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This Issue

Relationship Modeling between Work Environment, Employee Productivity, and Supervision in the Nigerian Public Sector

Osibanjo, Adewale Omotayo, Gbervbie, Daniel Esene, Adeniji, Anthonia Adenike, Oludayo, Akinrole Olumuyiwa

Studies have shown that enhanced productivity of organizations either in public or private sector is a function of employees' contribution arising from among others, their perception of supervision in the workplace. Previous studies identified a positive relationship between quality supervisory interventions, job satisfaction and employee productivity outcomes in an organization. This study examines the relationship between supervision, work environment of employees, conceptualized in this paper, as tasks layout, security and safety, infrastructure, regular electricity supply/availability of office equipment and job satisfaction in the Nigerian public sector organizations, as basis for enhanced productivity. In this study, survey method was adopted. The data collected through the self-administered questionnaire to 120 respondents were analyzed using Structural Equation Modelling (AMOS 21). The results showed that the studied variables have strong influence on employee productivity.

The Balanced Scorecard: A Review of Five Research Areas

Dag Øivind Madsen, Tonny Stenheim

The Balanced Scorecard (BSC) is one of the most influential concepts in accounting and management. The BSC recently celebrated its 20-year anniversary. Since its introduction, the BSC has been the subject of much debate among academics and practitioners. The research literature on the BSC has evolved considerably over the last 20 years. The purpose of this article is to provide an overview of five important areas of BSC research: (1) conceptual evolution (2) adoption and diffusion, (3) implementation and use, (4) performance effects, and (5) critical perspectives. The article discusses current trends and emerging issues in the BSC literature and suggests fruitful areas for further research.

Reliability of Special Synchronous Air Generators

Waltson Gomes Neto de Limad, Leonardo Mendes de Barros, Maria Lúcia Pereira da Silva

Wind power generators show a great number of constraints not only during production but also along their life cycle due to several reasons, among them the need of a long life cycle in order to provide an interesting ROI. This work uses a case study of special synchronous hexaphase multipolar generators to propose a methodology for reliability analysis in the area. The main results show the importance of using quantitative techniques (prognosis) to assure product reliability. A proposed model for dealing with reliability issues is the adaptation of the PDCA cycle leading to a SDCA cycle.
The Influence of Supply Chain Management Practices in the Enterprise Performance

Daniel Spina, Luiz Carlos Di Serio, Luiz Artur Ledur Brito, André Luís de Castro Moura Duarte

This empirical research identified which supply chain management (SCM) practices should be adopted by managers in order to achieve superior performance for their companies. Approximately 800 worldwide firms were analyzed, spread across 13 different industries, to understand the impact of 31 practices in five enterprise operational performance indicators.

To Pull or Not to Pull: A Concept Lost in Translation?

Daryl Powell, Emrah Arica

Though the term “pull” has become a cornerstone of modern manufacturing operations, there seems to be mixed views and interpretations of the pull concept across different contexts, in particular production management, supply chain management, and project management. We conduct a review of relevant extant literature in order to provide an overview of the different interpretations of the term, and we offer a set of three context-dependent definitions of the pull concept.

Incentives and Job Satisfaction: Its Implications for Competitive Positioning and Organizational Survival in Nigerian Manufacturing Industries

Oni-Ojo E. E., Salau O. P., Dirisu, J. I., Waribo, Y. J.

This paper assessed the attitude of workers towards incentive and their satisfaction to work. A sample of 127 valid respondents selected from the managerial and non-managerial staff and data collected were analyzed using Statistical Package for Social Science (SPSS) through descriptive statistics and regression. The findings revealed that financial rewards encourage workers externally; while non-financial rewards can satisfy employees internally by making them feel like a valued part of an organization. Also, it was indicated that some employees seem to be satisfied and content with their job not because they derive pleasure from the work itself but because there are no other alternatives. The manufacturing industry needs to embark on the restructuring of jobs and responsibilities in ways that would facilitate competitive advantage without sacrificing the basic objective of the organization.

Organizational Change Management in a Strategic Perspective

Roberto Kanaane, Getulio Akabane, Helena Peterossi, Daniele Cristina Naves Endler

The change management is currently recognized as one of the main factors governing a company’s success. Due to that perspective, the purpose of this work is to exemplify strategies that allow organizations to define change actions avoiding problems, trauma and dissatisfaction in the employees. The work developed is characterized as active, explorative and descriptive using the case study as its research strategy. Data gathering was performed in an organization during its preparation to receive the change – performed in a planned, authorized and documented manner – which successfully implemented the Enterprise Resource Planning – ERP, achieving significant result for the company in terms of processes enhancement and quality, besides establishing the sustainability positioning.
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Studies have shown that enhanced productivity of organizations either in public or private sector is a function of employees' contribution arising from among others, their perception of supervision in the workplace. Previous studies identified a positive relationship between quality supervisory interventions, job satisfaction and employee productivity outcomes in an organization. This study examines the relationship between supervision, work environment of employees, conceptualized in this paper, as tasks layout, security and safety, infrastructure, regular electricity supply/availability of office equipment and job satisfaction in the Nigerian public sector organizations, as basis for enhanced productivity. In this study, survey method was adopted. The data collected through the self-administered questionnaire to 120 respondents were analyzed using Structural Equation Modelling (AMOS 21). The results showed that the studied variables have strong influence on employee productivity.

INTRODUCTION

Research has revealed that no matter how well intentioned that may have necessitated the establishment of an organization either by the government or private interests; the goals for establishing such organization may never materialize without the availability of competent and hardworking employees. This is based on the fact that competent employees possess the required skills, experience and knowledge that add economic value in terms of quality and higher productivity to organizational outputs (Rao, 2000a; Riordan, Vandenberg, and Richardson, 2005; Gberevbie, 2010).

Further, Mohammed (2006) argues that the success and progress of an organization either in public or private sector depends on its ability to maximally explore the talent and potential of its workforce for enhanced performance. In this regard, Ejiofor and Mbachu (2001) posit that no other factor is as important as human resource in maintaining corporate stability, development and profitability of an
organization. In the same vein, Olowu and Adamolekun (2005) point out that it is becoming more essential to secure and manage competent human resource as the most valuable resource of any organization either in public or private sector, because of the need for effective and efficient delivery of goods and services for enhanced organizational productivity in the society. In recognition of the importance of the role of competent workforce, it becomes imperative that organizations either in public or private sector must of necessity put in place what will motivate their workforce in terms of quality supervision and work environment in order to induce them for improved performance with a view to achieving the overall organizational goals of higher productivity. According to Ntshangase and Parumasur (2013), “researchers have observed that the top performing organizations are on the top because they know how to keep their employees from crossing the street and taking the best offer available outside the organization.” In addition, they posit that “good people are hard to find, great people are much harder to replace.” This implies that for organizations to have and retain competent workforce for performance, they must make deliberate efforts to put in place measures to procure qualified manpower in terms of necessary experience, skills and educational qualifications to carry out the required tasks for the achievement of improved productivity.

Objective of Study

Previous studies identified a positive relationship between supervisory interventions, job satisfaction and employee productivity outcomes in an organization (Schroffel, 1999; Porter, Wrench and Hoskinson, 2007; Ladebo, Awotunde and Abdul-Salam-Saghir, 2008; Mohammad and Akhter, 2010; Adebayo and Ogunsina, 2011). However, none of these studies addressed the issue of supervision and work environment as they relate to employees’ productivity in the Nigerian public sector organizations such as Nigerian National Petroleum Corporation (NNPC). Therefore, the main objective of this study is to examine the relationship between supervision, work environment of employees, conceptualized in this paper, as tasks layout, security and safety, infrastructure, regular electricity supply/availability of office equipment and employee job satisfaction in the Nigerian National Petroleum Corporation, as basis for enhanced organizational productivity.

LITERATURE REVIEW

Supervision and Job Satisfaction

The importance of job supervision in the workplace as catalyst for the realization of enhanced individual and organizational productivity has been recognized in literature. Some scholars see the supervisor as an agent of the organization, who often interacts with employees on a daily basis, enabling the formal and informal procedures of organized activities and serving as an administrator of reward to subordinates on behalf of the organization (Farh et al, 1990; Chen et al, 2002). However, research has shown that the success of supervision in the workplace for employees’ performance depends on the style of supervisory behaviour employed by the individual supervisor involved (Eseka, 2009; Adebayo and Ogunsina, 2011). Dubrin and Maier (1993) identified supervisory behaviour as ranging from extremely autocratic, with all decisions made at the top to the extremely democratic with most decisions made by employees at the lowest level of the organization. Richmond and McCroskey (2000) identified subordinate perceptions of supervisor credibility and attractiveness in social and task as positively related to employee job satisfaction and motivation for higher productivity in the workplace. In this regard, Shaw and Ross (1985), observe that a sociable supervisor has the ability to enhance subordinates’ job satisfaction and subordinates’ perception of the supervisor’s credibility as catalyst for employees’ productivity in an organization.

McCroskey (2006) sees credibility as “the attitude toward a source of communication held at a given time by a receiver.” This means that the more credible a supervisor is perceived by his/her subordinates in the workplace, the more likely the supervisor would be accepted, and also realize his/her goals of a worthy agent, and an administrator of reward for subordinates’ job satisfaction. Job satisfaction is therefore vital for employees’ higher productivity for the realization of the overall goals of an
organization. Scholars see job satisfaction as an affective feeling emanating from the perception of an individual that his/her current job allows for fulfillment of important job values, while job dissatisfaction on the other hand is associated with less organizational commitment, lateness or absenteeism from work and low productivity on the part of employees (Noe Hollenbeck, Gerhart, and Wright 1994; Ladebo, Awotunde, and Abdulsalaam-Saghir, 2008).

The implication of the above position is that though the role of the supervisor is crucial to the realization of organizational goals, yet, for any organization to achieve enhanced productivity of its workforce, there has to be deliberate efforts on its part at attracting supervisors that have the necessary skills to actualize quality supervision required to achieve employees’ job satisfaction, or else the importance of the supervisory roles for higher productivity of employees and that of the entire organization would not be realized. This implies that there is a relationship between, not just supervision and employees’ job satisfaction, but also, the style of supervisory intervention in an organization as basis for enhanced productivity.

Regular Electricity Power Supply and Employees’ Productivity

Several studies have shown that bad lighting or electricity power supply can actually have a significant negative impact on worker’s productivity and safety. Improving lighting does not only help to save money on electricity bills, but it also, lower costs on insurance premiums, improve moral, generate more sales, increase productivity, reduce accidents and lower absenteeism (Brown and Leigh, 1996). Even organizations with outstanding safety records still believed there are some rooms for improvement and that better lighting would help achieve it. Brown and Leigh (1996) again in their researches demonstrates that light has a profound impact on people on their physical, physiological, and psychological health, and on their overall performance particularly in the workplace.

Using new technologies to create energy-efficient lighting systems can mean big savings for many organizations. Those savings can be realized through lesser lighting operating costs and increased productivity, which is made possible when lighting quality is improved. Like many other elements we take for granted such as air, we just do not think about lighting/electricity. We assumed it is been designed and planned to provide the best results. Unfortunately, while there have been significant developments in lighting technology, much of it has not been applied to support how people currently work especially in the factory and warehouse environment.

Light has a significant impact on our performance in the workplace. Research shows conclusively that when you get it right, a quality lighting programme can boost productivity and performance, reduce fatigue and eyestrain, and increase an organization’s opportunity for success (Schroffel, 1999). The extent to which different lighting designs affect productivity is less measurable than energy savings. A number of studies have been carried out and evidences illustrate correlation between lighting design and productivity (Welch, 1996).

According to the Rocky Mountain Institute’s “Greening the Building and the Bottom Line”, lighting is a key factor in allowing an organization’s main component, its people, to get their jobs done. If the environment is not hospitable, it can have a detrimental impact on the outcome of their endeavors, that is, the product that they produce (Sundstrom, 1994). In a typical business expenditure breakdown, labor accounts for 85 percent of the operating costs while lighting accounts for only one percent. A productivity increase of even one percent can offer savings in excess of an entire electric bill. Higher productivity and lower energy costs make businesses more competitive (Al-Anzi, 2009).

With the ever increasing focus on EVA (Economic Value Added), increasing productivity levels becomes even more necessary and desirable. Representing real profit versus paper profit, EVA underlies shareholder value, increasingly the main target of leading companies’ strategies. EVA does three things. First, it focuses on maximizing the wealth of shareholders (shareholder value); second, it calculates a company’s true economic profit; and third, it helps managers to create value for shareholders. Lighting has a direct effect on these three issues (Clugston, 2000).

By balancing efficiencies with effective lighting systems, proper lighting can cut down on the need for supplemental task lighting, error rates and quality control issues. It can affect a factory or warehouse’s
bottom line in the form of energy costs, higher productivity, lower absenteeism and smaller insurance
 premiums (Humphries, 2005).

It is not a common occurrence for those who own plants and other workplaces to invest in an
 improved lighting system solely to enhance safety. While safety, like energy, is important, if the financial
 benefits to be derived from improved lighting cannot justify the cost of the improvement, chances are that
 the improvement will be deferred or not made at all. And this is where knowledge comes in, because if
 better lighting in a workplace can improve safety, it probably can improve a lot more, and the value of
 those improvements can be huge compared to the values to be derived from energy savings and safety
 improvements alone. This might also depend on how one calculates the value of safety improvements.

Better lighting can make a substantial difference in the effectiveness of visual inspection. The right
 type of lighting, together with flexible fixtures, makes it easier for workers to see what they are
 assembling or inspecting. With the help of professional lighting consultants, a specific form of lighting
can be developed and applied to best illuminate finished goods for the conditions under which they are
 inspected, and to minimize the likelihood of problem products finding their way to customers. Worthy of
 note is the fact that better electricity help improve the speed with which workers get their work done. It
 also improves the accuracy with which workers get their work done. Not only that, it helps workers get
 their work done more safely and provides a visual environment that is conducive to high morale (Weiss,
 2002). Some plant managers pursue lighting-system modifications from a misguided costs-only point of
 view. They assume that light is light, just as heat is heat (Ghazzawi, 2008).

However, lighting is far more complex than many realize. Certain factors need to be considered
 among which include:

- **The quality and quantity of illumination**: The areas of most concern from a lighting standpoint tend to
  be workstation or task surfaces, since illumination there has a direct and immediate impact on
  productivity and error rates. If an insufficient amount of light is provided, poor visibility forces workers
to perform more slowly and make more mistakes than they otherwise would. Older workers are far more
  susceptible to glare and other lighting effects than their younger counterparts, and therefore need better
  quality lighting to produce at the same level.

- **The type of light**: Shadows, glare, and reflections must usually be minimized, but lighting that causes
  glare might actually be preferred when it comes. In other words, what is needed is lighting designed to
  deliver the type of light optimally suited for the tasks and workers involved.

