to the investors. Also, it is believed that investors perceived dividend payment as evidence of good corporate performance. Fama and Miller (1971) opined that managers tend to be efficient when distributing excess cash flow as returns to shareholders rather than investing it in unprofitable investment opportunities. Agency cost theory postulated that shareholders usually quest for more returns when perceived that a firm has excess cash flow, thus reducing redundant fund in the care of the managers to avoid misappropriations. In contrast, pecking order hypothesis by Donaldson (1961) posited that firms rely mostly on internally generated funds in financing growth opportunities rather than distributing it as dividends; and could only opt for debt when investment opportunities exceeded their internal finance capacity. Marris (1964) asserted that firms with greater growth projects possibly have high retention ratio and pay low dividend to shareholders in the short-run but due to the returns on such investment, thus turn high-dividend paying firms in the long-run. Conclusively, normative stakeholders' theory propounded by Freeman and Evan (1990) posited that investors should consider several factors which could impair or being impaired by manager's decision in projecting returns on their investment in a firm.

Empirical review

Earnings as determinant of dividend payout

The study of Okoro et al. (2018) reported an insignificant positive relationship between earnings and dividend payout of Nigerian firms. In the same market, Kajola et al. (2015), Rihanat et al. (2016), Sanyaolu et al. (2017), Uwuigbe (2013), and Uwuigbe et al. (2012) found that earnings significantly and positively influence dividend decision while Morakinyo et al. (2018) and Okpara (2010) revealed a significant negative relationship between earnings and dividend payout. Studies carried out in other countries reported mixed results of earnings effect on dividend payout. In India, Gangil and Nathani (2018), Kumar and Sujit (2018), Ganesh and Suresh (2018), Nishant and Ramesh (2015), Acharya et al. (2012),n and Pandey and Ashvini (2016) discovered a significant positive relationship between earnings and dividend payout; Singhania and Gupta (2012) obtained an insignificant relationship while Brahmaiah (2018) reported a significant negative effect of earnings on dividend yield. Al-Najjar and Kilincarslan (2018) study revealed a significant positive effect of earnings on dividend payout of Turkish firms, similar results were obtained in the studies of Jaara et al. (2018) in Jordan; Gwahula and Mnyavanu (2018) in Tanzania, Lestari (2018), Fitri et al. (2016), Pangemanan et al. (2015), and Ahmad and

Wardani (2014) in Indonesia, and Yusniliyana and Suhaiza (2016) in Malaysia. On the other hand, results obtained by Nkrumah et al. (2018), Nadeem et al. (2018), and Mahdzan et al. (2016) revealed insignificant positive relationship; while Yong and Mazlina (2016) obtained an insignificant negative effect of earnings on dividend payout of Malaysian firms.

Lagged dividend as determinant of dividend payout

Lestari (2018), Jaara et al. (2018), Nadeem et al. (2018), Okoro et al. (2018), Fitri et al. (2016), Adhikari (2015), Rihanat et al. (2017), and Yensu and Adusei (2016) reported a significant positive relationship between past dividend and current dividend; their findings are in accordance with Lintner's (1956) signaling hypothesis. Lagged dividend has insignificant positive effect on dividend payout (Yusniliyana and Suhaiza, 2016). While the study of Brahmaiah (2018) reported an insignificant negative relationship between past dividend and current dividend, the result of the study conducted in Nigeria during stock market crisis in 2009 by Musa revealed a significant negative relationship between past dividend and current dividend pattern.

Leverage as determinant of dividend payout

The reports of Kumar and Sujit (2018), Jaara et al. (2018), Nkrumah et al. (2018), Gul et al. (2012), Gwahula and Mnyavanu (2018), Tahir and Mushtaq (2016), and Mahdzan et al. (2016) showed that leverage has significant negative effect on dividend payout. Similarly, Okoro et al. (2018), Nadeem et al. (2018), and Morakinyo et al. (2018) reported negative but insignificant relationship between leverage and dividend decision. On the contrary, the studies of Brahmaiah (2018), Pandey and Ashvini (2016), and Sindhu et al. (2018) revealed that leverage significantly influence firm's ability to pay dividend positively while Lestari (2018), Gangil and Nathani (2018), and Yong and Mazlina (2016) obtained an insignificant positive relationship between leverage and dividend payout.

Growth as determinant of dividend payout

Gwahula and Mnyavanu (2018) discovered that a growing firm has low propensity to pay dividend. The report corroborated the findings of Kumar and Sujit (2018), Gangil and Nathani (2018), Fitri et al. (2016), Sanyaolu et al. (2017) and Rihanat et al. (2016), who discovered a significant negative relationship between firms growth and dividend decision. Similar but insignificant findings were reported by Lestari (2018), Nadeem et al. (2018) and Mahdzan et al. (2016). On the contrary, Nkrumah et al. (2018) and Yusniliyana and Suhaiza (2016) obtained an insignificant positive relationship between growth and dividend decision; while Tahir and Mushtaq (2016) discovered that growth has significant positive effect on dividend payout.

Firm size as determinant of dividend payout

The proportion of distributable profits payable to investors as returns is directly related to the firm's size. Larger firms have tendency to pay higher dividends (Kumar and Sujit, 2018; Jaara et al., 2018; Morakinyo et al., 2018; Yensu and Adusei, 2016; Tahir and Mushtaq, 2016; Yong and Mazlina, 2016; Al-Najjar and Kilincarslan, 2018; Sindhu et al., 2016; Nguri and Jagongo, 2017). Similar but insignificant results were obtained by Gwahula and Mnyavanu (2018), Rihanat et al. (2016) and Sindhu (2014) while Gangil and Nathan (2018), Brahmaiah (2018), and Okoro et al. (2018), reported an insignificant negative relationship between firm size and dividend decision. On the contrary, Mahdzan et al. (2016), Lestari (2018) and Bushra and Mizra (2015) concluded that the larger the firm, the lower the propensity to pay dividend.

Agency cost as determinant of dividend payout

Kumar and Sujit (2018) and Nishant and Ramesh (2015) reported that dividend decision is positively and significantly influenced by the agency cost. On the other hand, the result of Mahdzan et al. (2016) and Bushra and Mirza (2015) study showed an insignificant negative relationship between agency cost and dividend decision while Matthias et al. (2013) revealed that agency cost has significant negative effect on dividend payout.

Operating cash-flow as determinant of dividend payout

The result of the study carried out by Lestari (2018), Al-Taleb (2012) and Imran (2011) revealed that cash-flow exerts a significant negative influence on firm propensity to pay dividend. Similarly, Demirgüneş (2015) and Soodur et al. (2016) found negative but insignificant relationship between cash-flow and dividend payout. On the contrary, Musa (2009), Nishant and Ramesh (2015), Rihanat et al. (2016), and Wasike and Ambrose (2015) concluded that cash-flow and dividend payout are directly and significantly related while Yusniliyana and Suhaiza (2016) and Al-Najjar and Kilincarslan (2018), and Echchabi and Azouzi (2016) reported an insignificant positive relationship between cash-flow and dividend decision.

METHODOLOGY

This research is a reflection of causal-effect relationship between accounting ratios and dividend payout ratio of listed firms in Nigeria

(manufacturing sector with the exclusion of ICT and agricultural firms). The study is an *expost-facto* research. Seven hundred and twenty (720) year-observations of firms were considered, being twenty (20) years of study of thirty-six (36) selected listed manufacturing firms (2007-2016). Data used in this study was obtained from the audited and reported annual reports and accounts of the selected firms within the time frame of the study.

Understanding the dividend pattern of a firm is very important to the investors, therefore this paper sought to examine the influence of accounting information in predicting the dividend payout ratio of selected manufacturing firms in Nigeria. This study developed its model from the modified model of Okoro et al. (2018) as:

$$DPR = \alpha_0 + \alpha_1 D_{it-1} + \alpha_2 EPS_{it} + \alpha_3 AUR_{it} + \alpha_4 LEV_{it} + \alpha_5 OCF_{it} + \alpha_6 FS_{it} + \alpha_7 FG_{it} + \varepsilon_{it}$$

where DPR = Dividend Payout Ratio; LLD = Natural logarithm of preceding year dividend; EPS = Earnings per Share; AUR = Asset Utilization Ratio; LEV = Leverage; OCF = Operating Cash flow; FS = Natural logarithm of Total Assets; and FG = Firm's Growth.

The original model of Okoro et al. (2018):

$$DPO = \alpha_0 + \beta_1 MV_{-1} + \beta_2 PROF + \beta_3 LEV + \beta_4 SIZE + \beta_5 PDO_{-1} + \mu;$$

where DPO = Dividend Payout; MV = Market Value; PROF = Profitability, SIZE = Firm Size; PDO = Preceding Dividend Payout; was modified to suit the purpose of the current study and in accordance with the underpinning theories.

Three-staged procedural estimation analysis was carried out to investigate the relationship between accounting information and dividend payout ratio of listed firms in Nigeria (manufacturing sector). Nature of association among the series in the distribution was examined at first stage using correlational matrix and variance inflation factor tests. This was done to affirm the appropriateness of the combinations of the variables in the model. Pooled ordinary least square, fixed effects model and random effects model of analysis were conducted for the main analysis; while diagnostics tests, which are: serial-correlation, cross-sectional dependence and heteroskedasticity tests were carried out at the third stage to establish if: the residuals and the beta-factor of each variables in the model are uncorrelated; the residuals in the model across firms are unrelated; and there exist a constant variations among the residuals of the model within the time frame.

The individual influence and joint effects of explanatory variables on dividend payout was evaluated using t-tests and F-test at 90% confidence level, while coefficient of determination was used to examine the extent to which accounting information affects dividend payout. The analysis was carried out with the aid of Stata/IC 11.0.

RESULTS

Pre-estimation analysis

The pre-estimation tests were carried out to examine the appropriateness of the series in the distribution and ensure healthy association among the explanatory variables. The results of the tests are shown in Tables 1 to 3, respectively.

Descriptive statistics

The result of the preliminary analysis shown in Table 1 depicts the features of the series in the distribution and ensures the appropriateness.

Interpretation

The standard deviation, skewness and kurtosis values of the size (0.81, 0.17 and 2.4) reveal that firms operating in Nigerian manufacturing industry are relatively equal in asset capacity and evenly spread within the time frame. The skewness and kurtosis values of DPR and lagged dividend showed that dividend is averagely spread over the years; while there are periods of non-payment, there were also instances of almost 100% appropriation of earnings to dividend. Earnings reported in most of the periods are positively and widely dispersed from the mean value and there are periods of reported losses as indicated in the minimum value of -466.34.

Negative shareholders fund were reported in few periods resulting to minimum value of financial risk of -89.34. The minimum, maximum, standard deviation and skewness of the operating cash flow indicated that reported cash flow from operating activities over the period are widely below the mean value. Standard deviation of agency cost as measured as ratio of sales to total assets of 0.62 showed that assets are averagely transformed to sales; it is an indication of management efficiency. Over the years, the industry experienced minimum percentage decrease in sales of -90.7, maximum increase of 233.24 with an average increase of 13.05. The probability of the skewness and kurtosis revealed that all the series are trending, which is expected in a panel data due to heterogeneity of the firms which constitute the panel.

Multicolinearity test

A non-causal effect association among the variables was tested using Pearson correlation matrix; this is to know whether there is multicolinearity problem among the series. Variance inflation factor test was also conducted confirming the result of the correlation test.

The result of the Pearson correlation test shown in Table 2 reveals that there exist positive associations among lagged dividend, earnings per share, operating cash-flow, firm size and growth. The nature of association aligned with Lintner's signaling theory, agency costs of free cash-flow hypothesis and Marris growth maximization theory. On the other hand, financial risk is negatively associated with lagged dividend, earnings per share, agency cost and size; this is in accordance with pecking order theory and agency cost theory. It was also discovered that agency cost and size are negatively associated; this is a signal of agency problem, managers of large firms tend to have more resources in use thus leading to inefficient utilization. All the correlation coefficients depicted in the Table 2 with the least and highest value of -0.14 and 0.56 being lower than the

Table 1. Descriptive statistics.

Statistic/Variable	DPR	D_{t-1}	EPS	AUR	LEV	OCF	FS	FG
Mean	0.34	3.83	140.58	1.12	1.25	-313.86	6.64	13.05
Minimum	0	0	-466.34	0.07	-89.34	-168778	4.74	-90.7
Maximum	0.99	7.63	3749.53	4.14	543.98	5593.82	8.73	233.24
Std. Dev.	0.31	2.41	367.7	0.62	20.82	6358.16	0.81	29.12
Skewness (P-value)	0.42 (0.00)	-0.66 (0.00)	5.04 (0.00)	1.31 (0.00)	24.57 (0.00)	-25.92 (0.00)	0.17 (0.06)	1.83 (0.00)
Kurtosis (P-value)	1.90 (0.00)	1.98 (0.00)	36.47 (0.00)	5.95 (0.00)	643.22 (0.00)	686.48 (0.00)	2.40 (0.00)	12.78 (0.00)

Source: Author's Computation (2018).

Table 2. Result of Pearson Correlation Matrix Tests.

Variable	D_{t-1}	EPS	AUR	LEV	OCF	FS	FG
D_{t-1}	1						
EPS	0.41	1					
AUR	0.24	0.09	1				
LEV	-0.06	-0.01	-0.02	1			
OCF	0.05	0.03	0.05	0	1		
FS	**0.56**	0.43	**-0.14**	-0.02	0.05	1	
FG	0.01	0.11	0.18	0.03	0.08	0	1

Source: Author's Computation (2018).

threshold of 0.8 is an indication that the combinations of the variables are appropriate.

Variance inflation factor test results showed the highest value of 1.79 which is below the threshold of 10 as presented in Table 3 corroborated the result of the correlation matrix that there is no multicolinearity problem among the series in the distribution.

Regression results

Based on the result of the Hausman and diagnostic tests conducted which reflect that fixed effects is the most appropriate analysis method but due to the results of the Modified Wald Test and Wooldridge Test which revealed that there exists an econometric problem in the model (heteroskedasticity and serial correlation problem), the standard errors of the model was adjusted with Driscoll-Kraay to correct the errors in the model and thus, the fixed effects regression with Driscoll-Kraay standard errors was used to estimate the effect of D_{t-1}, EPS, AUR, LEV, OCF, FS and FG on DPR and the results are presented in Table 4.

The results presented in Table 4 reveal the strength and importance of each of the accounting information measures in predicting the dividend payout. The result of the regression analysis shows that lagged dividend, leverage and sales growth have significant direct relationship with dividend payout while earnings per share, change in operating cash-flow and firm size affect dividend decision negatively. The study also discovered that asset utilization ratio has insignificant negative relationship with dividend payout ratio.

DISCUSSION

The significant positive effect of past dividend on dividend payout ratio reported in this study aligned with signaling hypothesis of Lintner (1956). The

Table 3. Result of the variance inflation factor (VIF) test.

Variable	VIF	1/VIF
D_{t-1}	1.79	0.56
EPS	1.33	0.75
AUR	1.26	0.80
LEV	1.01	0.99
OCF	1.01	0.99
FS	1.79	056
FG	1.06	0.95
Mean VIF		1.32

Source: Author's Computation (2018).

Table 4. Regression result.

Variable	Coeff	t-stat	Std. Err	Prob
D_{t-1}	0.101	13.99	0.01	0.00*
EPS	-0.001	-2.95	0.00	0.01*
AUR	-0.020	-0.59	0.04	0.56
LEV	0.001	1.79	0.00	0.09*
OCF	-0.007	-1.94	0.00	0.07*
FS	-0.083	-5.88	0.01	0.00*
FG	0.001	2.53	0.00	0.02*
Constant	0.5271	4.96	0.11	0.00

$R^2 = 0.404$, $F_{(7, 19)} = 105.5$, Prob> F = 0.00; Hausman Test: $Chi^2_{(6)} = 15.8$, Prob> chi^2 = 0.015*; Test Parameters (testparm): $F_{(35, 658)} = 18.7$, Prob> F = 0.00*; Rho Test: $F_{(35, 677)} = 6.46$, Prob> F = 0.00*; Pesaran CD Test: $Chi^2 = 0.48$, Prob = 0.63; Modified Wald Test: $Chi^2_{(36)} = 11611$, Prob> chi^2 = 0.00*; Wooldridge Test: $F_{(1, 35)} = 14.49$, Prob >F = 0.001*. Dependent Variable: DPR; Confidence level: 90%
Source: Author's Computation, 2018.

finding corroborated the reports of studies conducted in Nigeria by Rihanat et al. (2017) and Okoro et al. (2018). Also, by Lestari (2018) and Fitri et al. (2016) in Indonesia, Jaara et al. (2018) in Jordan; Nadeem et al. (2018) in Pakistan; Adhikari (2015) in Nepal, and Yensu and Adusei (2016) using African countries. The result negates the findings of Musa (2009) carried out in Nigeria. The contrast between the findings of this study and Musa (2009) could be as a result of the timing of the research. The negative relationship between dividend payout and past dividend might be based on the occurrence of global financial market crisis that hit Nigeria economy in 2008.