- **Flexibility of lighting**: Given that multi shift operations may involve different workers performing the
  same task in the same space at different times of the day, flexible lighting is particularly important.
  Flexibility can be attained through lighting controls that can easily increase or decrease the amount of
  lighting from a given luminaire that can be easily moved. Developing a high-benefit lighting system one
  that provides optimal “seeing conditions” while also consuming the least amount of energy possible for
  such a system takes time and effort. Plant-management personnel need to inform lighting professionals of
  the specific goals they want to achieve. Lighting professionals can then identify options for attaining
  those ends (Ghazzawi, 2008).

Measuring the cost of lighting in terms of the energy it consumes misses the point. Lighting is not
 installed to consume energy. Lighting is for people, to help them perform their visual tasks at optimal
 efficiency; i.e., peak productivity. If better lighting in your facility will help prevent accidents, and the
 many costly side-effects they create, chances are better lighting can do a lot more; for example, help
 workers improve eye-hand coordination, and thereby improve productivity and lower reject rates
 (Greenwood and Wolf, 1987).

**Safety and Job Satisfaction**

Accidents commonly occur in organizational operations, particularly in many manufacturing
 companies. There are certain recognized factors which affect the occurrence of accidents. Robert Cooke
 of the University of Illinois at Chicago and The Reliability Group, a Miami, FL-based consulting firm,
 revealed that some 80 variables have a significant statistical effect upon accident rates (Krieger and
 Montgomery, 1997). The factors most consistently associated with job related injuries include:
environment, mood among workers, employee selection practice, types of work procedures, role clarity, and job satisfaction and stress, (Krieger and Montgomery, 1997). In a similar study, Sherry (1992) identified five major factors related to potential causes of accidents as psychological, environmental, ergonomic, physical, and stress. Likewise, in a study conducted by Osibanjo, Abiodun, and Adenijii (2013), they described job environment as the physical, geographical, professional surroundings or conditions wherein employees interact with colleagues and equipment in order to carry out some specific activities. Essentially, job environment is expected to be conducive, hazard free, well ventilated because hazardous environment tends to influence employees’ performance and their job satisfaction at the long run (Bakotia and Babiae, 2013).

Some researchers have wondered what comes first, job satisfaction or safe work environment? Most safety researchers agree that, job satisfaction often occurs first, that satisfied workers are more frequently safe workers, but safe workers are not necessarily satisfied workers (Blair, 1999). Kniest (1997) posited that ineffective leadership practice; such as lack of caring and supportive supervisors, not considering workers opinions, and employees feeling that their jobs are not important – was a critical employee’ safety performance factor.

Recent research by Bigos, (1986); Greenwood and Wolf, (1987); Holmstrom, (1992) concentrated on employee attitudes and their job-related stress, which are significantly related to the occurrence of accidents, health and job safety. According to these studies increasing employees’ job satisfaction is as important as eliminating physical hazards in the workplace. They consistently found that job satisfaction was more predictive of lower accident rates than such factors as: demographic, health, psychological, and stress. Safety climate is seen as a coherent set of perceptions and expectations that workers have regarding safety in their organization (Neal, Griffin and Hart, 2000; Griffin and Neal, 2000; and Zohar, 2000). It is considered as a subset of organisational climate (Griffin and Neal, 2000). Workers’ perceptions of safety climate have been regarded as a principal guide to safety performance, which provides a potent proactive management tool.

Consistent with this observation, researchers have noted that workers with a negative perception of safety climate (e.g., a high workload, work pressure) tend to engage in unsafe acts, which in turn increase their susceptibility to accidents (Hoffman and Stetzer, 1996; and Salmien, 1995). Similarly, workers who perceive job insecurity, anxiety and stress have exhibited a drop in safety motivation and compliance (Probst, 2001; Probst and Brubaker, 2001) and recorded a higher accident rate (Siu, Philips and Leugh, 2004). On the other hand, workers with a positive perception of their workplace safety have registered fewer accidents (Smith, Silverman, Heckert, Brodke, Hayes and Silverman, 2001). One aspect of organisational behaviour which is likely to affect workers’ perceptions of organisational safety climate, and in turn influence safe work behaviours, and accident frequency is the extent to which workers perceive their organisations as being supportive, concerned and caring about their general well-being and satisfaction. In the literature this has been technically referred to as job satisfaction (Rothmann and Coetzer, 2002).

Job satisfaction is defined as the degree to which a worker experiences positive affection towards his or her job (Locke, 1969). In his definition, Locke considers job satisfaction to be “a pleasurable or positive emotional state resulting from the appraisal of one’s job or job experiences and as a function of the perceived relationship between what one wants from one’s job and what one perceives it as offering” The general indication, however, is that job satisfaction is more of an affective reaction to one’s job, an evaluative measure and consequently an indicator of working conditions. Occupational injuries and industrial accidents are therefore likely to be mediated by organisational climate and job satisfaction.

The relationship between job satisfaction and organisational safety climate relates to the fact that the degree of an employee’s job satisfaction derives from meaningful organisational and social organisational values, norms, beliefs, practices and procedures operational at the workplace. In effect, the perceived level of support provided by an organisation will turn out to be closely associated with safety climate and other organisational and social factors which are important for safety. If workers perceive that their organisations are supportive and are satisfied with the organisational structures in place, they are more likely to recognise that the organizations value their safety and general well-being as well.
Thus, it is on record that when workers’ basic needs are met consistently and the workers express job satisfaction, they display greater emotional attachment, involvement and express stronger feelings of allegiance and loyalty to their organisations (Rhoades and Eisenberger, 2002). In line with this, a number of studies have consistently found strong and positive relationships between job satisfaction and productive organisational behaviours such as perceived organizational support (Rhoades and Eisenberger; Setton, Bennet and Liden, 1996), organisational citizenship behaviours (Podaskoff, Mackenzie and Paine, 2000; Simous and Robertson, 2003) and fairness perception (Godard, 2001 ; Rhoades and Eisenberger, 2002). Additionally, research reports on the job satisfaction-safety link have indicated that satisfied workers, more than their dissatisfied counterparts, are motivated into safe work behaviours (Probst and Brubaker, 2001; Barring, Kelloway and Iverson, 2003); and register relatively lower accident rates (Godard, 2001; Probst and Brubaker, 2001).

Workers who perceive a high level of organisational concern and support, and are satisfied with workplace conditions, feel a sense of indebtedness and a need to reciprocate in terms that will benefit their organisations/management (Hoffman, Morgeson and Gerras, 2003). Complementary research findings along this line of argument in both social psychology (Aryce, Budhwar and Chen, 2002) and the organisational literature have confirmed that one type of prosocial behaviour facilitates other types of prosocial behaviours due to the personal values acquired through the socialisation process. Organisational researchers have therefore found satisfied workers to be more actively engaged in activities that are considered as facilitative to organisational goals as their dissatisfied work colleagues (Aryce, Budhwar and Chen, 2002). Thus relative to their dissatisfied colleagues, satisfied workers are more likely to comply with safety-related practices.

In his work, Herzberg (1966) is of the opinion that managers who provide favorable motivators and hygiene factors will affect employees’ positive job satisfaction. Effective management and positive job satisfaction, in turn, will motivate positive employee behavior including improved safety performance and that the high safety performance variability may stem from inconsistent job satisfaction in various job-related organizational factors.

**Task and Job Satisfaction**

As employees spend a large portion of their lives at work, interpersonal relationships and friendships between/among employees at work are often formed. Researchers have consistently reported that workplace friendship (WF) positively affects employees’ work-related attitudes and behaviors which, in turn, enhance organizational outcomes. People may gain help, assistance, guidance, advice, feedback, recommendations, or information from workplace friends on a variety of work-related matters such as completing jobs, performing tasks, and handling issues with co-workers, subordinates, supervisors, and/or clients (Lambert, Hogan and Barton, 2001).

The offices are the daily work environments for a majority of the working population in the society. These employees often spend more than 40 hours per week at work in offices; as such the office layout exerts a significant impact on the daily life for a great number of people. Researches have it that over the past years an increasing number of people are absent from work due to stress related diseases. These factors combined make it appropriate to look at the possible relation between productivity and job satisfaction among office employees in relation to office layouts. Through research we know that the work layout does have an impact on the productivity and job satisfaction of employees (Karasek and Theorell, 1990; Siegrist, 1996; Toomingas, 1997).

The employees in cell-offices have a better self-rated health in general compared with those in other office-types. These employees also report higher job satisfaction. The high ranking position of the cell-office with regard to health and job satisfaction is not that surprising, considering it is often referred to as the best office-type from an employee perspective (Sundstrom, 1986; Shah, Jaffari, Aziz, Ejaz, Haq, and Raza, 2011).

Seven different office-types can be identified in office layout, shared-room office, open plan, small, medium and large open plan office, flex-office and combi-office (Ahlin and Westlander, 1991; Duffy, 1999). In terms of job satisfaction, medium open plan and combi-offices showed the highest prevalence
of bad job satisfaction. Best chances for good health and well-being which leads to higher productivity was found among employees in cell-offices and flex-offices.

A major finding with regard to satisfaction with office layout is that there are differences between employees in different office types where employees share workspaces and facilities, i.e. all office-types other than cell offices. It is not surprising that cell-office employees stand out in satisfaction with their office layout, including Design-related factors, since features that allow independence and control over the own workplace in many aspects define this office-type. With regard to Design-related factors the internal differences between the office-types that share workspaces and facilities are very interesting. Except the employees in cell offices, which are most satisfied with these aspects, those in shared-room offices and flex offices are more satisfied than other employees. The employees in shared-room offices report satisfaction in the same field of factors as those in cell-offices, but to a lower extent. The employees in flex-offices, on the other hand, are more satisfied with social aspects of the design, such as the workspace’s support of affinity and the office’s ability to reinforce interaction as well as good spaces for breaks.

When it comes to dissatisfaction with the office layout and problems with aspects that are highly connected to the physical office environment, medium and large open plan offices stand out as “high risk” with regard to these aspects. Overall these are the office-types where employees report highest degree of dissatisfaction.

**Furniture and Employees’ Performance**

Work environment comprises the totality of forces, actions and other influential factors that are currently and, or potentially contending with the employee’s activities and performance. Work environment is the sum of the interrelationship that exists within the employees and between the employees and the environment in which the employees work. Infrastructure includes the physical facilities (roads, airports, utility supply systems, communication systems, water and waste disposal systems), and the services (water, sanitation, transport, energy) flowing from those facilities. According to Cascio, (2006), performance refers to the degree of achievement of the mission at workplace that builds up an employee job. Mostly researchers used the term performance to express the range of measurements of transactional efficiency and input and output efficiency (Stannack, 1996).

A poor work environment has proved to be associated with reduced job satisfaction, absenteeism, somatic complaints, burnout and depression phenomena (McCowan, 2001, Osibanjo, Abiodun and Kehinde, 2012). According to Ramlall, (2003) people strive to work and to stay in those corporations that provide good and positive work environment, where employee feel that they are valued mostly and making difference. Selecting and using proper furniture and equipment, the important physical factors in the office is an important factor in enhancing employee productivity (Keeling and Kallaus, 1996; Oluseyi and Ayo, 2009). Selecting appropriate office furniture is an important consideration in which office managers need to pay more attention to make sure that the ergonomic environment is properly maintained. While ergonomic environment is important in increasing employee productivity, adjustable office furniture, such as desks and chairs, which can support employees in generating their work is recommended, to allow the work comfortably throughout the day (Burke, 2000). The office design encourages employees to work a certain way by the way their workstations are built. In doing so, the company is answering the firm’s business plan while making sure their employees have everything they need to work with (Al-Anzi, 2009).

Lambert, Hogan and Barton (2001) found that environmental factors are important determinant of job satisfaction. The level of salary, promotion, appraisal system, climate management, relation with co-workers and furniture/ fittings in the office are the very important factors. Huges (2007) surveyed 2000 employees pertaining to various organizations and industries in multiple levels. The reported results of these survey showed that nine employees out of ten believed that a workspace and quality of the furniture affects the attitude of employees and increases their productivity. James (1996) concluded that the type and the comfortability of the furniture and fittings an employee has in the office environment have significant impact on the satisfaction level of employees as it affects their performance. It is essential to
recognize the significance of these factors to boost the satisfaction level in the workforce. How employees perceive their work environment can affect employee's commitment, motivation, and performance and also helps organization to form a competitive edge over its rivals.

Brown and Leigh, (1996) concluded that a motivational and empowered work climate (furniture inclusive) can influence employee's attitudes toward work positively and can improve work performance. Work place survey conducted for steel case described that an effective work environment management entails making work environment (including attractive furniture) creative, comfortable, satisfactory and motivating to employees so as to give employees a sense of pride and purpose in what they do (Taiwo, 2009).

**Summary of Research Hypotheses**

Based on the review of the literature, the following hypotheses are proposed in this study:

- **H1**: Supervisory intervention is significant explanatory variable of job satisfaction
- **H2**: There is a relationship between job satisfaction and the design feature/office layout in the employee working environment.
- **H3**: The relationship between employee productivity/job satisfaction will be mediated by the electricity/lighting.
- **H4**: Employee’s perception of attractive furniture and fittings in their work place is positively related to their productivity.
- **H5**: There is a positive relationship between job satisfaction and organizational safety climate.

The proposed research model is depicted in Figure 1.

**FIGURE 1**

**PROPOSED RESEARCH MODEL**

---

**MATERIALS AND METHODS**

Survey research design was adopted for this study because of its features amongst which include; feasibility and economical in nature. The survey data was obtained from one hundred and twenty (120) respondents from Pipelines and Product Marketing Company (PPMC): A subsidiary of the Nigerian National Petroleum Corporation, Headquarters (NNPC) Abuja. The choice of this study location is based essentially on the fact that it is solely owned by the Nigerian government, and since one of the
employment policies into Nigerian government owned organizations is based on quota system or federal character principle, therefore, the respondents tend to represent the six geopolitical zones within Nigeria.

Structured questionnaire was utilized as research instrument in collecting data for this survey. The first path sought to establish the demographic status of the respondents while the remaining items focused on essential research variables in the study. However, these variables were developed having reviewed literature and supported by empirical evidences; supervision (Eseka, 2009, Adebayo and Ogunsanya, 2011); Task-layout (Karasek and Theorell, 1990; Siegrist, 1996); Security_safety (Probst and Brubaker, 2001); Electricity (Welch, 1996); furniture (Quible, 2000). Each of the items of the questionnaire was scaled on 5-point Likert scale. The survey instrument sought to identify, amongst others, relationships that exist between job supervision and job satisfaction; task layout and job satisfaction; security/safety and job satisfaction; electricity and job satisfaction; and furniture and employee productivity. Data analysis procedure was carried out using IBM SPSS AMOS 21. Responses were analyzed in SPSS data format, while Structural Equation Modeling (SEM) was adopted in order to identify the relationships that exist between variables studied.

RESULTS AND DISCUSSION

As depicted in Table 1, the sample for the survey comprises of eighty one (81) males, indicating that 67.5 percent of the respondents were males; and thirty two (32) females, indicating that 26.7 percent of the respondents were females. The demography of the sample indicates that 69 respondents are 38 years and above, which shows that 57.5 percent of the respondents belong to this category. Significant proportions of the respondents are married (76.7 percent), while insignificant had been married at a time (10 respondents are divorcees) with 14.2 percent of the respondents been unmarried. Similarly, 69 respondents had been on the payroll of this organization between 11 and 15 years, representing 57.5 percent of the sample. With reference to the respondents’ demography, the sample may be considered as a rich data for this survey.