It was observed that Nigerian manufacturing firms have high retention ratio which could have been the cause of significant negative relationship between earnings and dividend payout ratio. This implies that as earnings increase, the appropriated profit to the investors as returns reduces. The significant negative effect of EPS on dividend payout is in consonance with pecking order theory that stated that managers maximize the use of their earnings in financing growth opportunities rather than borrowing or issuing fresh stock, thus having high

retention policy. The findings also aligned with the reports of Morakinyo et al. (2018), Okpara (2010), and Brahmaiah (2018) who also obtained a significant negative relationship between earnings and dividend decision.

The asset utilization ratio with β-value of -0.02 and ρ-value of 0.56 indicates a statistically insignificant negative relationship between asset utilization ratio and dividend payout ratio. This negates the conceptual belief that a high yielded return is a function of efficient utilization of assets by the management. This result corroborated the reports of Mahdzan et al. (2016) and Bushra and Mirza (2015). These findings point to inefficient or under-utilization of assets in Nigerian listed manufacturing firms or indication of presence of agency problem whereby managers tend to trade-off shareholders return to shield their self-interest.

The significant positive effects of leverage and sales growth aligned with the postulations of Donaldson (1961) pecking order theory and Marris (1964) growth maximization theory. Donaldson believed that a firm tends to opt for debt when its growth and investment

opportunities exceed its internal finance capacity while Marris asserted that returns generated from such investment would lead to more profits in the long run and high dividend payments. The report of this study on relationship between leverage and dividend decision supported the findings of Brahmaiah (2018), Pandey and Ashvini (2016), and Sindhu et al. (2018). Similarly, the significant positive effect of sales growth on dividend payout as reported in this study corroborated the report of Tahir and Mushtaq (2016).

The coefficient of the percentage change in operating cash flow of -0.007 with ρ-value of 0.07 implies that firms with high operating cash flow tend to low propensity to pay dividend. This result negates the postulation of Fama and Miller (1971) agency cost of free cash flow hypothesis but aligned with the reports of Lestari (2018), Al-Taleb (2012) and Imran (2011). The negative mean value of -313.86 is an indication that Nigerian listed firms actually experienced high percentage reduction in their operating cash flows over the years, and this could be the result of the negative relationship between percentage change in operating cash flow and dividend payout.

This study also discovered that larger firms tend to low propensity to pay dividend as reflected in the negative coefficient of firm size of -0.083 with ρ-value of 0.00. This means that firm size has significant negative effect on dividend payout ratio of listed manufacturing firms in Nigeria. The result corroborated with the findings of Mahdzan et al. (2016), Lestari (2018) and Bushra and Mizra (2015).

The coefficient of determination measured by adjusted R^2 of 40.4% reflect the combined influence of earnings, past dividend, asset utilization ratio, leverage, size, sales growth and operating cash flow on dividend payout ratio. This implies that 40.4% variation in dividend payout ratio of Nigerian listed manufacturing firms is explained by the accounting information.

CONCLUSION AND RECOMMENDATION

The study investigated the predictive power of accounting information on shareholders returns using earnings, past dividend, asset utilization ratio, firm size, sales growth, leverage and operating cash flow as measure of accounting information and dividend payout ratio as dependent variable. It was observed that accounting information is useful to investors in forecasting the returns on their investment.

Generally, it is expected that larger and highly profitable firms should be highly rewarding in terms of returns to their shareholders but the reports of this study negate the conceptual beliefs. Based on the findings of this study, it is opined that investors should critically evaluate all relevant contents of accounting information within their reach in examining the returns as well as security of their investments in a firm.

CONFLICT OF INTEREST

The authors have not declared any conflict of interest.

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Journal of Accounting and Taxation

Full Length Research Paper

Operational efficiency and financial sustainability of listed manufacturing companies in Nigeria

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This study investigates the impact of operational efficiency on the financial sustainability of listed manufacturing companies in Nigeria. The recent economic crisis in Nigeria has caused an alarming decline in financial sustainability indicators of manufacturing companies. Managers are forced to make efficient use of resources to maximize profitability so as to cope with and compete in the harsh economic condition. Several measures of efficiency were analysed in relation to financial sustainability. There is a dearth of studies on effect of operational efficiency on long-term profitability in Nigerian manufacturing sector. Also, stock market performance has been ignored by studies in Nigeria. This study helps to fill these gaps by evaluating the impact of operational efficiency on long-term profitability (return on asset) and stock market performance (Tobin's Q). The efficiency variables considered include; employee growth, operating expenses, account receivables turnover, inventory turnover and asset turnover. A secondary panel dataset ranging from 2009 to 2016 for 16 listed manufacturing companies was obtained from the Bloomberg portal. The Ordinary Least Square method was used to test the 5 formulated hypotheses. The findings revealed that in relation to ROA, operating expenses and asset turnover had negative and positive significant relationship respectively. Employees' growth, account receivable turnover and inventory turnover were found to be insignificant. In relation to Tobin's q, both inventory and asset turnover had a positive significant relationship. Operating expense had a negative significant relationship. Again, employees' growth and account receivables turnover were found to be insignificant. Based on the findings, the study suggests that the common notion of employee retrenchment and keeping a thin workforce may not necessarily promote financial sustainability. The study recommends that firms should strive to reduce their operating expenses and implement efficient strategies that address asset and inventory turnover.

Key words: Financial sustainability, long-term profitability, stock market performance, efficiency, listed manufacturing companies.

INTRODUCTION

Financial sustainability has been a cause for concern among academics and industry players. The Nigerian manufacturing industry has gone through several troughs. The Nigerian economy is known to be heavily

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dependent on oil revenues, and this shows its priorities in terms of managing sustainable revenue sources. This dependence on the oil sector tends to have a significant negative effect on the other sectors (Ku et al., 2010). Crude oil revenues have been the major contributor to the country's national income and gross domestic product. On the other hand, the manufacturing industry in Nigeria accounted for as low as 3.91% of GDP in 2006, 4.02% in 2007, 3.6% in 2008 and 4.2% in 2009. While sectors like Agriculture contribute 39.5%, telecom 5.6%, crude oil and natural gas 13.6%, the manufacturing sector contributes a mere 4.5% to GDP (Alli, 2012). To address this, the Nigerian government seeks to place more emphasis on the development of the manufacturing sector in order to promote sustainable growth and development. It is believed that an improved manufacturing sector is a prerequisite for economic development (Asaleye et al., 2018). The sectors' contribution to GDP has not changed substantially over the course of the decade. The contribution of the manufacturing sector remains below its potential, well below other African peers such as South Africa (13%) and Mauritius (16%). According to African Business Magazine, the plunge in oil prices in 2014 induced fiscal pressures and foreign currency shortages which spilled over to non-oil sectors, tipping the economy into recession in 2016. Within the periods between 2000 and 2010, more than 850 manufacturing companies have either been shut down or forced to cease production activities due to financial sustainability issues (Atoyebi et al., 2014).

Financial sustainability has been defined and measured in several ways over the years. It has been defined from the perspective of asset sustainability (Playford, 2016; Department of Infrastructure Local Government and Planning DILGP, 2013), financial independence (Wallstedt et al., 2014; Price water house Coopers PwC, 2006) and solvency (Hur-Yagba et al., 2015; Wang et al., 2007; Carmeli, 2001; Lorig, 1941). However, profit plays a crucial role in the going concern of any firm. Its continuous survival depends to a large extent on its periodic profitability (Umobong, 2015).

Several studies have equated financial sustainability with profitability in current and future periods and measured it with long-term profitability ratios like return on asset (Okoye et al., 2017; Umobong, 2015; Chari et al., 2012; Karaca and Ekşi 2012). Also, since the study focuses on listed companies, stock market performance is also a component of financial performance and survival (Alakeci and Al-khatib, 2006). Stock market performance has been measured in several studies using the Tobin's Q ratio (Wahla et al., 2017; Karaca and Ekşi, 2012; Omowunmi, 2012; Heenetigala and Armstrong, 2011). There is a dearth of studies on the effect of operational efficiency on long-term profitability in the Nigerian manufacturing sector (Falope and Ajilore, 2009). Also, stock market performance has been ignored by studies in

Nigeria (Abubakar, 2017) and these constitute the gaps that this study fills by evaluating the impact of operational efficiency on long-term profitability (return on assets) and stock market performance (Tobin's Q). The harsh economic condition that has characterized the Nigerian business environment has caused an alarming decline in the financial performance and sustainability of listed manufacturing companies in Nigeria.