As cited in Adeniji, Osibanjo, and Abiodun (2013), various indicators of goodness-of-fit are adopted in research models (Bentler and Wu, 2002; Kaplan, 2000). However, it is argued that the greater number of the indices, the assured probability of a good fit. Therefore, for a model to be accepted, the Normed Fit Index (NFI) => .90; while the Comparative Fit Index (CFI) cut-off value => .90 (Bentler and Bonett, 1980). Essentially, in order to avert the disagreement and illogical results of chi-square tests, other indices of model fit such as Root Mean Squared Error of Approximation (RMSEA) and CFI are argued to be informative measures of how close the model corresponds with the data. The model fit summary for the survey is illustrated in Table 2.
TABLE 1
RESPONDENTS’ DEMOGRAPHY

<table>
<thead>
<tr>
<th>Gender</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>81</td>
<td>67.5%</td>
</tr>
<tr>
<td>Female</td>
<td>32</td>
<td>26.7%</td>
</tr>
<tr>
<td>Missing Cases</td>
<td>7</td>
<td>5.8%</td>
</tr>
<tr>
<td>Total</td>
<td>120</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 – 22 years</td>
<td>2</td>
<td>1.7%</td>
</tr>
<tr>
<td>23 – 27 years</td>
<td>6</td>
<td>5.0%</td>
</tr>
<tr>
<td>28 – 32 years</td>
<td>14</td>
<td>11.7%</td>
</tr>
<tr>
<td>33 – 37 years</td>
<td>24</td>
<td>20.0%</td>
</tr>
<tr>
<td>38 years and above</td>
<td>69</td>
<td>57.5%</td>
</tr>
<tr>
<td>Missing Cases</td>
<td>5</td>
<td>4.2%</td>
</tr>
<tr>
<td>Total</td>
<td>120</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Marital Status</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single</td>
<td>17</td>
<td>14.2%</td>
</tr>
<tr>
<td>Married</td>
<td>92</td>
<td>76.7%</td>
</tr>
<tr>
<td>Separated/Divorced</td>
<td>10</td>
<td>8.3%</td>
</tr>
<tr>
<td>Missing Cases</td>
<td>1</td>
<td>0.8%</td>
</tr>
<tr>
<td>Total</td>
<td>120</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Work Experience</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 5 years</td>
<td>18</td>
<td>15.0%</td>
</tr>
<tr>
<td>6 – 10 years</td>
<td>33</td>
<td>27.5%</td>
</tr>
<tr>
<td>11 – 15 years</td>
<td>69</td>
<td>57.5%</td>
</tr>
<tr>
<td>Total</td>
<td>120</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Source: Survey, 2013

TABLE 2
MODEL FIT SUMMARY

<table>
<thead>
<tr>
<th>Model-fit Index</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chi-square/Degree of Freedom</td>
<td>.217</td>
</tr>
<tr>
<td>Goodness-of-fit (GFI)</td>
<td>.987</td>
</tr>
<tr>
<td>Comparative Fit Index (CFI)</td>
<td>1.000</td>
</tr>
<tr>
<td>Normed Fit Index (NFI)</td>
<td>.996</td>
</tr>
<tr>
<td>Root Mean Square Error of Approximation (RMSEA)</td>
<td>.000</td>
</tr>
</tbody>
</table>

Source: Survey, 2013

The goodness of fit of a model explains the degree in which it fits the observed and expected values. In comparing the scores obtained from the analysis with the recommended cut-off value, it could, therefore be concluded that the research model is perfect and acceptable fit.
The model described in Figure 2 adequately fits the full dataset and is clear and easily interpretable. Path coefficient scores of the study variables as depicted in Figure 2, employee productivity appears to be strongly and positively influenced by electricity (.37); furniture (.17); while job satisfaction appears to be positively influenced by electricity (.24); security-safe (.22); furniture (.05); task-layout (-.03). It is evident that among all the tested variables, electricity tends to be one of the best determinants of employee productivity and job satisfaction. Evidently, close relationship exists among the variables studied under independent construct (supervision, task-layout, security-safe, electricity, and furniture). As shown in Figure 2, the path coefficient value between furniture and electricity is .23; furniture and security_safe; is .21.

CONCLUSION AND MANAGERIAL IMPLICATION

The survey examined the modelling relationship between supervision, work environment and employee productivity in the Nigerian public sector, using PPMC, Abuja as the location of the survey. Essentially, the proposed variables in the model were analyzed using Structural equation modelling and it was observed that strong positive association exists among the proposed variables.

Further, it was discovered that electricity a major determinants of employee productivity, safety in the workplace increases employee quality of work; task layout tends to increase the degree of efficiency, and also, adequate supervision is an important factor in increasing employee productivity.

It can therefore, be concluded, based on the findings that adequate supervision and work environment (task layout, security, safety, electricity, and furniture) are important factors in determining the degree at which employees are satisfied on their jobs and thereby increase their productivity level. Managers and policy makers should take these factors into consideration while formulating their employment policies in order to have formidable, efficient, and productive workforce.

REFERENCES


The Balanced Scorecard: A Review of Five Research Areas

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Tonny Stenheim
BI Norwegian Business School

The Balanced Scorecard (BSC) is one of the most influential concepts in accounting and management. The BSC recently celebrated its 20-year anniversary. Since its introduction, the BSC has been the subject of much debate among academics and practitioners. The research literature on the BSC has evolved considerably over the last 20 years. The purpose of this article is to provide an overview of five important areas of BSC research: (1) conceptual evolution (2) adoption and diffusion, (3) implementation and use, (4) performance effects, and (5) critical perspectives. The article discusses current trends and emerging issues in the BSC literature and suggests fruitful areas for further research.

INTRODUCTION

The Balanced Scorecard (BSC) recently celebrated its 20-year anniversary (Hoque, 2012, 2014). Since the BSC was introduced by Robert Kaplan and David Norton (KN) in 1992 (Kaplan & Norton, 1992), it has received considerable attention in the management and business community. The Harvard Business Review has referred to the BSC as one of the most influential management ideas of the last 75 years (Sibbet, 1997: 12). The consulting firm Bain & Company’s biannual survey of management tools and trends consistently ranks the BSC as one of the most widely used tools by managers worldwide (Rigby & Bilodeau, 2009, 2011, 2013). The BSC has also been the subject of much debate in academic circles. In recent years, several literature reviews have been carried out on the extensive BSC research literature (Abdel-Kader, Moufty, & Laitinen, 2011; Banchieri, Planas, & Rebull, 2011; Hoque, 2014). Just in the last few years two special issues of Journal of Accounting and Organizational Change have been devoted to papers on the BSC (Hoque, 2012; Norreklit & Mitchell, 2014).

Taken together, these review articles, special issues and various other contributions show that the BSC is a highly relevant and timely topic. At the same time, several authors have noted that it can be challenging to define what the BSC really is (Perkins, Grey, & Remmers, 2014; Soderberg, Kalagnanam, Sheehan, & Vaidyanathan, 2011). The BSC concept has evolved considerably over the last 10-15 years (Bible, Kerr, & Zanini, 2006; Braam & Nijssen, 2004; Cooper, Ezzamel, & Qu, 2012). In the same time period, there has been a growth not only in terms of the number of published articles, but also in terms of the areas covered. Today, research on the BSC is not only confined to discipline-based journals in accounting and management, but can also be found in context-specific journals covering hotels and tourism (Palatková, 2015; Sainaghi, Phillips, & Corti, 2013; Vila, Costa, & Rovira, 2010), education...
Karathanos & Karathanos, 2005; Sayed, 2013), the health sector (Trotta, Cardamone, Cavallaro, & Mauro, 2012) and the public sector (Dreveton, 2013; Northcott & Taulapapa, 2012).

This article will focus on five research areas which we deem the most essential in the BSC literature. Thus, our intention is not to cover all areas of the BSC literature. The reader should, therefore, consult the aforementioned review articles for more systematic and exhaustive reviews of the BSC literature. In addition, we will not focus on the practitioner-oriented or normative literature on the BSC which focuses on the design and implementation of the BSC. These issues are covered in a number of books on the BSC concept (e.g. Niven, 2005; Olve, Roy, & Wetter, 1999; Olve & Sjostrand, 2006) as well as nearly all textbooks on management accounting and control (e.g. Atkinson, Kaplan, Matsumura, & Young, 2011; Merchant & Van der Stede, 2012).

The article is structured as follows: Section two takes a closer look at the BSC concept’s evolution since 1992, and the most important actors shaping its evolution and trajectory. In section three we look at research on the adoption and diffusion of the BSC in different contexts. In section four we focus on the implementation and the use of the BSC in practice. Section five discusses the performance effects of adopting and implementing the concept. Section six discusses various critical perspectives on the BSC. The last section summarizes the present state of the research literature and provides some suggestions for future research on the BSC.

THE EVOLUTION OF THE BSC CONCEPT

In this section we discuss (1) how the BSC concept was presented in the 1990s, and (2) how the concept has evolved since the turn of the millenium. As shown, the BSC concept has evolved considerably since its introduction in 1992, and has over time taken up elements and inspirations from other concepts and ideas (Barnabè & Busco, 2012; Bible et al., 2006; Cooper et al., 2012; Kaplan, 2008; Kaplan, 2012).

Pre-2000

The BSC was originally formulated and presented as a multi-dimensional performance measurement system (Kaplan & Norton, 1992). Its main purpose was to provide managers with more and better information for strategic decision-making. The original version of the BSC focused primarily on integrating financial and non-financial performance measures. KN called this a dashboard of different performance measures grouped in four perspectives. However, the narrow focus on performance measurement soon shifted. From the 1996 book by KN (Kaplan & Norton, 1996) and onwards, there has been an increasing focus on the link between these measures and the organization’s strategy and the causality between measures and perspectives (Braam & Nijssen, 2004; Bukh & Malmi, 2005; Stemsrudhagen, 2003). Instead of using the dashboard as a metaphor, KN started to use the airplane metaphor, where the managers are seen as pilots using the cockpit’s instrument panel to fly the plane to its destination (Norreklit & Mitchell, 2007).

Post-2000

Around the turn of the millennium, KN started to discuss the so-called strategy-focused organization (Kaplan & Norton, 2001). They also introduced the term strategy map, which over time has become perhaps the most significant element of the BSC concept. Strategy maps are used to visualize and communicate the strategy to the organization (Kaplan & Norton, 2001; Kaplan & Norton, 2004). The use of such strategy maps are supposed to contribute to better alignment of different parts of the organization (Kaplan & Norton, 2006a).

More recently, KN have suggested that strategy should be a separate function in the organization («the office of strategic management») (Kaplan & Norton, 2005), placing an emphasis on strategy implementation. KN’s most recent book (Execution Premium) revolves around this theme (Kaplan & Norton, 2008). KN have developed the concept from being a rather ‘narrow’ performance measurement
system to a ‘broader’ and more holistic management system which can be used to describe, communicate and implement the organization’s strategy (Kaplan, 2008; Kaplan, 2012).

In other words, over the course of the last two decades there has been a considerable shift in the way the BSC is presented in the literature (e.g. KN’s books). Nowadays there is a much stronger emphasis on strategy, while performance measurement has gradually moved into the background. This does not necessarily mean that the current BSC concept is in conflict with prior versions. Performance measurement still plays an important role in the implementation of and the monitoring and control of strategy. The measurement ‘scorecard’ or ‘dashboard’ is still relevant. For example, many organizations use simpler versions of the BSC where the main focus is performance measurement (Madsen, 2014b; Speckbacher, Bischof, & Pfeiffer, 2003).

Who has shaped the BSC’s evolution?

There is a number of actors that have shaped the evolution of the BSC concept, but it is widely recognized that the concept’s originators, KN, have been of particular importance (Cooper et al., 2012; Nørreklit, 2003; Qu, 2004). For example, the magazine The Economist has called the duo «the most inseparable double-act in management». Over a period stretching more than 20 years, KN have produced a steady stream of new books, articles and other products and services through their consulting organization Palladium Group (Cooper et al., 2012; Qu, 2004).

There is also a number of other academics who have jumped on the ‘BSC bandwagon’ and written competing books (Niven, 2005; Niven, 2011; Olve & Sjostrand, 2006) and articles (Marr & Adams, 2004; Marr & Neely, 2003). KN’s books have also been translated to a number of different languages. The Scandinavian countries may serve as an example, as there are number of country-specific BSC books containing local case examples (Bukh, Bang, & Hegaard, 2004; Bukh, Fredriksen, & Hegaard, 2000; Christensen & Bukh, 2013; Hoff & Holving, 2002, 2015; Olve, Roy, & Wetter, 1997; Olve et al., 1999). Some of these local BSC books have become very popular. For example, Olve et al. (1997) has been translated into several other languages.

These various sources of evidence show that actors from academia (business schools) have played an important role in the evolution of BSC as a concept. The importance of academics in the development of the BSC can be contrasted with the case of the Beyond Budgeting philosophy which to a larger extent than the BSC has been shaped by consultants and practitioners in multinational corporations (Becker, Messner, & Schäffer, 2010; Bjørnenak, 2010; Johanson, 2013; Sandalgaard & Bukh, 2014).

ADOPTION AND DIFFUSION OF THE BSC

An important stream of BSC research concerns the adoption of the BSC in organizations, and how the concept has been diffused between organizations in different national and cultural contexts. In this stream of research it is useful to distinguish between studies of the supply-side and studies of the demand-side. The supply-side consists of the field of actors providing products and services (e.g. consulting advice and software) related to the concept, while the demand-side consists of potential users of the concept, i.e. organizations and managers.

The Supply Side of the BSC Concept

A number of researchers have found that different supply-side actors such as consulting firms, professional organizations, software firms, business schools, and public sector agencies have been important drivers of BSC diffusion (Ax & Bjørnenak, 2005; Ax & Bjørnenak, 2007; Banchieri, Campa-Planas, & Sanchez-Rebull, 2012; Braam, Benders, & Heusinkveld, 2007; Braam, Heusinkveld, Benders, & Aubel, 2002; Cooper et al., 2012; Madsen & Slåtten, 2013; Modell, 2009; Qu, 2004). In an interview study carried out in Finland, Malmi (2001) found that supply-side actors played an important role. Ax and Bjørnenak (2005) studied the diffusion of the BSC in Swedish firms from a supply-side perspective, focusing on how the concept was communicated in the business media and in conferences. They found that supply-side actors, particularly consultants, were important drivers of the diffusion process. Another
finding was that local consultants customized the BSC to fit better with local market preferences in Sweden, where unions and employees are particularly important and influential stakeholders.

Qu (2004) studied the processes shaping the emergence and popularization of the BSC, focusing particularly on the role of the network of actors around Harvard Business School. In what may be characterized as a follow-up study, Cooper et al. (2012) have looked at how KN have popularized the BSC concept. Seen together, these studies show that KN and the network of actors around Harvard Business School have been important drivers in the diffusion and popularization of the BSC and shaped organizations’ propensity to adopt the concept. More recently, Madsen and Slåtten (2013) studied the configuration of the ‘management fashion arena’ supporting the diffusion of the BSC in Scandinavia. Actors such as consultants and conference/seminar organizers played important roles in all three countries, but there were also differences in terms of the roles played by for instance the business media and academics.