Return on assets

Figure 1 hints that the year 2009 indicates when the effect of the financial crisis began to greatly affect the financial performance of companies. The industry average of return on asset between 2009 and 2016 was 8.63% with some companies having as low as -37.9%. The industrial average of return on asset has been on a consistent decline since 2010. The Central Bank of Nigeria left its benchmark interest rate at 14% since July 2016. Some commercial banks charge interest on loans as high as 25% since interest rates were deregulated (Okoye and Eze, 2013). This implies that manufacturing companies will find it difficult to repay debt and interest payable (comparing 8% with 14%-25%).

Tobin's Q index

The average Tobin's q ratio was relatively better with an industrial average value of about 1.97 which is at least greater than 1. However, the industrial average has been on a consistent decline since 2013 (Figure 2). Companies have found it wise not to depend on government policies and interventions but instead to manage profitability by tweaking internal variables within their control. Profitability (and financial sustainability in the long run) can be achieved by either maximizing revenue or minimizing costs. Cost minimization strategies require managers to be prudent and efficient in managing items that reduce profits. Efficiency in simple terms refers to an organization's ability to achieve a certain level of output with the minimum level of input (without compromising quality). Efficiency is the effort put in by management to reduce costs while the additional profit is the reward for doing so. Thus, managers can improve profitability both in short and long-term and thus become financially sustainable.

The question that this study addresses is; what are some of the key efficiency variables that management must control to optimize profit and financial sustainability in the long run so as to hedge itself as much as possible from harsh financial conditions and policies that characterize the recent Nigerian business environment? This study addresses some gaps in existing literature in that it is one of the few studies that look at financial sustainability in Nigeria, even fewer to look at financial
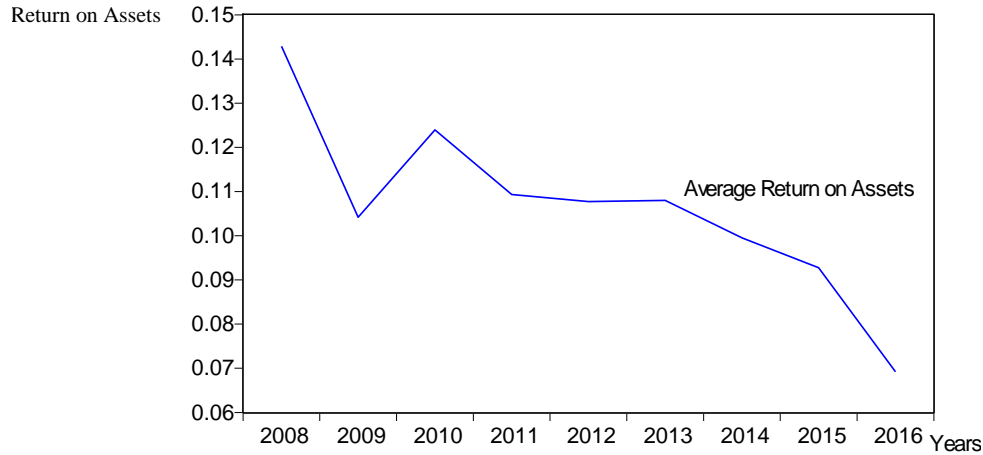
Figure 1. Graph of Industrial average return on assets of listed manufacturing companies.
Source: (Author's Computation and EViews 9 Output).
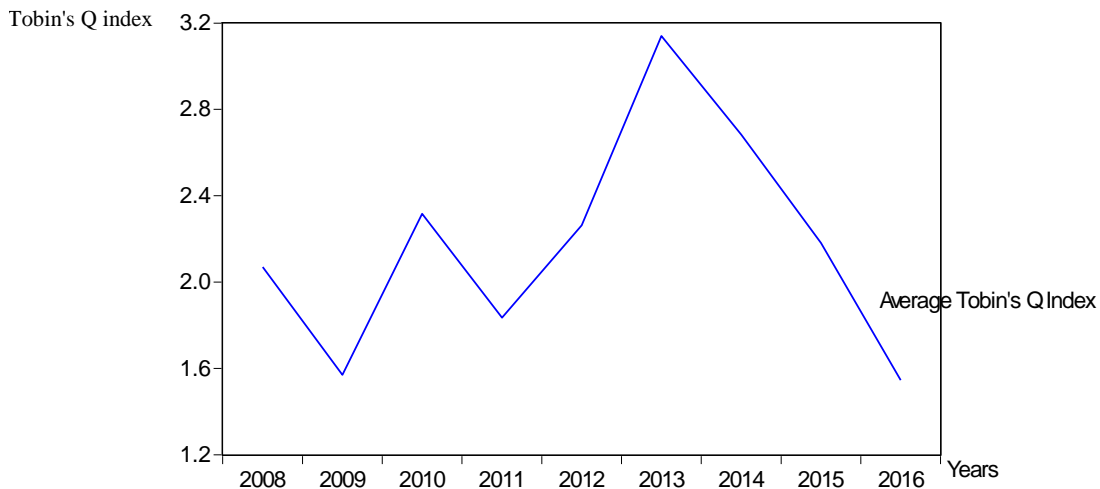
Figure 2. Graph of Industrial average Tobin's Q Index of listed manufacturing companies
Source: (Author's Computation and EViews 9 Output).

sustainability in the manufacturing sector and the first to look at sustainability in Nigerian manufacturing sector from a stock market perspective.

LITERATURE REVIEW

Operational efficiency in the manufacturing sector continues to be a prominent issue among academics and industry players. An efficient manufacturing sector is an important solution to resolving the problems of unemployment and sustainable economic growth (Asaleye et al., 2018). The Rent Theory of Profit is one of the few theories that explain the impact of efficiency on profits (Bloom et al., 2018; Teece, 2017; Syversson, 2011; Walker, 1887).

Rent theory of profit

The rent theory of profit was propounded by Francis Amasa Walker (an American Economist) and so is sometimes called Walker's Theory of Profit. He saw profit (pure profit) as the additional income that results from the difference in ability that one entrepreneur may possess over others (Teece, 2017; Walker, 1887). He related this to business profit which he described as the difference between the rent of the least and that of the most efficient entrepreneurs. Walker assumed a perfect situation where all managers' abilities were equal and received their normal wage (which he equates with normal profit and doesn't constitute pure profit). In such situation, there will be no super profit (above normal profit) and thus extra profit (in addition to normal profit) will be due to

Figure 3. Relationship map of operational efficiency and financial sustainability.

managers' efficiency level. He suggests that the least efficient workers try to cover only the cost of production while the more efficient workers try to earn extra for their differential abilities. According to Walker, the pure profit (additional profit) depends on managers' ability to produce in the simplest and shortest ways; by saving all unnecessary waste of materials and machinery while meeting customer demand and retaining product quality (Syversson, 2011; Walker, 1887). Lean manufacturing and improved quality are based on this theory (Drew et al., 2016; Sutton, 2007).

The theory was criticised because it focused more on explaining the reason for differences in profit more than describing the nature of profit itself (Macvane, 1887). However, in this study, we are looking at the relationship between operational efficiency and changes in profitability as well as controlling for other factors that can cause changes in profitability. Thus, this criticism doesn't limit the application of this theory for this study.

On a firm level, the theory views efficiency as a form of competitive advantage and thus, like other competitive-advantage-based theories of profit, it suggests that manufacturing firms often differ systematically in the extent to which their processes for transforming inputs into outputs can create economic value (Makadok, 2011; Brandenburger and Stuart, 1996). Economic value is described as the difference between what customers are willing to pay for the company's product and the cost incurred by the company to produce and deliver that product to those customers. This is closely related to operational efficiency. This economic value often takes

the form of working capital savings. Producing more output from unchanged input, consuming less input for unchanged output, reducing operating costs without damaging the corporation, reducing the days in the cash conversion cycle, improving operating cash flows, increasing total asset turnover, and effecting reductions in operating risk are all signs of relative operational efficiency (Gill et al., 2014; Owolabi and Obida, 2012).

Operating in an efficient manner can help to minimize working capital spending and thus enhance financial performance of companies (Owolabi and Obida, 2012). When the operational efficiency of companies increases, it tends to reduce working capital spending and thus increase financial sustainability of the company (Figure 3). This theory views profit as the reward of a firm for being relatively more efficient than others. More efficient companies earn additional profit and are therefore more financially sustainable than others. There are several ratios that measure different aspects of efficiency of companies (efficiency ratios). This study attempts to test the accuracy of this theory with regards to listed manufacturing firms in Nigeria by relating efficiency ratios to financial sustainability measures and evaluating which of the efficiency measures have strong relationship with financial sustainability.