The Demand Side of the BSC Concept

As pointed out in the introduction, Bain & Company’s biannual survey has consistently shown that the BSC is one of the most popular management tools among managers. In 2007, 66 per cent of the respondents claimed to be BSC adopters (Rigby & Bilodeau, 2007), and even though the adoption rate has come down a bit, it still hovers around 50 per cent (Rigby & Bilodeau, 2009, 2011, 2013). In the literature over the last 15 years there have been a number of surveys which have looked more closely at the adoption and diffusion of the BSC in different contexts, such as the US (Maisel, 2001; Marr, 2005; Silk, 1998), Denmark (Nielsen & Sørensen, 2004), Sweden (Ax & Björnenak, 2005; Olve & Petri, 2005), Norway (Eriksrud & McKeown, 2010; Kjøde, 2003; Madsen, 2012; Stemsrudhagen, 2004), the Netherlands (Braam et al., 2007; Braam et al., 2002), India (Anand, Sahay, & Saha, 2005), Jordan (Al Sawalqa, Holloway, & Alam, 2011) and the German-speaking countries (Speckbacher et al., 2003).

Table 1 provides an overview of studies which have looked at the adoption and diffusion of the BSC in different national contexts. It is difficult to draw conclusions based on these studies since they have been carried out by different researchers, at different points in time, and by using different types of research methods and samples. However, the studies cited in Table 1 demonstrate that the BSC has been adopted and diffused in most parts of the world.

Why Are Organizations Adopting the BSC?

Why do organizations decide to adopt the BSC? Researchers typically distinguish between two types of explanations. Rational accounts of adoption behavior assume that organizations act rationally, and adopt concepts such as the BSC to improve performance measurement practices or strategic control. Such explanations have intuitive appeal. In contrast, social accounts explain adoption behavior by highlighting that organizations are embedded in their institutional and social environments, and are influenced by management fashions (Abrahamson, 1991, 1996) or other types of social and institutional pressures (Sturdy, 2004). In the following section we will take a closer look at whether these two explanations of BSC adoption behavior are mutually exclusive.
TABLE 1
ADOPTION RATES IN DIFFERENT COUNTRIES/REGIONS

<table>
<thead>
<tr>
<th>Country/Region</th>
<th>Adoption rate (approx.)</th>
<th>Sample</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Worldwide</td>
<td>66 %</td>
<td>Managers of large companies</td>
<td>Rigby and Bilodeau (2007)</td>
</tr>
<tr>
<td>Nordic countries</td>
<td>27 %</td>
<td>Publically traded companies</td>
<td>Kald and Nilsson (2000)</td>
</tr>
<tr>
<td>Germany, Austria and Switzerland</td>
<td>25 %</td>
<td>200 large companies</td>
<td>Speckbacher et al. (2003)</td>
</tr>
<tr>
<td>Norway</td>
<td>30 %</td>
<td>Manufacturing companies</td>
<td>Olsen (1999)</td>
</tr>
<tr>
<td>Norway</td>
<td>26 %</td>
<td>Controllers and CFOs</td>
<td>Eriksrud and McKeown (2010)</td>
</tr>
<tr>
<td>Sweden</td>
<td>38 %</td>
<td>Technical and industrial companies</td>
<td>Olve and Petri (2005)</td>
</tr>
<tr>
<td>Jordan</td>
<td>35 %</td>
<td>Large companies</td>
<td>Al Sawalqa et al. (2011)</td>
</tr>
<tr>
<td>India</td>
<td>45 %</td>
<td>Large companies</td>
<td>Anand et al. (2005)</td>
</tr>
<tr>
<td>UK</td>
<td>57 %</td>
<td>Large companies</td>
<td>Anonymous (2001)</td>
</tr>
<tr>
<td>USA</td>
<td>35 %</td>
<td>Fortune 5000 companies</td>
<td>Marr (2005)</td>
</tr>
<tr>
<td>USA</td>
<td>43 %</td>
<td>Members of the American Institute of Public Accountants</td>
<td>Maisel (2001)</td>
</tr>
<tr>
<td>USA</td>
<td>60 %</td>
<td>Fortune 1000 companies</td>
<td>Silk (1998)</td>
</tr>
</tbody>
</table>

Malmi (2001) identified five motives behind BSC adoption: (1) to translate strategy into action, (2) to manage organizational changes, (3) to implement quality programs and win quality awards, (4) as a response to managerial fads and fashions, and (5) as a response to the abandonment of traditional budgetary control. In another Finnish study, Rautiainen (2009) investigated the adoption of the BSC in municipalities. Rautiainen distinguished between three types of motives: (1) imitative, (2) rational, and (3) normative-experimental motives. Rautiainen found that the motives were not mutually exclusive, but were tangled and interrelated. Similar findings have also been reported elsewhere. For example, Madsen (2013) interviewed 39 managers of Scandinavian organizations which had adopted the BSC, and found that the motives can be grouped in different categories. Some managers emphasized that they wanted to improve processes related to performance measurement, budgeting and strategy, while others emphasized organizational politics and changes as the reasons for adopting the BSC. Some mentioned broader cultural and social trends, e.g. the increased focus on being ‘balanced’ and take into account more than just financial performance measures. Finally, some had also been in contact with supply-side actors (e.g. consultants) which indicates that management fashion had a certain degree of influence on the decision to adopt the BSC (see also Madsen, 2014a).

These studies suggest that BSC adoption may be explained by economic rationales and social factors. There is also reason to believe that the motives and rationales might be tangled and interrelated. The available evidence, however, is limited, and it is still not clear which role the supply- and demand-sides play in shaping adoption behavior in relation to the BSC.
THE IMPLEMENTATION AND USE OF THE BSC

Interpretation and Understanding of the BSC

Research has shown that the BSC concept can be interpreted and understood in different ways (Aidemark, 2001; Ax & Bjørnenak, 2005; Braam, 2012; Braam et al., 2007; Hansen & Mouritsen, 2005; Madsen, 2011, 2014b; Modell, 2009; Wiersma, 2009). A wide room for interpretation makes the BSC appealing to a large number of potential users in different contexts. This also makes the concept plastic and stretchy, and less likely to clash with local cultural values and cognitive frameworks. This is one possible explanation of the BSC’s apparent global appeal (see Table 1). However, research has shown that the way the BSC is interpreted depends on factors such as professional background and specializations. For example, one study shows that users with an accounting background tended to place more emphasis on the technical aspects of the BSC and were more likely to interpret and use the concept in the traditional ‘accounting way’ as a performance measurement system. In contrast, users with an HR or organizational background were more likely to interpret and use the BSC as a tool for strategy development and implementation (Braam et al., 2002). Divergent interpretations of the BSC are also likely to occur as users read and are exposed to different versions of the BSC literature (Braam & Nijssen, 2004) or are exposed to different intermediaries (e.g. consultants) who put their own spin on the BSC (Ax & Bjørnenak, 2005; Braam et al., 2007; Madsen, 2011; Madsen, 2014a).

Customization and Adaptation of the BSC

In their BSC books and articles, KN emphasize that the BSC can be adapted to the user’s unique situation and needs. A recent review article which looks at adaptations of the BSC, shows that the concept is customized and adapted in a variety of ways in practice (Lueg & Silva, 2013). In other words, the BSC should not be viewed as a ‘straight jacket’ which has to be applied in a specific way.

The adaptations of the BSC can happen on both the supply-side and the demand-side. For instance, Ax and Bjørnenak (2005) showed that supply-side actors ‘bundled’ the BSC with other local initiatives and ideas such as the intellectual capital model and non-budgetary control. The end result was a ‘Swedish BSC’ which looked quite different from the original BSC model proposed by KN.

Other researchers argue that the adaptation mainly happen on the demand-side of the market, i.e. among the users in practice. The main reason is due to the fact that the BSC is a flexible concept with a considerable room for interpretation (Aidemark, 2001; Ax & Bjørnenak, 2005; Braam & Nijssen, 2004; Dechow, 2012; Johanson, Skoog, Backlund, & Almqvist, 2006).

Some are going even further and view the BSC as a so-called boundary object (Star & Griesemer, 1989). According to this theoretical perspective, the BSC is a ‘plastic’ concept which only contains certain core elements that can be identified across different adaptations and translations. Typical elements which can be recognized in most BSCs are the four standard perspectives (financial, customer, internal processes, and learning/growth) and a mix of lead and lag indicators. Among researchers who take this theoretical position, the way the BSC is interpreted and used depends on the users’ unique situation and organization-specific problems and issues (Hansen & Mouritsen, 2005).

Typologies of BSC Use

A number of researchers have looked more closely at patterns in the use of the BSC in practice. These researchers have developed different typologies or classifications of BSC use. Below we describe and compare five of these typologies (See Table 2).

Speckbacher et al. (2003) identified three types of BSC use (Type I, II and III). This typology is possibly the most well-known and cited typology in the BSC research literature. Type I describes use of the BSC as a performance measurement system. This type of use is closely related to how the BSC concept was presented in the 1990s. Type II includes cause-and-effect relationships and a stronger link to the organization’s strategy. This type of BSC use is close to the use prescribed in KN’s 1996 book. Type III represents the most advanced form of BSC use, and includes more advances elements such as a link to
rewards and compensation systems. Speckbacher et al. (2003) found that less than 10 per cent of the organizations in their sample utilized a type III BSC.

Cobbold and Lawrie (Cobbold & Lawrie, 2002; Lawrie & Cobbold, 2004) classify BSC in three generations: first, second, and third generation BSCs. A first generation BSC is essentially a performance measurement system, while third generation has taken several additional steps, e.g. applied strategy maps and destination statements. Brudan (2005) distinguishes between five types of BSC use. The simplest type of BSC is primarily used for reporting, while the most advanced form is a complete BSC which includes strategy maps and other advanced elements.

Soderberg et al. (2011) distinguish between five levels of BSC use. The first level is a BSC where the performance measures are derived from the organization’s strategy. Level two can be divided into a level 2a and level 2b. Level 2a includes level 1 plus a balance between the different performance measures, while level 2b includes cause-and-effect relationships. Level 3 is a BSC which fulfills the requirements of level 2a plus level 2b. Level 4a includes so-called double-loop organizational learning where the organization is capable of challenging its own assumptions and ‘worldview’, whereas level 4b also includes a link to compensation and reward systems. Finally, level 5 is the most advanced BSC system, which fulfills all the lower-level requirements.

Perkins et al. (2014) distinguish between three generations of BSCs. BSC 1.0 refers to use of the BSC as a performance measurement system, while BSC 3.0 is third generation use. This typology builds on Lawrie and Cobbold’s (2004) earlier typology, but is more fine-grained and divides the three generations into eight different versions.

A Comparison of the Typologies

There are many commonalities between the typologies presented in Table 2. The five typologies all separate between ‘simple’ use of the BSC as a performance measurement system to more ‘advanced’ application of the newer theoretical elements (e.g. strategy maps, strategic destinations, reward/compensation systems) which have been incorporated into KN’s concept over the course of the last two decades. At the same time, there is disagreement between the researchers when it comes to the distribution of different types of BSCs among organizations. For example, Speckbacher et al. (2003) found that few organizations used an advanced type of the BSC (‘type III’), while Soderberg et al. (2011) argue that this group is much larger. One explanation of this inconsistency is that these articles where published at different points in time. The study by Speckbacher et al. (2003) was carried out when terms such as strategy maps were relatively unknown in practice. The increased use of the new and ‘advanced’ elements might be explained by the fact that more organizations over time have gained knowledge about and experiences with these areas of the BSC theory and literature. This makes organizations more inclined to adopt and implement a more ambitious BSC.

### Table 2

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<td>Type I</td>
<td>First generation</td>
<td>Reporting</td>
<td>Level 1</td>
<td>BSC 1.0 (four versions)</td>
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<tr>
<td>Type II</td>
<td>Second generation</td>
<td>Functional</td>
<td>Level 2 (a+b)</td>
<td>BSC 2.0 (two versions)</td>
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<td>Type III</td>
<td>Third generation</td>
<td>Control</td>
<td>Level 3</td>
<td>BSC 3.0 (two versions)</td>
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<td>Goal congruence</td>
<td>Level 4 (a+b)</td>
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<td>Complete</td>
<td>Level 5</td>
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THE PERFORMANCE EFFECTS OF USING THE BSC

An important question in the research literature is whether or not the use of the BSC has an effect on organizational performance, as is typically claimed in the normative BSC literature and by promoters of the BSC such as management consulting firms.

Direct Effects of BSC Use on Organizational Performance

Researchers have pointed out that the BSC is a management concept which may increase organizational performance by supporting the implementation of an organization’s strategy (De Geuser, Mooraj, & Oyon, 2009). Yet, it has proved difficult to document a strong relationship between BSC use and performance (Braam & Nijssen, 2004; Davis & Albright, 2004; De Geuser et al., 2009). To a large extent, the jury is still out on whether BSC increases performance. There are many variables mediating and moderating the relationship between BSC use and performance. It is conceivable that the effects of BSC use is related to how the concept is interpreted, understood, and in turn implemented (cf. Braam & Nijssen, 2004). For example, an organization which interprets and implements the BSC as a performance measurement system is likely to experience different effects than an organization which interprets and implements it as a strategic management system (Braam & Nijssen, 2004).

Therefore, there is reason to believe that there is a close relationship between how the BSC is implemented and the associated performance effects (Braam & Nijssen, 2004; Davis & Albright, 2004). Use of the BSC which complements and supports the organization’s strategy can improve its competitive position and performance, while BSC use which does not have a good fit with the organization’s strategy may have an opposite effect and may reduce performance (Braam & Nijssen, 2004; Davis & Albright, 2004; De Geuser et al., 2009). Lucianetti (2010) finds that the use of strategy maps gives organizations increased performance. Organizations that have a thorough process related to the development of strategy maps will typically have a better fit between the BSC and their strategy. One example of BSC use which may lead to decreased performance is the use of a large number of unrelated performance indicators (Madsen & Stenheim, 2014c).

Indirect Effects of the BSC on Organizational Performance

In interviews managers typically report that they perceive a number of benefits of using the BSC (Madsen & Stenheim, 2014b). Therefore, it is also likely that there will be other more indirect effects of using the BSC. For example, by utilizing strategy maps it becomes possible to visualize the organization’s strategic goals and how these can be reached through the assumed causal relationships. This can be useful in order to facilitate strategic discussions in the top management group and to communicate to the rest of the organizations members how they should work in order to reach the organization’s long-term strategic goals. Hence, it is possible to argue that the BSC, and particularly the use of strategy maps can be useful for ‘strategizing’, i.e. the use of the BSC in actual strategy work (Jarzabkowski, Balogun, & Seidl, 2007; Whittington, 2003).