Financial sustainability

Emmanuel (2015) defined financial sustainability as the ability of a project, a program or an organization to maintain broader sources of funding in order to provide

standard services to its clients over time and can be evaluated through profitability, liquidity, solvency, efficiency, and effectiveness. Sa-Dhan Microfinance Resource Centre (2005) defines financial sustainability as the ability of a company to cover all its present costs and the cost incurred in its growth if it expands its operations. These costs include operational and financial costs. Some of these costs are inherent and so may not be easily spotted out. However, efficiency ratios help to evaluate how well the manager has been able to manage those costs.

In this study, we are interested in the impact of management's efficiency on financial sustainability. We look at the financial sustainability of quoted manufacturing companies from 2 perspectives; long-term profitability and stock market performance.

Return on asset

Several studies have measured financial sustainability with return on asset (Okoye et al., 2017; Yameen and Pervez, 2016; Khidmat and Rehman, 2014; Oyewale and Adewale, 2014; Al Manaseer et al., 2012; Uwalomwa and Olamide, 2012; Hartanka 2004). Return on asset has been preferred because it gives an all-encompassing view of profitability. It measures a firm's financial self-sufficiency. The return on asset has been suggested to give a broader and more long-term view of profitability as it relates profit (in form of earnings before interest and tax) to the total asset of the firm. Many other measures (e.g. Return on Equity and Net Profit Margin) relate profit to revenue which is periodic (short-term) or equity which is myopic i.e. only from shareholders' perspective (Aliabadi et al., 2013; Hagel et al., 2010). From data collected, Dangote cement plc, Nestle Nigeria plc, Nigerian Breweries Plc, Dangote Sugar Plc, GlaxoSmithKline Consumer Nigeria Plc, Guinness Nigeria Plc and Unilever Plc were found to have high return on asset (ROA>10%).

Tobin's Q

Some studies have measured financial sustainability with the Tobin's Q ratio (Banerjee, 2018; Karaca and Ekşi, 2012; Wahla et al., 2012; Heenetigala and Armstrong, 2011; Herly and Sisnuhadi, 2011; Ibrahim and Samad, 2011; Kang and Kim, 2011). However, there is still a lack of studies that measure stock market performance in Nigeria with Tobin's Q. The Tobin's Q index measures the investors' perception of the firm. It compares the market value of the total asset (i.e. market value of equity + market value of debt) to the book value of the firm's total assets (Al-Matari et al., 2014). It shares some of the characteristics of return on assets in that it is based on the total asset of the firm (and not just net profit or equity).

The number of quoted companies on the Nigerian stock exchange fluctuates periodically thus indicating that some companies are listed and delisted from time to time. Some of these delisted companies leave voluntarily out of inability to compete for share prices, thus indicating financial sustainability issues from a stock market perspective. Most companies that were found to have favourable return on assets were also found to have favourable Tobin's Q ratio (TBQ>1). They include Nestle Nigeria plc, Nigerian Breweries Plc, Unilever Plc, Dangote cement plc, Guinness Nigeria Plc, Champion Breweries Plc, PZ Cussons, GlaxoSmithKline Consumer Nigeria Plc, Larfarge Plc and Dangote Sugar Plc.

Operational efficiency

Peter Drucker refers to efficiency as "doing things right". (Drucker, 1963). Several studies have emphasized the importance of efficiency as a factor that affects profitability and sustainability. Eskandari (2007) opined that a company's overall efficiency and performance are closely related. Efficiency in an organisation's operations relates to the optimum utilization of its resources. To survive and prosper, firms must produce their output from input efficiently.

According to Michael Porter, cost and product differentiation are the key elements of successful competitive strategies (Tanwar, 2013; Porter, 1989). Operational efficiency is the basis for cost leadership strategies. The cost leader in any industry is the one who is capable of producing goods and services similar to those of competitors but at the least cost. This requires him to produce a certain level of output using minimal input. The cost leader has strong competitive advantage as he can simply decide to reduce his price to the minimum amount required to remain profitable so as to capture larger portion of the market share, thus forcing competitors to either reduce their prices. Some competitors can only bear a certain level of reduction in profit to justify remaining in business and so may be forced to quit. It is a case of "give in or give up" (i.e. reduce prices or quit).

Several measures have been used to measure operational efficiency in different studies e.g. employee growth (Pantea et al., 2013; Sathye, 2001; Zhu, 2000), operating expenses (Ghebregiorgis and Atewebrhan, 2016; Al-Jafari and Alchami, 2014), account receivables turnover (Yameen and Pervez, 2016), inventory turnover (Yameen and Pervez, 2016; Enekwe et al., 2013) and asset turnover (Yameen and Pervez, 2016; Jamali and Asadi, 2012; Fairfield and Yohn, 2001). In the periods under consideration in this study, companies like Nestle Nigeria plc, Nigerian Breweries Plc, Flour Mills Nigeria Plc, Dangote Sugar Plc, GlaxoSmithKline Consumer Nigeria Plc, PZ Cussons Plc, Guinness Nigeria Plc,

Unilever Plc and Vitafoam Plc were seen to possess relatively high operational efficiency ratios with average turnovers (Account receivable, Inventory and Asset) greater than 100% and some having average operating expenses below ten billion naira.

Employees' growth

Employees' growth was measured as the percentage change in the number of employees. The porter's generic strategy of cost leadership has been applied in different ways by several companies. A congestion study of manufacturing firms in the fortune 500 companies by Zhu (2000) suggested that a reduction in current levels of employees may actually increase revenue and profit levels. Many firms are growing content with having as low as 2 or 3 employees while expecting to improve financial performance by reducing staff cost (Sathye, 2001). Some companies that are content with current profit levels and do not want to rock the boat keep a thin work force that enables them to merely stay afloat.

Several small companies have also resolved to remain small by keeping a thin workforce and retrenching employees, if need be, in other to keep personnel costs within a certain range. These companies then compensate for lack of employees by overburdening the available ones. Thus, you have employees getting used to doing unpaid overtime and slammed with unrealistic targets. From time to time, they compensate these employees with a salary increase and performance bonuses which are usually less than the amount that would have been paid to an extra employee. There may be a need for a trade-off in number of employees and profitability prospects. And so, this leads us to the inevitable question: Is there a relationship between change in number of employees and financial sustainability?

H_1: There is no relationship between change in number of employees and financial sustainability

Operating expenses

Operating expense has been used to measure efficiency in some studies either alone or in relation to revenue or total assets (Ghebregiorgis and Atewebrhan, 2016; Al-Jafari and Alchami, 2014; Gill et al., 2014) The rising costs of imports and private generation of electricity and other vital infrastructures to sustain production processes result in high cost of production, increase in product prices, and consequently reduction in consumer demand (Adegbie and Adeniji, 2013). The high fuel import bill (16% of total imports) highlights the need for investment in oil refineries (African Business Magazine, 2017). Fuel and energy expenses constitute between 30-40% of total expenses for most manufacturers. Energy spending in Nigeria's manufacturing sector has continued to rise rapidly, owing to incessant power outages experienced not just in industrial clusters but also across the country (Anudu, 2018). Also, the unfavourable foreign exchange rates make import of raw materials and other items of inventory more expensive. Companies that require raw materials that are not produced locally suffer from fluctuations in the exchange rate, thus, making operating expenses less predictable and controllable. This is a crucial factor for must industrial goods producers. Industrial assets require larger expenses to keep them running compared to those of consumer goods producers. This leads us to ask: Is there a relationship between operating expenses and financial sustainability?

H_2: There is no relationship between operating expenses and financial sustainability

Account receivables turnover

The account receivables turnover ratio relates credit sales to average debtors. It evaluates the rate at which debtors redeem their debt to the firm and how efficient the organization's credit policy and debt collection system are. A high account receivables turnover ratio indicates a high level of efficiency in debt collection and a high level of liquid revenue available to the firm.

During periods of inflation, debtors benefit as they get to pay the same nominal amount at a later date when the purchasing power of money may have reduced, thus paying a lower real amount. Debtors are tempted to prolong payment of their debt to the company and this can reduce the company's liquidity. This can also affect the efficiency of the company since it will reduce the account receivables turnover and may cause the company to incur some extra cost on debt collection e.g. bad debt forgone, cost of hiring a debt factor and cost of administering and negotiating credit terms. These costs may affect liquidity and profitability
Efficient credit policy and debt collection system may reduce liquidity and credit risk and thus improve financial sustainability, which leads us to ask: Is there a relationship between account receivables turnover and financial sustainability?

H_3: There is no relationship between account receivables turnover and financial sustainability

Inventory turnover

Inventory turnover compares the cost of goods sold to the cost of inventory. A high inventory turnover indicates that the firm sold most of the good produced with few inventories left. Inventory turnover can be used to

evaluate a firm's marketing power. Although having high inventory may not be a good idea. However, in periods of inflation, firms whose products are relatively or perfectly inelastic tend to hoard inventory so as to sell inventory in later periods at a higher price. But in an economy where prices are fairly stable, keeping inventory could be harmful because keeping inventory has its costs (holding cost and time value of money). Keeping inventory postpones profit on goods sold without any compensation.

With harsh inflation rates and highly competitive business environment, managers have been forced to take actions that compromise quality in a bid to save cost. Several consumer goods manufacturers, in a bid to compete efficiently, have reduced their product content, quantity and/or quality and sell them at the same price thus leaving profit unchanged. This has a negative effect in the long-run; like loss of customer patronage, goodwill and brand identity. Even in the short-term, if this strategy is not matched with aggressive marketing, it could lead to excess inventory (low inventory turnover) which may also affect the firm's profitability.
This brings us to another research question and hypothesis of this study: Is there a relationship between inventory turnover and financial sustainability?

H_4: There is no relationship between inventory turnover and financial sustainability

Asset turnover

Asset turnover relates the revenue generated for the period to the company's expenditure on all its assets. It measures the extent to which the company has put its assets to use in generating revenue (Bodie and Alan, 2004). The asset turnover gives a hint on the capacity actualization of the company. Among the fortune 500 companies, only about 3% of manufacturing companies were operating on the best-practice frontier (Zhu, 2000). In Nigeria, this problem has been said to be caused by power outages resulting in the use of alternative power generating system (which attracts high cost), lack of funds to produce inputs, fallen demand for locally manufactured goods and industrial unrest (Adegbie and Adeniji, 2013).

Companies, with the aim of avoiding huge capital expenditure, result to making use of over-depreciated assets in production process. Walking into the average Nigerian company, one would probably identify an asset that obviously needs to be changed. Making use of such assets can lead to frequent machine breakdown which will reduce operational efficiency and could even lead to employee idle time which management will nevertheless still have to pay for. Frequent machine breakdown would lead to poor asset turnover which could also affect financial performance of the firm.

Poor choices of asset specification can also lead to poor asset turnover. This is also worsened by the fact that capital projects are most times irreversible. In situations where managers purchase sub-standard or wrong specification of assets, those assets may not operate to the full capacity of the firm and thus may reduce revenue generated for the period and continue to do so for several future years, hence reducing financial sustainability. This leads us to the big question: Is there a relationship between asset turnover and financial sustainability?

H_5: There is no relationship between asset turnover and financial sustainability

Empirical framework

Some existing studies have tried to evaluate the nature of the impact of efficiency measures on financial performance and sustainability. Some have identified positive relationship between both variables while some have identified negative relationship. A few others have also identified no relationship (i.e. no significant correlation).

Banerjee (2018) did a study on the ability of financial ratios to predict the Financial Performance of UAE Banks. His paper, like this one, examined the financial performance as it relates to accounting–based performance (measured by Return on Assets) and Market-based performance (measured by Tobin's Q). These measures were regressed against some financial ratios from the audited financial statements of the sampled banks for the period of 2014 till 2017. The regressors included; individual size of the bank, the credit risk, operational efficiency and asset management. The result reported that operational efficiency and asset management had a positive significant relationship with financial performance and sustainability. These results were similar with those of Tarawneh (2006) and Khizer et al. (2011). Tian et al. (2018) also did a study on the Combination of efficiency and innovation to enhance financial performance in emerging economies. They buttressed that firms in these economies have to enhance their efficiency and innovative capabilities synthetically in order to combat competitors. The paper analysed data for more than 20,000 firms from 36 emerging economies and found strong evidence to prove the arguments. Efficiency was found to be positively related to productivity and, through it, financial performance. Yameen and Pervez (2016) carried out a study on the impact of liquidity, solvency and efficiency on profitability of steel authority of India limited. Financial sustainability was measured using return on equity, return on assets and return on capital employed. Efficiency ratios (asset turnover, inventory turnover and account receivables turnover) were found to have positive significant relationship with return on assets.

Ndolo (2015), using correlation matrix in his study, found asset turnover to be a major determinant of financial performance. Al-Jafari and Alchami (2014) also found that management efficiency, as a function of operating expenses and asset management, had significant impact on profitability of banks in Syria. Jamali and Asadi (2012) also did a study on management efficiency (which was measured with asset turnover) and profitability (measured with Gross profit ratio) in the Indian automobile industry. The study was conducted using Pearson Coefficient correlation test on the variables. The central conclusion of the study was that profitability and management efficiency are highly positively correlated with each other. Agiomirgianakis et al. (2006) also revealed that efficiency in management of assets, as well as age, size, fixed assets growth, exports, reliance on debt and sales growth all impacted significantly on firm performance. Fairfield and Yohn (2001), in an analysis on 9,147 U.S. firms for the periods 1977–1996 concluded that change in return on assets is strongly dependent on changes in asset turnover. They concluded that asset turnover ratios are useful for predicting future profitability changes. Zhu (2000), in his study, found number of employees to be negatively associated with firm performance

On the other hand, some authors also found negative relationship between operational efficiency and financial performance indices. Sohail (2018) carried out a research to determine how profitability of Pakistani banks was affected by operational efficiency and several risk types (liquidity risk, credit risk and capital risk). Simple regression analysis was used for analysis of data and the Hausman test was used to select between random and fixed effects model. The results revealed that banks' profitability was negatively affected by operational efficiency. Aremu et al. (2013), in their study, applied cointegration and error correction techniques and revealed that cost efficiency, along with credit risk and capital adequacy, were inversely related to financial performance of Nigerian firms while money supply and labour efficiency were directly associated. Pantea et al. (2013), in their study, found number of employees to be positively associated with firm performance in Romania, thus, suggesting that efficiency strategies involving decrease in number of employees could lead to reduced firm performance. This result supports that of Sathye (2001).

Some studies also found too little or no relationship between operational efficiency measures and firm performance. Evans (2018) carried out a research to discover whether the changes in profitability in Nigerian companies where as a result of changes in operational efficiency. To answer the question, the study conducted four different panel unit root tests to establish the stationarity of financial performance (profit after tax) and operational efficiency variables in Nigeria. Asset turnover ratio was one of the efficiency variables. With a cross section of 20 quoted companies on the Nigerian Stock Exchange, the analyses showed that profit after tax was non-stationary while efficiency variables were stationary. In other words, while financial performance was changing, asset turnover and other efficiency variables remained stagnant thus, signifying a lack of correlation between operating efficiency and financial performance of quoted companies in Nigeria. This result was a bit similar to that of Enekwe et al. (2013), who found that while inventory turnover proved to be a significant determinant of firm performance, asset turnover ratio was insignificant.

The above summary suggests that there are doubts as to whether there is a consistent relationship between efficiency measures and financial performance. This disparity may be due to the fact that there are other country specific factors that affect this relationship (the relationship between efficiency and financial performance is contextual to the business environment). Given the mixed results in existing literature, this study attempts to fill the gap by clarifying the relationship between operational efficiency and financial sustainability measures using the Nigerian manufacturing sector as a case study.

MATERIALS AND METHODS

This section explains the skeletal framework for the data collection, presentation and analysis from which relevant conclusions can then be drawn. It includes a model specification and explanation of variables used and population, sampling and data collection.

Model specification

The study aims at testing the functional dependence of Financial Sustainability on the following efficiency variables; employee growth rate, operating expenses, account receivables turnover, inventory turnover and asset turnover.

Employees' growth rate, operating expenses, account receivables turnover, inventory turnover and asset turnover were the major/vocal independent variables. Firm size has been used in some studies to control for firm specific characteristics (Dang et al., 2018) and was used in this study, represented with market capitalization. Following the suggestions of Keele and Kelly (2006), the lagged values of return on asset and Tobin's Q were also included as control variables because current year's financial performance is largely dependent on previous year's performance (Van et al., 2010), thus, capturing a theory of dynamics with dynamic specification. This is partly what justifies using previous year's results as a benchmark for the current year. The lagged variables were also included to control for autocorrelation as financial ratios tend to auto-correlate since they all come from a similar set of financial statement information. Financial sustainability is the dependent variable in the regression and will be measured across Return on Asset and Tobin's Q. The three non-vocal variables (market capitalization, return on asset for previous period and Tobin's Q for previous period) were included because they have been found to be significant determinants of financial performance and sustainability in previous studies and thus will increase the explanatory coefficient (R^2) (Table 1). Therefore, the functions can be represented I n two functional forms. We have:

ROA = f (EGR, OPX, ART, IVT, AST, MKC, lagROA, lagTBQ)

(1)

TBQ = f (EGR, OPX, ART, IVT, AST, MKC, lagROA, lagTBQ)

(2)