An Assessment of BSC Effect Studies

Researching the performance effects of adopting and implementing management concepts can be challenging from a methodological standpoint. In the BSC research literature there are different ways of measuring the ‘effect’ of BSCs. Some researchers focus directly on the concept’s effect on organizational performance, while others focus more on indirect effects, which are of a more behavioral nature. Further complicating issues is the fact that there are many moderating and mediating variables blurring the relationship between BSC use and performance. In addition, not one study is perfectly comparable to another. The methodologies differ, the samples differ and the point in time at which the data are collected differ. This makes it difficult to compare the results from different studies. Nevertheless, studies on performance effects are important since it will ultimately matter whether or not the concept has a performance enhancing potential. Moreover, it will be important to get more knowledge about how different versions of the BSC influence the relationship between use and performance.
As we briefly touched upon in the last section, it is difficult to document the effects of using the BSC. Therefore, a number of researchers have raised the question of whether or not the BSC can deliver on its promises and live up to the hype. The BSC has been criticized from a number of different angles. The criticisms are leveled at different aspects of the concept. There are particularly six aspects which have been discussed extensively in the BSC literature: (1) the causal relationships between the perspectives and measures, (2) the underlying assumption that organizations implement strategy in a rational top-down process, (3) the use of dramatic and seductive rhetoric in the BSC literature, (4) how BSC hinders creativity, innovation and organizational learning, (5) the BSC as a management fashion, and (6) the BSC as a consulting product and ‘old wine in new bottles’. The first three aspects can be seen as direct criticism of the fundamentals of the concept, while the latter three are mainly concerned with the ways in which the BSC is used by different actors in praxis.

Causal Relationships

One of most fundamental criticisms of the BSC is directed at the assumed causal relationships between lead and lag indicators, and between the indicators in the four perspectives. This criticism has particularly been raised by Nørreklit and colleagues in a series of articles published in the management accounting literature (Nørreklit, 2000, 2003; Nørreklit & Mitchell, 2007; Nørreklit & Mitchell, 2014; Nørreklit, Nørreklit, Mitchell, & Bjørnenak, 2012). As pointed out by Perkins et al. (2014: 152) it is not an easy task to summarize this criticism as it is complicated and abstract, but it revolves around three aspects of the BSC theory: (1) lack of a time dimension in the BSC, (2) lack of clarity about the relationships between the different perspectives in the BSC, and (3) little knowledge about causal relationships between different measures and performance.

Some have moderated Nørreklit and colleagues’ criticism and argued that they focus strongly on the older version of the BSC, particularly KN’s 1996 book (e.g. Bukh & Malmi, 2005; Kaplan, 2012). In defense of the BSC, it can be argued that the concept has evolved considerably since the 1990s and that the criticism is leveled at an outdated version of the BSC. Kaplan (2012) argues that most of the (academic) criticism of the BSC focuses too much on these aspects of the BSC, and to a large extent overlooks the role that the BSC can play as a tool for strategy implementation (strategy execution).

A Rational Top-Down View of the Strategy Process

In the BSC literature there is an assumption that organizations are, by and large, rational and instrumental. This entails that it is possible for managers to plan their strategy and then implement this strategy in a top-down orchestrated process. It is assumed that the strategy is developed in the upper-echelons of the organization (i.e. the top management group). In the management accounting and control literature it is particularly Nørreklit (2000) who has criticized this view. Together with colleagues, Nørreklit has questioned whether the top-down thinking inherent in the BSC concept is a good starting point when trying to implement strategies (Nørreklit, 2000; Nørreklit, Jacobsen, & Mitchell, 2008; Nørreklit et al., 2012). Furthermore, this rational view of strategy (‘the planning school’) has been criticized by practice-oriented researchers in the field of strategy and organization studies (Jarzabkowski et al., 2007; Jarzabkowski & Spee, 2009; Whittington, 2003).

Rhetoric

Some critics have pointed out that KN’s BSC literature appeals to managers’ emotions instead of logic (Nørreklit, 2003; Nørreklit et al., 2012). Nørreklit (2003) argued that KN are using dramaturgical and rhetorical devices, which make the BSC literature exciting and engaging for the reader. This means that KN’s books resemble those written by management gurus (Nørreklit, 2003; Nørreklit et al., 2012). For example, KN frequently utilize metaphors to make their points. The manager is portrayed as an airline
pilot who utilizes the instrumental panel in the cockpit (i.e. the BSC) in order to safely maneuver the plane (i.e. the organization) to its (strategic) destination (Nørreklit & Mitchell, 2007).

**Hindering Creativity, Innovation and Organizational Learning**

Studies have shown that the BSC may have certain negative organizational implications. Voelpel, Leibold, and Eckhoff (2006) argue that the concept can become a ‘straight jacket’ which may potentially harm the organizations seeking to be innovative and creative. The reason for this is that the BSC is built on notions of strong organizational control. This may be negative for organizations which operate in knowledge-intensive industries. It should be noted that KN has responded strongly to the arguments made in this paper (Kaplan & Norton, 2006b). A similar criticism is made by Antonsen (2014) who looks at negative organizational effects of using the BSC. Antonsen studied the use of the BSC in a Norwegian bank, and found that the BSC may hinder information sharing, cooperation and organizational learning. Again, this is related to the notions of formal control inherent in the BSC concept.

**Management Fashion**

The BSC has also been criticized for being a management fashion. Several researchers have pointed out that the BSC has many of the characteristics of a ‘management fashion’ (Ax & Bjørnenak, 2005; Braam et al., 2007; Madsen, 2011; Malmi, 2001). As pointed out in part two, a number of different supply-side actors have been involved in the diffusion and popularization of the BSC (Ax & Bjørnenak, 2005; Braam et al., 2007; Cooper et al., 2012; Madsen & Slåtten, 2013; Qu, 2004). For instance, in this paper we have looked at research which has studied how KN have used rhetorical strategies to appeal to and captivate their audience (Nørreklit, 2003). In a similar vein, the BSC has also been referred to as ‘rhetorical machine’ which shapes how the concept is diffused and used in praxis (Busco & Quattrone, 2009; Busco & Quattrone, 2014). Other researchers have pointed out that the BSC is a ‘seductive’ concept which can be hard for managers to resist (Andon, Baxter, & Mahama, 2005). The BSC is presented in an appealing way, and the relatively high adoption rates reported in the studies cited in part three show that managers have indeed been ‘seduced’ by the BSC. The BSC is consistently ranked as one of the most popular management tools in the world (Rigby & Bilodeau, 2007, 2009, 2011, 2013). On the other hand, the BSC has had a longer life-span than what is typical of management fashions. Therefore, the BSC can possibly be called an ‘enduring management fashion’ since the concept is still widely used more than 20 years after it was introduced (Frigo, 2012; Hoque, 2012, 2014; Madsen, 2011). In many ways, the BSC concept has been institutionalized as part of what can be considered ‘good practice’ in management accounting and control, evidenced by the fact that most influential textbooks in the field are devoting many pages to describing the concept (Atkinson et al., 2011; Hoque, 2006; Merchant & Van der Stede, 2012).

**Old Wine in New Bottles**

Some have also raised questions of whether the BSC is a ‘consulting product’ (Ittner & Larcker, 1998). This leads to the final area of criticism, namely that the BSC is ‘old wine in new bottles’. Is the BSC primarily a repackaging and rebranding of existing knowledge sold by merchants of management knowledge? To this point, it has been pointed out that there is not much new in terms of content, instead it is primarily the wrapping and the rhetoric which is new. For instance, some researchers have shown that the BSC does much the same as some older management control tools such as the French concept Tableau de Bord (Bessire & Baker, 2005; Bourguignon, Malleret, & Nørreklit, 2004; Epstein & Manzoni, 1997).

The Tableau de Bord has existed since the 1930s, and can be described as a dashboard which can be used to measure an organization’s performance. As in the BSC, key performance indicators are used. The main difference is that the Tableau de Bord as a concept is adapted to the French culture and ideology, while the BSC can be seen as a product of the American shareholder-oriented philosophy (Bourguignon et al., 2004).
SUMMARY AND AREAS FOR FUTURE RESEARCH

Summary
The current article has provided an overview of the research literature on the BSC. In the review, we have chosen to focus on certain main research areas. The first area concerned the evolution of the BSC over the course of the first two decades. Research has shown that the concept has evolved in different ways since its introduction in 1992. The second area covered the adoption and diffusion of the concept. Here we looked at the role of the supply-side of the BSC in the adoption and diffusion process. We also looked at the demand-side of the concept.

Section four focused on the implementation and use of the BSC in practice. First we discussed how the concept’s wide room for interpretation means that the concept is interpreted, understood and enacted in different ways by actors operating in different contexts. Then we looked at how the concept is adapted. The BSC is not a ‘straight jacket’ but may be customized to fit an organization’s needs and characteristics. Finally, we looked at patterns in the use of the BSC. Different researchers have made typologies or classifications of BSC use. We compared and contrasted five such typologies. One commonality is that the typologies separate between simple and advanced types of BSC use. A common finding in the literature is that relatively few organizations are using the more comprehensive or ‘advanced’ versions of the BSC.

In section five we looked at the performance effects of BSC use. Research has shown that it is difficult to document the effect of BSC use on financial performance. As discussed, this may be due to the interpretive space of the BSC, which means that it lends itself to different interpretations and use in practice. In addition, there are many variables which may mediate and moderate the relationship between BSC use and performance.

Finally, we presented several critical perspectives on the BSC. One important line of criticism has focused on conceptual and theoretical issues related to the assumption of causality. Furthermore, some have criticized the assumption of rationality and the view that strategy can be implemented in a top-down fashion. Others have criticized the rhetoric surrounding the BSC and the way the concept is presented in books and articles. In a similar vein, some researchers have pointed out that the BSC exhibits many of the hallmarks of a management fashion, and could be an example of a consulting product which to a large extent is ‘old wine in new bottles’.

Areas for Future Research
Our review of five areas in the research literature on the BSC reveals many interesting opportunities for future work. One promising area is more research on the adoption and diffusion of the BSC. What factors explain why the BSC seemingly has had a worldwide impact, an even stronger impact than most other management concepts? Is there something in particular about the rhetoric (Nørreklit, 2003; Nørreklit et al., 2012) or the way the concept is presented visually (Free & Qu, 2011) which makes the BSC particularly contagious? Since the concept has arguably reached stage of maturity in terms of its life-cycle, there should in the future be ample opportunities to study abandonment and deinstitutionalization processes in relation to the BSC.

It would also be useful to obtain more knowledge about the perceived benefits and problems associated with BSC use (Al Sawalqa et al., 2011; Hoque, 2014; Madsen & Stenheim, 2014b, c). Most of the extant research has focused on problems and failed implementations of the BSC, and relatively few success stories have been reported in the research literature (Hoque, 2014). More insight into successful applications of the BSC can be of great interest and use to practitioners grappling with BSC implementation in practice.

Another area which has received scant attention in extant research is the use of BSC in different types of organizations, particularly of different sizes. Most of the research on the BSC has been carried out in large organizations, but the concept is also used in SMEs (Andersen, Cobbold, & Lawrie, 2001; Fernandes, Raja, & Whalley, 2006; Machado, 2013; Rompho, 2011). However, the literature on the use of
the BSC in SMEs is under-developed, which is regrettable given that SMEs play important roles in most economies (cf. Mitchell & Reid, 2000).

Finally, there is a need for cross-national comparative studies of BSC use. For instance, researchers could examine patterns in terms of adoption, diffusion and implementation in different countries. Such studies could shed light on the role of culture, ideology and values (Ax & Bjørnenak, 2005; Bourguignon et al., 2004) and preferences in terms of corporate governance (Johanson, 2013; Näsi, 1995) in shaping country-specific adoption, diffusion and implementation of the BSC.

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Reliability of Special Synchronous Air Generators

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Wind power generators show a great number of constraints not only during production but also along their life cycle due to several reasons, among them the need of a long life cycle in order to provide an interesting ROI. This work uses a case study of special synchronous hexaphase multipolar generators to propose a methodology for reliability analysis in the area. The main results show the importance of using quantitative techniques (prognosis) to assure product reliability. A proposed model for dealing with reliability issues is the adaptation of the PDCA cycle leading to a SDCA cycle.

INTRODUCTION

The considerable growth in potential electricity consumption leads to the need to implement various energy sources (GWR, 2012; Bazmi et al., 2011). Therefore, the issue of power generation is currently at stake, especially in developing countries such as Brazil. In this scenario, the wind power segment, which has experienced excellent growth rates, should continue to perform well in Brazil. The installed capacity of wind power in Brazil was about 3400 MW, representing approximately 3% of the total power in the country for 2014; the outlook is reaching a plateau of approximately 7300 MW (ABEEOLICA, 2014). To attain a long life cycle, which means at least 25 years to achieve adequate ROI, initial costs are very high and time is sometimes a limiting factor. Hence, the whole development has to respond to both technological and operational expectations.

It is worth noting that wind power generation is considered environmentally correct (Kaldellis et al., 2011), its major impact occurring during air turbine production, although most of the consumed material can be recycled after its life cycle (Dones et al., 2007). In fact, a decade ago, Nemet (2008) already pointed out the need for stimulating innovation in low-carbon energy technologies, such as wind power sector. In this case, the need of a framework based on pull demand and push technology policies in order to pursuit the required innovation is highlighted. Analyzing the wind power case in California, the author draws attention to three major characteristics regarding climate change prevention: non-greenhouse
emission energy sources, which means considerable increase in wind power supply along the century, commercial availability of this long-lived technology and dramatic technological change that reduced wind turbines costs by a factor of five in two decades last century. However, the main driving forces of the well-established wind power model in that state, according to the author, is more owed to the gains from learning by-doing/and -using that are quick derived, often within a year or two, and the construction of the wind farm itself, that takes less than two years. However, the interval between making an investment and its payoff is longer; in other words “new devices must be adapted to real world conditions, integrated into large technological systems, and often require the development of supporting technologies for users to adopt them”. Thus, “push technology may dominate for radical innovations, and pull demand for incremental ones”. Nonetheless, such incremental approach allowed the costs of California wind power to decline by a factor of ten without any radical changes in design in three decades; which, at the end of century, also meant wind power without subsidies almost competitive with natural gas power. A similar analysis regarding the dichotomy between technology-push and demand-pull was presented by Taylor in her review of California's solar policy (Taylor, 2008), but the major argument was the importance of the environmental innovation policy since the dichotomy may be necessary, but not sufficient, for innovation to occur. Note that she considers the term solar energy technologies as “not only to technologies powered directly from the sun energy, but also to technologies powered indirectly from that energy, including wind power, tidal power, and biomass power”.