The empirical analysis for this study employs the econometric model specified as follows:

$$ROA_{it} = \beta_0 + \beta_1 EGR_{it} + \beta_2 OPX_{it} + \beta_3 ART_{it} + \beta_4 IVT_{it} + \beta_5 AST_{it} + \beta_6 MKC_{it} + \beta_7 ROA_{i(t-1)}$$
$$+ \beta_8 TBQ_{i(t-1)} + \mu_{it}$$

(3)

$$TBQ_{it} = \beta_0 + \beta_1 EGR_{it} + \beta_2 OPX_{it} + \beta_3 ART_{it} + \beta_4 IVT_{it} + \beta_5 AST_{it} + \beta_6 MKC_{it} + \beta_7 ROA_{i(t-1)}$$
$$+ \beta_8 TBQ_{i(t-1)} + \mu_{it}$$

(4)

Where,

ROA: was calculated as earnings before interest and tax / total assets

TBQ: was calculated as (Market value of equity + total debt) / total assets

EGR: was calculated as the percentage change in the number of employees between current and previous period

OPX: is a line item on the financial statement;

ART: was calculated as Total revenue / accounts receivable

IVT: was calculated as cost of goods sold / average inventory

AST: was calculated as total revenue / total asset

MKC: was measured Market price per share x number of outstanding shares

β_0 = is the constant term representing the value of financial sustainability (which is measured across return on asset and Tobin's q) when the hypothesized efficiency variables and control variables are zero in the given models;

β_{1-8} = slope coefficients measuring the impact of the hypothesized efficiency variables and control variables on Financial sustainability which is measured across return on asset and Tobin's q;

μ = is the random error term of the model capturing other factors not captured by the hypothesized efficiency variables and control variables.

Apriori expectations

The study expects all hypothesized efficiency variables except employee growth and operating expense to have positive impact on financial sustainability. The control variables are all expected to have positive correlation since increase in market capitalization ought to attract more investors and investment opportunities thus increasing profitability and firms tend to want to improve by setting previous years target as the minimum benchmark of performance. Therefore:

β_3, β_4, β_5, β_6, β_7, β_8 > 0.
β_1, β_2 < 0

Population, sampling and data collection

The research work was carried out using secondary data obtained from the Nigerian Stock Exchange as well as the Bloomberg portal for annual reports and account of the relevant companies. Data for Tobin's Q were author computed from component variables (market value of equity, book value of debt and book value of total assets).

The population of this study includes the thirty-five quoted manufacturing companies (producing industrial and/or consumer goods) on the Nigerian Stock Exchange. The sample was taken on the basis of availability of financial statement for the different financial period that the study focuses on. Only sixteen of the thirty-five quoted manufacturing companies had readily available financial statements information as at the date of the research.

The empirical model was regressed on a panel data set for 16 companies and spanning 8 years period (2009-2016).

RESULTS OF ANALYSIS

OLS regression technique was employed as the primary test of the hypotheses using E-Views (version 9). This method is preferred as it will allow for testing relationships in dynamic environments and controlling for the effects of other independent variables. Two least squares regression models were generated for the two measures of financial sustainability and are reported in tables 1 (ROA) and 2 (Tobin's Q).

In Table 1, the findings, at 5% level of significance, reveal that there is a positive and significant relationship between asset turnover and return on asset as a measure of financial sustainability with p-value of 0.0017. The findings also reveal a negative and significant relationship between operating expenses and return on asset as a measure of financial sustainability with p-value of 0.0227. Employee growth, account receivable turnover and inventory turnover were insignificant. The R^2 and adjusted R^2 reported explanatory coefficients of 0.824327 and 0.811314 respectively. This indicates that 82.4327% of ROA can be explained by the combination of the variables in Table 1. The F-statistic of the overall model was also significant with p-value of 0.000000. At 5% level of significance, Table 2 reveals that there is a positive and significant relationship between Inventory and asset turnover and Tobin's Q as a measure of financial sustainability with p-values of 0.0172 and 0.0265 respectively. The findings also reveal a negative and significant relationship between operating expenses and Tobin's Q as a measure of financial sustainability with p-value of 0.0261. Employee growth and account receivable turnover were insignificant. The R^2 and adjusted R^2 reported explanatory coefficients of 0.760377and 0.742627 respectively. This indicates that 76.0377% of Tobin's Q can be explained by the combination of the variables in table 2. The F-statistic of

Table 1. Variables measurement and representation.

Variable	Measurement	Notation
Dependent variable		
Financial sustainability	Return on Asset	ROA
	Tobin's Q	TBQ
Independent variable		
	Employee Growth Rate	EGR
	Operating Expenses	OPX
Operational efficiency	Account Receivables Turnover	ART
	Inventory Turnover	IVT
	Asset Turnover	AST
Control variable		
Stock Market Index	Market Capitalization	MKC
Previous year's financial performance	Previous year's Return on Asset	ROA_{t-1}
	Previous Year's Tobin's Q	$TBQt_{t-1}$

Table 2. OLS regression model for return on asset.

Dependent Variable: ROA				
Panel least squares regression				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.022322	0.014517	-1.537667	0.1271
EGR	-0.015406	0.019100	-0.806584	0.4217
OPX	-5.77E-13	2.50E-13	-2.312006	0.0227**
ART	2.35E-05	2.65E-05	0.885024	0.3781
IVT	0.001363	0.001692	0.805642	0.4222
AST	0.040523	0.012561	3.226104	0.0017***
MKC	3.61E-14	9.51E-15	3.790946	0.0002***
$ROA_{(t-1)}$	0.611620	0.049112	12.45347	0.0000***
$TBQ_{(t-1)}$	0.002110	0.002697	0.782380	0.4357
R^2	0.824327	Mean dependent var		0.094547
Adjusted R^2	0.811314	S.D. dependent var		0.087187
F-statistic	63.34741	Durbin-Watson stat		1.662324
Prob(F-stat)	0.000000			

* Significant at 10%, ** Significant at 5%, *** Significant at 1%.

the overall model was also significant with p-value of 0.000000.

The control variables were also regressed against the dependent variables. The lagged variables of return on asset and tobin's q ($ROA_{(t-1)}$ and $TBQ_{(t-1)}$) were control variables but also acted as auto-regressors thus correcting for autocorrelation so as to avoid spurious regression results (Tables 1 and 2). Market capitalization had a positive significant relationship in both models with p-values of 0.0002 and 0.0022 for ROA and TBQ respectively. $ROA_{(t-1)}$ was significantly related with return on asset for the period but insignificantly related to

Tobin's Q with p-values of 0.0000 and 0.3256 respectively. $TBQ_{(t-1)}$ was significantly related to Tobin's Q for the period but insignificantly related to return on assets with p-values of 0.0000 and 0.4357 respectively.

The Durbin Watson statistic of 1.662324 and 1.902192 in Tables 1 and 2 respectively tends towards 2 and thus signifies an absence of autocorrelation. Residual diagnostic tests for the violations of heteroscedasticity and cross-sectional dependence were also carried out on the return on asset model to ensure that the regression results are meaningful, and that the analysis generates the best linear unbiased equation. Cross-sectional

Table 3. OLS Regression Model for Tobin's Q.

Dependent Variable: TBQ				
Panel least squares regression				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	-0.673721	0.337694	-1.995066	0.0486
EGR	-0.095683	0.444310	-0.215351	0.8299
OPX	-1.31E-11	5.81E-12	-2.255151	0.0261**
ART	0.000575	0.000617	0.932624	0.3531
IVT	0.095200	0.039357	2.418887	0.0172**
AST	0.657489	0.292194	2.250177	0.0265**
MKC	6.94E-13	2.21E-13	3.134258	0.0022***
$ROA_{(t-1)}$	1.128261	1.142453	0.987578	0.3256
$TBQ_{(t-1)}$	0.718039	0.062748	11.44329	0.0000***
R^2	0.760377	Mean dependent var		2.052967
Adjusted R^2	0.742627	S.D. dependent var		1.736544
F-statistic	42.83846	Durbin-Watson stat		1.902192
Prob(F-stat)	0.000000			

* Significant at 10%, ** Significant at 5%, *** Significant at 1%.

Table 4. Residual cross-section dependence test.

Residual cross-section dependence test			
Null hypothesis: No cross-section dependence (correlation) in residuals			
Equation: ROA			
Test employs centered correlations computed from pairwise samples			
Test	**Statistic**	**d.f.**	**Prob.**
Breusch-Pagan LM	140.1388	120	0.1010
Pesaran scaled LM	0.267155		0.7893
Pesaran CD	0.217101		0.8281

dependence can lead to bias in tests results (also called contemporaneous correlation). The Breusch-Pagan Lagrange Multiplier tests for heteroskedasticity and cross-sectional dependence was carried out on the OLS model on ROA in Table 1 (as it is Durbin Watson statistic of 1.662324 does not fall within 1.8 and 2.2). The null hypothesis in the LM test is that there is cross sectional independence. The Breusch-Pagan LM showed a p-value of 0.1010 (Table 3). This proves that there is neither heteroskedasticity nor cross-sectional dependence since p-values are not significant at 5%. The Pesaran Scaled LM and CD test, like the Breusch-Pagan test, are also used to test whether the residuals are correlated across entities. The null hypothesis is that residuals are not correlated. The p-values of 0.7893 and 0.8281 (Table 4) lead us to accept the null hypothesis that there is no contemporaneous correlation.

DISCUSSION

Existing literature has suggested that managers should minimize cost as much as possible. The capitalist philosophy of business encourages managers to reduce costs as much as possible in other to maximize profits. Efficiency is the degree to which firms actually achieve this. Efficiency ratios act as measurement basis of manager's efficiency. The Rent theory of profit suggests profit as a reward for good efficiency ratios. However, inferring from the results of this study, not all the efficiency ratios are essentially rewarded with Profit. Operating expense and asset turnover had a significant relationship with both return on asset and Tobin's Q and thus are essential determinants of financial sustainability. This result is consistent with those of Banerjee (2018), Tian et al. (2018), Yameen and Pervez (2016), Ndolo (2015), Al-Jafari and Alchami (2014), Jamali and Asadi (2012), Khizer et al. (2011), Agiomirgianakis et al. (2006), Tarawneh (2006) and Fairfield and Yohn (2001). The result also goes against those of Sohail (2018), Enekwe et al. (2013) and Aremu et al. (2013). Also, Inventory turnover was found to be a significant determinant of ROA. This result is similar to that of Enekwe et al. (2013). Managers' effort to minimize operating expenses and

increase asset and inventory turnover is rewarded by an increase in financial performance and sustainability, thus, verifying the Rent theory of profit. However, employee growth rate and account receivables turnover nullified the generalization of this theory in the Nigerian manufacturing sector, as those variables were insignificant with regards to profitability. This is contrary to the findings of Pantea et al. (2013) and Zhu (2000) both of which suggested a significant relationship between number of employees and financial performance.

Operating expense was significant and thus, is a key factor to be managed. Data collected revealed that listed manufacturing companies in Nigeria incur average operating expense as high as eighteen billion naira annually. The operating costs of the business should be reduced as much as it can with production quality remaining the same. When production quality is reduced while reducing operating expenses, companies tend to lose their competitive advantage in form of product uniqueness. Then, cost saving becomes geared toward short-term profits instead of long-term financial sustainability.

Operating expense optimization is even more important for industrial goods producers as they tend to incur larger operating expenses. Industrial assets require larger expenses to keep them running compared with those of consumer goods producers, and so, measures have to be put in place to keep those operating expenses in check.

Asset turnover was also significant. The capacity utilization rate in the manufacturing sector (currently between 40 - 45%) may need to increase. This can be done via proper asset management decision. Assets should have a proper maintenance schedule and proper usage. Operating manuals should be respected, especially for first time assets users. Companies should also avoid making use of over-depreciated assets in production process. Rickety machines disrupt the learning curve process of employees (due to frequent breakdowns and irregularities), causing them to take longer to familiarize themselves with how the machine works. Managers should document specifications and brand of assets that work well with the organization's production and administration process and consider them when purchasing new assets. Purchase of sub-standard or wrong specification of assets could reduce operational efficiency and cause the organization a lot of harm, both financial and non-financial.

Conclusion

The operating costs of the business should be reduced as much as it can with production quality remaining the same. Given that energy spending in Nigeria's manufacturing sector has continued to rise rapidly, managers should endeavour to try out other cheaper energy sources or import foreign energy creating technologies e.g. solar panels, biofuel engines (since Nigeria generates a lot of wastes due to large population), high capacity inverters (to prevent idle times during power outages) etc. Although, these may involve huge cost outlays, but it has its long-term advantages (in form of cost savings) and so can be a good investment.

In the case of fixed asset (for asset turnover), managers need to make sure that its machines and equipment are always in good working condition and avoid any breakdown or bottlenecks that could prevent the machine from producing at maximum capacity. Also, managers should ensure that working hours are respected and productive. Idle time should be minimized as much as possible so that value-in-use of assets is realized. Managers should ensure that they make appropriate and suitable choice of asset expenditure. Purchase of substandard assets or assets that do not meet the production specification should be avoided as this will render assets inactive or unfit (like asking a carpenter to do a plumber's work).

The role of local SMEs in financial sustainability

Employees' growth rate had a negative coefficient but insignificant probability with both measures of financial sustainability (profitability and stock market performance). This indicates that changes in the number of employees do not necessarily lead to any change in profits. This is a unique discovery as many SME managers often tend to minimize cost by avoiding unnecessary extra hands. Most Nigerian SMEs have very thin work force. They argue that 'there is no need to increase capacity when you haven't exhausted the existing capacity'. Managers should avoid hiring unnecessarily as this can create excess capacity and lead time which could reduce the ratio of profit to cost. However, managers need not deliberately retrench employees with the aim of improving profits significantly since change in number of employees was found to be insignificant.

SME managers are often associated with cost cutting strategies so as to merely survive the current financial period without incurring loss. Many SME managers often consider expansion strategies as over-ambitious while the others, who are ambitious, view expansion more from an asset-based perspective (total asset). Growth strategies often depend on product uniqueness to positively influence financial performance (Alkasim et al., 2018). Operational efficiency does not necessarily oppose expansion as long as there is always 'value for money'. Large Companies (with large asset base, sales turnover and market capitalization) can still operate efficiently and tend to be more financially sustainable as long as their operations yield good revenue turnover (Olawale et al., 2017). In this study, market capitalization, which has been suggested as a measure for firm size

(Dang et al., 2018), was found to have a significant positive relationship with financial sustainability as can be seen from the analysis (Tables 2 and 3).

Role of the central government in financial sustainability

Lack of infrastructural facilities is one of the primary causes of high operating expense of businesses and thus there is a lot that the government can do to help companies lower their operating expense, and thus, improve financial sustainability. Transportation costs and energy costs are two major costs that comprise the operating expenses of manufacturing companies. The government can help reduce companies' expenses by providing good road network and adequate power. The Nigerian waterways (using boats and ships to transport goods within and between states) have not been exploited to its full potential and this might reduce transportation time and cost substantially and even help existing road structures last longer. Imagine if companies did all their intra-state and inter-state freight by water!

Government can also help by subsidizing the import of power generation technologies and/or encourage local ones by granting them pioneer status and other business and tax incentives.
Also, government can improve the educational system and curriculum with the aim of producing quality and efficient graduate management students, who can take on managerial roles and implement efficient strategies that will improve financial sustainability in the Nigerian manufacturing sector.

Internationalization of local production and attraction of foreign investors

Manufacturing companies need not limit their operational activities or market base to Nigeria only. They need to launch into foreign markets with huge prospects so as to profit from more favourable business environments and expand revenue from market share which will lead to higher turnover ratios. Market development has been found to improve competitive advantage and financial performance in recent studies (Alkasim et al., 2018). This may involve some huge investment (in terms of market research and development cost), but if carried out properly, companies can increase the revenue generated per cost of asset by taking advantage of the internationally liberalized market. If done efficiently, this can improve financial sustainability. Also, the recent unfavourable foreign exchange rates make import of raw materials and other items of inventory more expensive. Companies that require raw materials, which are not produced locally, may need to hedge foreign exchange risk by entering into forward and future contracts with foreign suppliers to stabilize costs of those raw materials.

Such partnership with foreign companies can help to eliminate or at least postpone foreign exchange risk and improve operational efficiency, and thus, increase profits. The country is in need of foreign investments as the foreign exchange reserve is fast depleting. The government should create a friendlier business environment for foreign investors in Nigerian manufacturing sector so as to attract more foreign currency.

Limitations of the study

This study used secondary data from the Bloomberg financial information portal. Unlike primary data, secondary data may not be totally free from error and thus may be inaccurate. Also, the small sample size may make generalization of results of the study statistically incorrect.

Suggestions for further studies

This study looks at financial sustainability from profitability and stock market perspective. However, bankruptcy and financial distress are also important measures of how financially sustainable a company is. Further study could be done on the determinants of financial sustainability measured across financial distress. The ability of financial ratios to predict financial distress and bankruptcy could be a possible study that will be relevant for manufacturing companies as it will help them identify key factors that predict financial distress and its possible causes.

CONFLICT OF INTERESTS

The author has not declared any conflict of interests.

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