Innovation, pressure due to quick changes, cost reduction with increase in performance and environmental concerns is not a prerogative of the wind power sector; for instance, the electronic sector has dealt with such hindrances for at least five decades now. Thus, in order to respond to such issues, the ITRS (International Technical Roadmap for Semiconductors) group, historically responsible for the roadmap in semiconductor technologies, changed its approach in the last decade. Whereas until recently the application of Moore’s law – which states that the numbers of components on a chip double every year while costs decrease – was the driven force for a virtuous cycle that provide exponential growth of the semiconductor market and high investments in corresponding technologies, i.e., a roadmap based on the technology push approach, highly focused on the R&D efforts, the current trends have changed significantly. The drive force is now to incorporate functionalities that add value to devices, creating integrated systems with pre-determined functions. This new approach requires implementing a new methodology, which goes through the identification of new societal needs to the definition of technological gaps; then determining the physical and chemical parameters that are important limitations to technologies development (Arden et al., 2010). An interesting feature is that the approach changed after decades of incremental performance using the same mechanism – scaling of integrated circuits – because this conception was reaching its physical and chemical fundamental limits (Roy et al.; Wristers, 2010). Moreover, the expensive and risky pursuit of new technologies also leads to innovative ecosystems, in which partnership not only reduces these costs and risks but also combines complementary knowledge in order to address complex problems; again, the semiconductor sector is a paramount example (Leten et al., 2013).

With the previous considerations in mind, let us discuss the main technological constraints in wind farm and wind power life cycle. In fact, in a recent interview (Foyer; Wilcox, 2014), information of insurance concerns pointed out that to this industry “it's not the frequency of claims as much as it is the severity of the claims. For instance, a wind turbine blade damaged by lighting could result in a $500,000 claim. And that's just the damage to the blade itself — not any loss of income that may have resulted from the lack of activity”. Thus “maintenance becomes an issue the longer a wind farm is in operation” and “if a system is not properly maintained, then it will break down and subsequently shut off the income stream”, i.e., is not only preventive maintenance but also predictive maintenance, which comes from condition monitoring. According to Xin et al. (2014), wind turbine accidents are becoming a global concern. Auditing in China, top country in the world for installed capacity in 2012, the reasons for accidents in wind power sites, wind turbine burn and collapse showed to be the primary concern. Some explanation can be derived from the hurried application of new “technologies and concepts (such as large turbines, large blades, low wind speed, high-altitude wind turbine technology)”; furthermore, “with the
low prices for wind power equipment, it is hard to invest sufficiently in areas such as technological improvement and product quality guarantee”; therefore, “quality problems of wind turbines are also coming along”. Considering that wind turbines are produced in a few months but must remain operational for at least 20 years, the consequence is a highly critical scenario for this production area (Crawford, 2009) where quality issues, and specially reliability, should play an important role.

Thus, this work uses the case study of special synchronous hexaphase multipolar generators to propose a methodology for reliability analysis in that area. The importance of this study is to survey the data and possible causes for the problem, the theoretical correlation with the practice the way in which will both think the project design, process development and operation; such that the guarantee of product quality is improved from setting the correct product, specification and process.

THEORETICAL

Although Sustainability is not an easy concept, this paper presents straightforward assumption, i.e., it is considered as the application of the Sustainable Development concept, its praxis, to human processes. It is used herein as proposed by Poudel (2002), who described Sustainability as effectiveness in the form of management applied for obtaining certain objectives, which requires correctly defining the criteria to evaluate the objectives, goals and the actors involved in the issue, along with methods to determine criteria and indicators, which results in significant assessment tools. Furthermore, although slightly discordant concepts may have been used to define Sustainability in the last four decades, as Adeodato (2005) notes, all these approaches concern the search for long permanence of certain necessary features, desirable in a socio-political system and its natural environment, not infinitely durable but which is capable of transforming society. In addition to goals, targets and indicators, the time issue should be also evaluated. Finally, in the secondary sector, a very important concept is that of Industrial Ecology, which states that all waste/materials must be continuously recycled within the system and only the unlimited solar energy should be used in a dissipative way (Andersen, 2007). This should occur synergistically – thus, an analogy between industrial systems and natural ecosystems, which favors the evaluation of timing, in that there is concern about the flow of materials, which not only occurs between firms, but also in their interaction with the environment (Hauff; Wilderer, 2007), (White, 1994), (Seuring, 2004).

Sustainability, among other actions, requires the production of renewable energy as a primordial asset; therefore, wind power energy plays an important role. The manufacturing of wind power devices, on the other hand, can be an extremely impacting activity, and should hence be thoroughly studied. As aforementioned, among the parts and pieces that compose an air turbine, the greatest environmental concern device is the generator. There are several distinct features for wind power generators developed over time; however, the permanent magnet synchronous generator is a recent approach that presents several advantages and also differs from conventional generators, because instead of using excitation control to create the electromagnetic field, permanent magnets are employed. This type of generator will probably be extensively used in the near future for generating wind power due to the low amount of raw material applied and to the new technology being based on permanent magnetic devices, which leads to fewer moving parts. However, to enable this application, power electronics has its pivotal role. As the wind does not have a constant speed and cannot maintain constant voltage and frequency, converters have to be used to stabilize these parameters, causing a range of problems not yet known (Venugopal et al., 2014), (Mohammad et al., 2014).

Since the generator may be subjected to over voltages, generating unknown faults, the affinity diagram might be helpful. This matrix is a graphical representation of the particular relationship between variables, showing what is in common or distinguishes them. Furthermore, faced with a tangle of information, often loose and not clearly related, the Relations Diagram is used to logically assign the links of cause and effect. This tool has the following advantages: it simplifies the list of troubleshooting because divides it into its main points; it quantifies these main points; it shows the key points of the problems correlated to possible solution scenarios. Finally, to complement the review of the problems and their causes in order to build a realistic scenario of traceability and consequent reliability, the application
of the Matrix Diagram is recommended. This tool relates multidimensional reasoning through a set of phenomena decomposed into factors, which may facilitate understanding the interaction between them (Toledo et al., 2013).

METHODOLOGY

Despite the existence of a complex system for analyzing the failures (private information) in the wind power sector, there is also lack of information, and data must be gathered to permit observing patterns within a range of variables; ergo, a possible choice is using a series of tools, such as affinity and relations diagram, to unravel such data.

The case study herein has some issues that must be primarily considered. The main constraints in such case are the loose connection between the relevant data available and, at same time, the huge amount of such data. Thus, especially for this study, the affinity diagram is useful to gather data and to organize confused dispersed groups of data, such as e.g. the various components used by setting the generator in the timeline. In other words, in this case this tool was applied to:

- drive the problem solutions;
- organize information towards problem solutions;
- organize problem root causes;
- predict future situations – extrapolation;
- add a new methodology related to the evaluation process;
- data collection plan for future stratification.

However, only the affinity diagram would not be enough to solve the main problems, since this tool is useful to categorize the data in several distinct patterns, but is less powerful to correlate them. Therefore, the use of Relations Diagram was attempted although it presented some difficulties to be implemented in this study because:

- the subject is complex and the relations of cause and effect are not easily visible;
- the correct sequence of actions is critical to the development of the theme;
- process revisions are constant and impact time;
- it clarifies the structure of the problem and assembling combinations;
- it provides means for achieving the goals.

As soon data is correlated in a cause and effect scheme, it is necessary to evaluate the importance of each parameter. Then, the Matrix in "L" was selected for the implementation due to the possibility of representing the data and their relationships in a Cartesian way. Its main task is to organize the quality systems and to show the relationship between the characteristics of the product and their quality control plans.

The case study was developed in a multinational industry belonging to the Energy Sector, located in 3 countries, Brazil, Argentina and Malaysia, which manufactures air and hydraulic turbines. This company has more than 1000 employees and it is over 100 years old. This Company not only produces turbines, but also performs tests and has an important group of engineers to conduct R&D for new products.

The object of study chosen was an air turbine generator, composed of 4 main structures – the rotor and stator, which form the generator, and the hub and nacelle, responsible for the controls and actuations. Although this kind of turbine shows some of the most important technological advances in wind power sector, its life cycle is short, i.e., smaller than expected to provide a good ROI. Figure 1 shows the schematics of the air turbine.
RESULTS & ANALYSIS

This section presents the qualitative and quantitative tools used to describe the investigation process and applicability of solving analysis method.

In order to achieve the correct data to build the affinity matrix, several classic quality tools were preliminarily applied to the air turbine case study. At this step, the main quality tools applied were: check list providing the main parameters to be checked during the air turbine operation. This check list was developed during several brainstorming encounters with expert people that defined, among other things, which parameters could be measured accurately, even if only qualitative information was provided. Then, Pareto was applied for ranking all the parameters available according to failure frequency and severity. Using this approach, the Ishikawa Diagram was modified to establish the possible causes for such failures.

Several checklists were developed and Figure 2 shows an example of a check sheet. Note that the proposed checklist aims to record and to collect data in a simple and feasible way for further use; furthermore, this sheet is a counting table, i.e. data is evaluated quantitatively. An example of the Modified Ishikawa Diagram can be seen in Figure 3. This diagram consists of a graphic representation that organizes logically and in order of importance, the potential causes contributing to an effect or given problem; in our case, generator failures.
FIGURE 2
DATA SHEET USED FOR FILLING TECHNICAL DATA GENERATORS

FIGURE 3
MODIFIED ISHIKAWA DIAGRAM: 6 M’S ADAPTED: 1. MATERIALS; 2. MACHINE; 3. WIND FARMS; 4. MANUFACTURING; 5. SUPPLIERS; 6. QUALITY CONTROL; 7 – CAUSES OF FAILURE
Affinities Diagram

Figure 4 shows an example of graphical representation of data groups that have some natural relationship among themselves that distinguishes them from others, applied to gathering scattered data or data groups randomly organized.

This graph presents technological evolution in time; a number of machines had to be repaired or installed simultaneously. The first main separation is the type of construction of each device; after that, identification. The advantage of this procedure is the diagnosis that allows instantly recognizing any operational point from each generator being analyzed. Note that this diagram has considered the 4 main parts of the generator, defined in the methodology section. In this case, only the important parts of the nacelle are presented. Furthermore, any generator that suffered remanufacturing is identified, which allows quickly verifying the dimension of the problems occurred, for example.

Therefore, in general, the generator could be classified by a set of letters characterizing the localization of each generator being analyzed. Note that this diagram has considered the 4 main parts of the nacelle, defined in the methodology section. In this case, only the important parts of the nacelle are presented. Furthermore, any generator that suffered remanufacturing is identified, which allows quickly verifying the dimension of the problems occurred, for example.

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Matrix Diagram

Once a failure is well defined, its description must be broken down by the expected correlations, in order to prevent those same conditions from being repeated in other equipment and also to improve new manufacturing processes. Therefore, a Matrix Diagram was carried out. Figure 6 shows an example of such a tool, in this case a matrix in 'L'. On the basic form of the matrix, two or more interrelated groups of items or variables are presented in rows and columns.

This matrix was performed in excel program in order to provide an easy manipulation of such data; in other words, since any operator can choose the data to be displayed in the matrix, the correlation and/or pattern will be visualized quickly, in a simple step. Thus, using the Relation Diagram, any operator chooses the pattern that seems important to provide a specific characteristic and then the matrix is tailored by combinatory analysis among parameters.

For Figure 6, e.g., considering all the quality tools previously applied, the data point out that although the technological improvements achieved from DD11 to EE1, for instance, were impressive, they were not enough to expand the life cycle, as required, for a convenient ROI, i.e. 25 years. This situation, on the other hand, requires the focus on the next developments to be placed on the new parts and pieces, now detected as new issues for development in a new technological cycle.

Modeling and Corresponding Proposed Methodology

The most important consequence of generating the Matrix Diagram is assembling the data, once this somehow allows the traceability of the entire process and product. Particularly, this traceability information consisted of design, materials and supplies; however, by monitoring the air turbine in operation, some characteristics are also measured, such as hours worked, power generated, electrical insulation and others. Furthermore, all environments could also be considered, which means adding environmental data, such as rainfall, presence of ionic compounds. In such a scenario, to a single location, it is possible to combine internal and external parameters for monitoring and, consequently, to optimize the performance.
According to Caldeira Filho (2004) *apud* Deming (1981), improvements, i.e. the pursued optimization, requires planning, action and checking. However, it is impossible to act without previous tests, at lab or pilot scale, which is time-consuming and sometimes not cost effective, especially for a high technological and demanding area, such as wind power. Therefore, we employed the consecrated idea of a PDCA cycle leading to a SDCA cycle but adapted it to include reliability. Figure 7 shows the proposed model. Thus, the cycle is as follows: traceability is aimed by the use of conventional quality tools that indicate the main issues to be considered in development and in process production.

The main approach to reduce risks in this proposal is to define traceability as the major pillar in the development and production areas. This assumption makes obtaining information for several different parameters mandatory and, as a consequence, any failure can be quickly combined with a pattern (group of parameters) or correlated situations (strong correspondence between parameters). This roadmap assures quick response to malfunctions while still permitting marked changes in development and project. More important, if this approach is quickly linked with other procedures, such as lab analysis, carried out simultaneously with project modifications, the system will be much more robust.

Although this study proposes a conceptual map, shown in Figure 7, for reliability analysis in the wind power sector, this structure could be easily adapted to any other area where changes in production are
quick and demand process changes without extensive laboratorial tests, such as the ones developed in prototypes.

Finally, the path proposed in this study allows inferring information on material flows and cycles, mandatory in the Industrial Ecology approach in order to increase sustainability.

**FIGURE 7**
**MODEL PROPOSED FOR WIND POWER RELIABILITY ANALYSIS**

![Diagram](image)

**CONCLUSIONS**

We proposed a methodology for reliability analysis for a production area in which development is quick and leads to so high change rates that hinder many conventional attitudes to assure reliability in process production and product use.

After using conventional quality tools, such as brainstorm, to define the main parameters to be analyzed and data to be collected, several data sheets were provided and data compiled in a way that allowed to be gathered in an affinity diagram with Matrix in ‘L’ for composing the statistical analysis. The result of this study generates points of improvement since these time problems are identified at their root cause, which validates the whole production process, which means concluding an entire operating cycle of the proposed methodology, by the use of reliability analysis.

Thus, logic of quality tools was presented herein, providing a method for reliability analysis of sequence generators. From the proposed methodology, some conditions for problems were predetermined, and the points to be collected and analyzed in the special synchronous generators applied to wind generation. An example of the strength of this methodology is the improvement in generators (listed previously as DD11 configuration replaced by EE11 configuration) that continuously shows decrease on causes of failures, i.e. from each previous version. Applying a technical study from a statistical methodology based on reliability was found to generate meaningful results.

**REFERENCES**


The Influence of Supply Chain Management Practices in the Enterprise Performance

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This empirical research identified which supply chain management (SCM) practices should be adopted by managers in order to achieve superior performance for their companies. Approximately 800 worldwide firms were analyzed, spread across 13 different industries, to understand the impact of 31 practices in five enterprise operational performance indicators.

INTRODUCTION

First level headings should be bold, all caps, 11 pt Times New Roman, Left Justified with 1 line space above and below the heading. What practices should supply chain managers adopt to increase operational performance of their processes? This question has been the key motivator in developing this investigation, as many researchers have attempted to understand the effect of adopting practices on company performance (Ahmed et al 1996; Alam et al 2012; Cao e Zhang 2011; Chavez et al 2012; Gunasekaran et al 2004; Harrison and New 2002; Hayes and Pisano 1994; Hayes and Wheelwright 1984; Hayes and Upton 1998; Li et al 2005; Liu et al 2013; Lockamy and McCormack 2004; Ramanathan 2012; Sukati et al 2013; Tan 2002).

Some studies, however, have not been conclusive (Ketokivi and Schroeder 2004; Pilkington and Fitzgerald 2006) and others only focus on the impact of practices on organizations’ financial performance (Venkatraman and Ramanujam 1986). In addition, the use of context variables provides greater explanatory power in understanding the relationship between practices and performance. What we have seen, though, is that many investigations end up failing to duly explore control variables and tend to deal with the influence of practices in isolation rather than collectively (March and Sutton 1997). In other words, it is important for practices to be connected by multiple variables in order for us to understand the broad effect on enterprise performance.
Hence, the intent of this research was to identify which supply chain management practices are able to increase organizational performance and, consequently, indicate to managers which practices they should incorporate in their business processes. For that purpose, this investigation sought to address previously identified gaps by analyzing over 800 businesses, spread over 13 different industries, to ascertain the effect of 31 supply chain management practices on 5 performance indicators. Finally, the study considered three context variables: industry type, company size and continental region of operation.

LITERATURE REVIEW AND HYPOTHESIS

Supply Chain Management as a Source of Superior Performance

Supply chain management has been emerging as one of the main areas in businesses that can offer sources of competitive advantage (Lockamy and McCormack 2004). Furthermore, the importance of this topic to organizations is reinforced by factors such as increasing competition, globalization, greater product variety, outsourcing, shorter product life cycles, continuous advances in technology and ever-demanding clients (Giunipero et al 2008; Gunasekaran et al 2001; Lee 2002; Li et al 2005; Mentzer et al 2001; McCormack and Lockamy 2004). In addition, the amount of scientific research, congresses and studies has been increasing yearly (Burgess et al 2006; Giunipero et al 2008).

Currently, competition in global markets is much greater between supply chains than between enterprises. For this reason, supply chain management has become a critical factor of success for companies. In this context, collective efficiency requires internal and external partner collaboration throughout the supply chain (Friemann and Verhasselt 2012). According to Alam et al (2012), an effective supply chain must connect the network’s members and their respective functions to ensure an uninterrupted flow for balancing supply and demand. To Reiner and Hofmann (2006), the search for improving efficiency has been stimulated not only by companies’ individual perceptions, but also throughout the supply chains.

To Chen and Paulraj (2004), the supply chain management construct begins by developing a collaborative advantage, as opposed to Porter’s competitive advantage. Likewise, Dyer and Singh (1998) adopt a relational perspective as motivation for obtaining competitive advantage. Therefore, according to Chen and Paulraj (2004), supply chain performance is not affected by a single company, but by the influence of all members in the chain. Thus, one of the tendencies of modern economics is that competition will not remain centralized in firms against firms, but will include supply chains versus supply chains (Lambert et al 1997).

Based on the discussion on supply chain management (Christopher and Ryals 1999; Giunipero et al 2008; Gunasekaran et al 2001; Hendricks and Singhal 2005; Lambert et al 1997; Lee 2002; Li et al 2005; Mentzer et al 2001; McCormack and Lockamy 2004) and the resource-based view, we may say that management practices can offer superior performance to enterprises. Thus, said practices are internal resources and/or competences used to create value (Hayes and Pisano 1994; Hayes and Upton, 1998; Wu et al 2012). As a result, existing competitive differences between companies are explained by how the resources are combined with each other (Barney 1991). In other words, the heterogeneity of practices helps justify the differences in organizations’ operational performance (Peteraf and Barney 2003). Table 1 presents the elements found in the literature that address the influence of management practices in supply chain processes.
### TABLE 1
SUPPLY CHAIN MANAGEMENT PRACTICES

<table>
<thead>
<tr>
<th>SCM Practices</th>
<th>Contribution</th>
</tr>
</thead>
</table>
| Collaboration          | • Collaboration practice is related to the perspectives of: transaction costs, resource-based view, extended resource-based view and relational view (Cao & Zhang 2011)  
                          • VMI (Vendor Managed Inventory) and CPFR (Collaborative Planning Forecasting and Replenishment) programs are examples of collaboration practices (Cigolini, Cozzi and Perona 2004)  
                          • Collaboration practices do not involve only technological initiatives, but also simulation and optimization systems: ERPs, MRPs, what-if scenarios (Gimenez et al 2012)  
                          • The exchange of information involves sharing critical information, while coordination affects how firms will process such information (Liu et al 2013)  
                          • Collaboration practices exalt mutual benefits. Collaboration practices have explained approximately 23.7% of enterprise performance variability (Flynn et al 2010)  
                          • Internal and external collaboration practices explained 8.5% of enterprise performance variability in Malaysia (Sukati et al 2013) |
| Demand and Supply Planning | • Planning practice is based on decision-making that is centralized and in combination with other company areas (Feng 2010)  
                             • Practices must incorporate qualitative and quantitative elements in order to improve forecast accuracy: promotions, cannibalization, product life cycle, seasonal variation, trends, prices (Ramanathan 2012)  
                             • Planning practices need frequent updating, due to fluctuations in demand, prices, costs, leadtime (Jonsson and Mattsson 2008) |
| Inventory, Production and Distribution | • Lean philosophy is a way of minimizing waste in the production process: excess inventory, inactivity, set-up time reduction (Chavez et al 2012; Li et al 2005)  
                                           • JIT practices seek to minimize the level of inventory, ensure product quality and equipment reliability (Cigolini, Cozzi and Perona 2004)  
                                           • Production practices (reorder point, kanban, MRP) are applicable according to the type of product and inventory to be employed (Jonsson and Mattsson 2008)  
                                           • APS practices use the concepts of finite capacity and prioritization during planning, and not at a posteriori (Jonsson and Mattsson 2008)  
                                           • DRP practices use the same logic as MRP to determine which products should be distributed when and where (Cigolini, Cozzi and Perona 2004) |
| Logistics              | • The level of warehouse automatization favors loading and replacing products in a quick and frequent manner (Cigolini, Cozzi and Perona 2004)  
                          • Corporate partnerships and arrangements can help in supporting logistical services, transportation and movement (Chen and Paulraj 2004)  
                          • Transport process design is needed to support decisions on inventory level and transportation costs (Cigolini, Cozzi and Perona 2004)  
                          • Transportation optimization practice is used for the purpose of reducing transportation costs by defining the best route (Cigolini, Cozzi and Perona 2004) |

As the object of this study, 5 indicators were selected to measure the correlation between supply chain management practices and enterprise performance. Figure 1 presents the hypotheses defined to answer the research question.
FIGURE 1
HYPOTHESIS – THE INFLUENCE OF SCM PRACTICES IN KEY OPERATIONAL INDICATORS

METHODOLOGY

This study used dependent, independent and control variables. The latter were net revenue, location and industry type. Dependent variables were the performance indicators, tested against the independent variables (supply chain management practices), in order to measure the strength of their relationship. The dependent variables applied were: on time delivery (%), forecast accuracy (%), days in inventory, total warehouse management costs (% of revenue) and total transportation costs (% of revenue). Dependent and independent variables were selected based on the intersection of two sources. The first variables were selected from the SAP Benchmarking survey; these were later crossed with the variables selected from the literature review.

The research method used quantitative, more specifically multivariate analysis. Initially, each variable was described statistically (average, standard deviation, Q1, Q3, median, asymmetry and kurtosis). After that, a series of factorial tests was conducted, so as to abbreviate the group of 31 practices into a smaller set of variables. Finally, the relationships between practice components (independent variables) and performance indicators (dependent variables) were identified by multiple linear regression. Table 3 below details each type of variable used in the investigation.

Multivariate analysis was conducted using a secondary database from the SAP Benchmarking program, which currently covers over 30 business processes, close to 800 performance indicators and upwards of 1200 best practices. This study specifically used the survey on supply chain management in 875 companies, of which 88.9% displayed revenues under 5 billion USD. Regarding location, most of said businesses were in North America (46%), followed by Europe, Middle East and Africa (22%), Asia Pacific (20%) and lastly Latin America (12%).

DISCUSSIONS

The individual average for each type of industry was calculated in descriptive analysis. The results are detailed in Table 3. Generally speaking, the average for all industries was 87.3% in on time delivery and 77.4% in forecast accuracy. Regarding the days in inventory indicator, the general average was 94 days (discounting industries with identified outliers). Warehouse management costs (also discounting outlier industries) averaged at 1.5% of company net revenue. Finally, the average for total transportation
costs was 3.6% of company net revenue (again discounting outlier industries).

**TABLE 2**

**KEY PERFORMANCE INDICATOR MEAN PER INDUSTRY**

<table>
<thead>
<tr>
<th>Industry</th>
<th>Delivery On-time (in %)</th>
<th>Forecast Accuracy (in %)</th>
<th>Days in Inventory (in days)</th>
<th>Warehouse Management Costs (in % of revenue)</th>
<th>Transportation Costs (in % of revenue)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerospace</td>
<td>78.16</td>
<td>65.46</td>
<td>316*</td>
<td>137*</td>
<td>23.8*</td>
</tr>
<tr>
<td>Automotive</td>
<td>91.48</td>
<td>78.47</td>
<td>61.95</td>
<td>2,439</td>
<td>3,439</td>
</tr>
<tr>
<td>Chemicals</td>
<td>81.19</td>
<td>77.95</td>
<td>723*</td>
<td>1,194</td>
<td>4,209</td>
</tr>
<tr>
<td>Consumer Products</td>
<td>90.27</td>
<td>75.74</td>
<td>182</td>
<td>31.8*</td>
<td>15*</td>
</tr>
<tr>
<td>Engineering Construction</td>
<td>81.64</td>
<td>75</td>
<td>84.3</td>
<td>0.1532</td>
<td>1,279</td>
</tr>
<tr>
<td>High Tech</td>
<td>84.32</td>
<td>76.75</td>
<td>68.43</td>
<td>0.781</td>
<td>1,262</td>
</tr>
<tr>
<td>Industrial Machinery</td>
<td>85.18</td>
<td>76.87</td>
<td>2376*</td>
<td>1,396</td>
<td>2,382</td>
</tr>
<tr>
<td>Life Sciences</td>
<td>89.51</td>
<td>75.57</td>
<td>134.9</td>
<td>0.855</td>
<td>1,237</td>
</tr>
<tr>
<td>Mill Products</td>
<td>87.95</td>
<td>81.42</td>
<td>114.4</td>
<td>11.56*</td>
<td>39.2*</td>
</tr>
<tr>
<td>Oil and Gas</td>
<td>92.72</td>
<td>82.48</td>
<td>26432*</td>
<td>4.05</td>
<td>1,325</td>
</tr>
<tr>
<td>Retail</td>
<td>87.91</td>
<td>84.66</td>
<td>92.8</td>
<td>1,191</td>
<td>10.24</td>
</tr>
<tr>
<td>Telecommunications</td>
<td>94.25</td>
<td>76.69</td>
<td>25.8</td>
<td>1,334</td>
<td>3.17</td>
</tr>
<tr>
<td>Wholesale Distribution</td>
<td>90.04</td>
<td>79.44</td>
<td>86.4</td>
<td>16.8*</td>
<td>7.43</td>
</tr>
</tbody>
</table>

*Values with outliers

Supply chain management practices, in turn, were analyzed using the average of each practice per industry. Values observed the scale of 1 (low-level adoption) to 5 (high level adoption). For a neater presentation of the averages, the 31 practices were combined in 11 groups. Table 4 details the averages for each group of practices in all industries. Generally speaking, collaboration practices had a low level of adoption (1.9) with both customers and suppliers.

**TABLE 3**

**SCM PRACTICES ADOPTION MEAN**

<table>
<thead>
<tr>
<th>SCM Practices</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance Management</td>
<td>2.5</td>
</tr>
<tr>
<td>Demand Planning And Forecasting</td>
<td>2.5</td>
</tr>
<tr>
<td>Supply Planning</td>
<td>2.6</td>
</tr>
<tr>
<td>Inventory Planning</td>
<td>2.2</td>
</tr>
<tr>
<td>Distribution Planning</td>
<td>2.4</td>
</tr>
<tr>
<td>Sales And Operations Planning (S&amp;OP)</td>
<td>2.4</td>
</tr>
<tr>
<td>Customer Collaboration</td>
<td>1.9</td>
</tr>
<tr>
<td>Supplier Collaboration</td>
<td>1.9</td>
</tr>
<tr>
<td>Production Planning And Detailed Scheduling</td>
<td>2.1</td>
</tr>
<tr>
<td>Transportation Planning And Vehicle Scheduling</td>
<td>2.3</td>
</tr>
<tr>
<td>Sales Order Promising</td>
<td>2.1</td>
</tr>
</tbody>
</table>

*Scales from 1 (low-level adoption) to 5 (high-level adoption)*
Close to the average of the selected scale (2.4) were performance management and planning practices involving demand, inventory, supply, sales and operations, distribution and transportation. Production planning and sales order promising placed a little below the average (2,1).

Factorial analysis indicated that the 31 supply chain management practices studied (sales and operations planning, demand planning, supply planning, distribution planning, inventory planning, production planning and control, transportation management, availability check, collaboration and supply chain monitoring) could be combined into 6 groups, which explained close to 60% of total variance in practices. The 6 practice groups were planning, collaboration, transportation, distribution, inventory and production.

### TABLE 4

<table>
<thead>
<tr>
<th>Components</th>
<th>Cronbach’s alpha</th>
<th>Number of practices</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Sales and Operations Planning Practices</td>
<td>0.876</td>
<td>8</td>
</tr>
<tr>
<td>2 Transportation Management Practices</td>
<td>0.832</td>
<td>6</td>
</tr>
<tr>
<td>3 Collaboration Practices</td>
<td>0.779</td>
<td>5</td>
</tr>
<tr>
<td>4 Distribution Management Practices</td>
<td>0.785</td>
<td>4</td>
</tr>
<tr>
<td>5 Inventory Management Practices</td>
<td>0.812</td>
<td>4</td>
</tr>
<tr>
<td>6 Production Management Practices</td>
<td>0.799</td>
<td>4</td>
</tr>
</tbody>
</table>

Table 4 presents each formed component and the amount of practices combined in each group, as well as Cronbach’s alpha, signaling the strength of the grouping. With this analysis, the first question of the investigation could now be answered: in other words, managers should pay attention to practices related to planning, collaboration, transportation, distribution, inventory and production.

Finally, the multiple linear regression results showed that on time delivery and forecast accuracy are positively influenced by supply chain management practices. Furthermore, the indicators for days in inventory, warehouse management and transportation costs are influenced by company size and location. Table 6 lays out the results of each of the tested hypotheses, as well as a brief discussion addressing the aspects noted in the literature and in the conducted multiple linear regression.

### CONCLUSIONS

This investigation sought to assess whether supply chain management practices can influence enterprise operational performance. To that end, certain theories were used to support the matter and define the scope of the study. The first evoked the theory of supply chain management as a value-generating leverage (Giunipero et al 2008; Gunasekaran et al 2001; Lee 2002; Li et al 2005; Mentzer et al 2001; McCormack and Lockamy 2004). The resource-based view was then discussed as a foundation for defining supply chain management practices (Hayes and Pisano 1994; Hayes and Upton 1998).
TABLE 5  
MULTIPLE LINEAR REGRESSION ANALYSIS

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Result</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCM Practices → on-time delivery (H₁)</td>
<td>Hypothesis H₁ can be <strong>ACCEPTED</strong>, because collaboration and distribution practices explained 4.1% of on-time delivery variability</td>
<td>Reinforced the works of Li et al (2005) and Alam et al (2012), who claimed that adopting supply chain management practices could result in superior performance in on-time delivery. The model did not, however, confirm that planning practices influenced on-time delivery performance as proposed by Lockamy and McCormack (2004).</td>
</tr>
<tr>
<td>SCM Practices → forecast accuracy (H₂)</td>
<td>Hypothesis H₂ can be <strong>ACCEPTED</strong>, because the practice of collaboration explained 5.1% of forecast accuracy variability</td>
<td>Reinforced the works of Li et al (2005) and Ramanathan (2012), who claimed that adopting supply chain management practices could result in superior performance in forecast accuracy. It did not, however, confirm that planning practices influenced forecast accuracy performance as proposed by Lockamy and McCormack (2004).</td>
</tr>
<tr>
<td>SCM Practices → days in inventory (H₃)</td>
<td>Hypothesis H₃ can be <strong>REJECTED</strong>; although, despite no practices appeared to be significant, the company size variable explained 4.3% of days in inventory variability</td>
<td>The influence of supply chain management practices in days in inventory was not confirmed – opposed to other authors’ conclusions (Gaur et al 2005; Gunasekaran et al 2004; Harrison and New 2002; Hendricks and Singhal 2005; Jonsson and Mattsson 2008; Lee and Billington 1992; Li et al 2005). The study corroborated, however, the work of Choudhary and Tripathi (2012), which mentioned the existence of other factors that would justify maintaining a high inventory level in order to deal with uncertainties in the supply chain.</td>
</tr>
<tr>
<td>SCM Practices → total warehouse management costs (H₄)</td>
<td>Hypothesis H₄ can be <strong>REJECTED</strong>; the production practice presented a negative relationship and the company size and location variables explained close to 12.8% of the model’s variability</td>
<td>The model did not confirm that inventory management practices influenced warehouse costs, as proposed by Lockamy and McCormack (2004).</td>
</tr>
<tr>
<td>SCM Practices → total transportation costs (H₅)</td>
<td>Hypothesis H₅ can be <strong>REJECTED</strong>; the production practice presented a negative relationship and the company size and location variables explained close to 15.6% of the model’s variability</td>
<td>The model did not confirm that supply chain management practices influenced transportation costs, as commented by Gunasekaran et al (2004), Lee and Billington (1992).</td>
</tr>
</tbody>
</table>
In this context, several authors have cited the impact that supply chain management practices bring to company performance (Alam et al 2012; Choudhary and Tripathi 2012; Harrison and New 2002; Gunasekaran et al 2004; Jonsson and Mattsson 2008; Lee and Billington 1992; Li et al 2005; Lockamy and McCormack 2004; Ramanathan 2012). There is a large amount of practices investigated in both the academic and corporate worlds, making it difficult for managers to decide which to adopt. The main aspect of this research was to answer which practices managers should select in order to achieve superior performance in their organizations.

Generally speaking, we may say that supply chain management practices positively influenced enterprise performance indicators. Collaboration and distribution practices explained performance in on time delivery and forecast accuracy. The practices of production management, planning, transportation and inventory, on the other hand, were not significant to explain businesses’ superior performance – which does not mean that these practices cannot improve companies’ performance. According to Ketokivi and Schroeder (2004), said practices may no longer be perceived as a tool for creating competitive advantage, but rather for competitive parity. Similarly, Barney (1991) highlights that adopting organizational resources (practices) can result in temporary or sustainable improved performance. This helps to explain why businesses don’t obtain superior performance, even when they adopt supply chain management practices.

The control variables of company size and location were dominant in explaining metrics related to costs, days in inventory, warehouse and transportation costs. This demonstrates the strength of large businesses within the supply chain, especially regarding costs metrics. Moreover, factorial analysis results reveals that the 31 practices studied here can be condensed into 6 groups explaining 63% of the practices’ variance. An important contribution to management is this division into groups for planning sales and operations, collaboration, distribution, production, transportation and inventory.

In closing, these results enable a better understanding of the effects of adopting supply chain management practices on business performance. As aforementioned, there are few empirical investigations that address a group of practices and performance indicators, as well as contemplating a large number of companies and industry types. This article has also contributed meaningfully by presenting descriptive industry measurements that can be used for comparison in future studies. Finally, these results can influence which supply chain management practices managers should adopt for increased enterprise performance.

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To Pull or Not to Pull: A Concept Lost in Translation?

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Though the term “pull” has become a cornerstone of modern manufacturing operations, there seems to be mixed views and interpretations of the pull concept across different contexts, in particular production management, supply chain management, and project management. We conduct a review of relevant extant literature in order to provide an overview of the different interpretations of the term, and we offer a set of three context-dependent definitions of the pull concept.

“Disagreements over terminology are the natural consequences of competing paradigms”
- Ballard and Howell (2004)

INTRODUCTION

Originally focusing purely on operational issues at the shop floor level, the Operations Management field has over the past decades expanded its scope, and has now grown to encompass far more strategic issues such as the management of global manufacturing supply chains (Kleindorfer et al., 2005). This means that certain concepts that were originally developed on the shop floor are now being transferred and extended to applications in other areas; not just on a greater scale, but also seemingly across different and sometimes competing paradigms. The pull concept is certainly no exception to this phenomenon.

Pull systems have been part of the manufacturing lexicon for more than a quarter of a century (Hopp and Spearman, 2004). Having started out as a term synonymous with the Kanban system developed at Toyota (e.g. Ohno, 1988; Sugimori et al., 1977), the word “pull” is now used to describe a number of different situations within operations management literature, some of which are seemingly contradictory in nature. Having taught on various Master level education programs within the fields of production logistics and supply chain management for several years, we tend to agree with Hopp and Spearman (2004), who described an increasing confusion amongst students regarding the various interpretations of the pull concept. For example, many students are quick to equate pull with a make-to-order strategy, which is in direct contradiction with the original thinking behind the supermarket pull systems developed to support the just-in-time (JIT) concept described by Sugimori et al. (1977). This observation was also recognized by Hopp and Spearman (2004), who essentially concluded that pull be defined in terms of a cap on work-in-process (WIP) inventory. However, although these authors compared and contrasted the
fundamental differences between push and pull and make-to-stock and make-to-order, we feel that there remains a significant lack of clarity when the pull concept is transferred from the production management context to other domains, such as supply chain management and project management. Thus, the aim of this paper is to carry out a review of the most imperative extant literature in order to offer more robust, context-dependent definitions of the term “pull”.

RESEARCH METHOD

We adopt literature review as our research method for this investigation. We analyze an array of articles from leading scientific journals such as the Journal of Operations Management, the International Journal of Production Research, the International Journal of Production Economics, and the International Journal of Operations and Production Management. We also considered several peer-reviewed conference papers. These articles were retrieved using online journal databases (e.g. Science Direct and Google Scholar). In order to gain relevant insight in terms of the challenges experienced in defining the term “pull” for educational purposes, we also considered the more popular textbooks used in educational programs. It became clear that there were a number of different attempts to define and explain the word “pull” across the various fields, i.e. production management, supply chain management and project management. These various interpretations are explored in the following section.

PULL: ONE WORD, MANY INTERPRETATIONS...

In order to address the pull concept across several different contexts, we first consider the basic semantics of the word. The Oxford English dictionary identifies several definitions of pull, including:

(Verb) To apply force to, so as to cause or tend to cause motion toward the source of the force; To remove from a fixed position; To extract; To draw out; To remove.

In contrast, push can be defined as:

(Verb) To exert outward pressure or force against something; To urge forward.

Thus, it goes to say that pull and push, though two very distinctive actions, can indeed be considered as having the same objective: to move an object; where push means moving the object away from the source of the force, and pull means moving it towards the source of the force.

In this paper, we use basic semantics to define the various connotations of the pull concept in the context of various domains. In the next section, we consider pull in the context of production management, supply chain management and project management.

Production Management

In the production management domain, pull has grown to be a central element of Lean production, which can be described as a development of the just-in-time (JIT) philosophy, itself stemming from the Toyota Production System (Papadopoulos and Özbayrak, 2005). We suggest that the evolution of Lean thinking is perhaps one of the reasons for the confusion behind the meaning of the word “pull” – whereas JIT researchers and Kanban practitioners in the 1980s tended to describe pull with respect to the Just-in-Time supermarket pull systems that were being implemented at that time (e.g. Demmy and Constable, 1988; Fry and Leong, 1986; Karmarkar, 1986; Ketcham, 1988; Spurgeon, 1986); the tables were seemingly turned in the 1990s when Lean researchers introduced pull as “the ability to design, schedule, and make exactly what the customer wants just when the customer wants it” (Womack and Jones, 1996 p.24), unintentionally giving the false impression that pull is a make-to-order concept. We use the word “unintentionally” here as Womack and Jones later referred to pull in the original JIT context:
“…but they flowed only when pulled by the next step. That is the blanking machine did nothing until it received a signal from the stamping machines and the stamping machines did nothing until instructed to do so by the welding booth. Each activity pulled the next. The shipping schedule became the pacemaker for the entire operation”

(Womack and Jones, 1996 p.70).

A similar contradiction can also be found in Cortes-Comerer (1986), who describes JIT in terms of the more conventional pull system, yet chooses to state in the title of the work “JIT is made to order”. We assert that such oversimplifications have lead many researchers and practitioners to falsely equate pull in the most literal sense with a make-to-order approach.

Supply Chain Management

“Traditional supply chains are often categorized as either push or pull strategies. Probably, this stems from the manufacturing revolution of the 1980s, in which manufacturing systems were divided into these categories”.

- Ahn and Kaminsky (2005)

This statement from Ahn and Kaminsky illustrates the point made initially by Kleindorfer et al. (2005). Terminology and concepts are being transferred from the shop floor manufacturing environment and expanded to suit the needs of other contexts, in this case that of supply chain management. In fact, Billington (1999) discusses in some detail the language of supply chains, and suggests that:

“In formulating a supply chain grammar, the most important syntactical feature is something we call the push-pull boundary. This inflection point is where demand information – the actual customer order – exerts its influence on manufacturing”.

Billington states that after orders are received, the product is pulled by demand. Though this may in fact be the case from the supply chain management perspective, we suggest that it was the onset of the push-pull boundary concept that has also contributed to creating the somewhat restricted view that equates push with make-to-stock and pull with make-to-order.

Indeed, when we consider supply chain management in general and Lean supply chain management in particular, we also quickly discover the concept of Leagility (Ben Naylor et al., 1999; Mason-Jones et al., 2000b; Mason-Jones et al., 2000a; Naim and Gosling, 2011). The notion of Leagility seemingly develops the push-pull boundary concept to include an element of pull upstream of the customer order decoupling point (CODP), a term we feel is much better suited for the order penetration point than push-pull boundary. For example, Naylor et al. (1999) suggest that though upstream of the decoupling point the supply chain is initially forecast driven, the advent of Kanban-driven supply means that this part of the supply chain has become more than simply a push system. Thus, there is a need for clarification of the word “pull” in the context of supply chain management as an alternative to the definition most commonly used in the context of production management.

Project Management

A considerable amount of the literature regarding pull in the context of project management rightfully stems from the Lean Construction movement (Ballard and Howell, 1994; Koskela, 1997; Koskela, 1999). Due to the project-based nature of this type of production, there is of course an inherent focus on activity planning, rather than the material requirements focus typically found in the manufacturing industry. As such, much of the literature from the Lean Construction domain discusses Pull planning (Johansen, 2002) or Pull scheduling (Ballard and Howell, 2003). In this sense, resources are procured and distributed in
accordance with schedules, but no value-adding activity is performed until the plan “pulls” forward resources and materials (Ballard and Howell, 1995).

TOWARDS MORE CONTEXT-DEPENDENT DEFINITIONS OF PULL

By analyzing the various definitions and accounts of pull that can be found in the most prominent extant literature, we draw useful insights that enable us to offer more context-dependent definitions of the pull concept. Our analysis can be seen in Table 1, where we present the most significant findings of our literature review. In total, we analyzed in detail some 32 articles. Interestingly, the results of our study indicate a strong trend towards the possibility for three context-dependent definitions of pull: Demand-pull, Production-pull, and Plan-pull.

Demand-pull

Many of the authors across the various domains opt to discuss pull in terms of production and logistics “in response of customer demand”. Though one might expect this from the supply chain management literature, it was very interesting to observe that many of the definitions of pull retrieved from the production management literature also related more to a supply chain perspective than to the original definitions of pull seen from the shop floor perspective (e.g. Monden, 1998; Ohno, 1988). As such, our first context-dependent definition of the pull concept is Demand-pull, for which we offer the following:

In Demand-pull, value-adding activities only take place in response of real customer demand. However, production can still be either pull-based or push-based.

This goes to say that a state of Demand-pull is present if operations are carried out in response of customer demand as opposed to being based on forecasts. In this context, it is possible to equate Demand-pull with make-to-order, for example. Relating back to the previous definition of pull from the Oxford English Dictionary, we can equate Demand-pull with “causing motion toward the source of the force”, where the source of the force is customer demand. We can also say that Demand-pull is a context-dependent definition of pull at the macro-level. Notice, however, that production operations can themselves still be carried out using either pull- or push-based approaches. This means that when we move to the production management and project management domains, we require the adoption of a more micro-level perspective for our analysis in order to distinguish between such pull- and push-based approaches.

| TABLE 1 |
| DEFINITIONS OF PULL IN THE LITERATURE |

<table>
<thead>
<tr>
<th>Production Management</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arnold et al. (2008)</td>
<td>The underlying concept is not to preplan and generate schedules but instead to react to the final customer order and produce only what is needed to satisfy demand and also only when it is needed.</td>
</tr>
<tr>
<td>Cortes-Comerer (1986)</td>
<td>A method of handling the flow of materials from one stage of manufacturing to another by having operations in the downstream stage of production draw work from the previous stage; removal of a piece for final assembly typically initiates the back-to-front chain reaction.</td>
</tr>
<tr>
<td>Hopp and Spearman (2004)</td>
<td>A pull production system is one that explicitly limits the amount of work in process that can be in the system.</td>
</tr>
<tr>
<td>Huang and Kusiak (1996)</td>
<td>The Kanban system is known as a ‘pull’ system in the sense that the production of the current stage depends on the demand of the subsequent stages, i.e. the preceding stage must produce only the exact quantity withdrawn by the subsequent manufacturing stage.</td>
</tr>
<tr>
<td>Ketcham (1988)</td>
<td>With demand-pull scheduling, such as JIT, production is initiated and</td>
</tr>
<tr>
<td>Author and Year</td>
<td>Description</td>
</tr>
<tr>
<td>-----------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Monden (1998)</td>
<td>The subsequent process will withdraw the parts from the preceding process, a method known as the pull system…Further, each part-producing process withdraws the necessary parts or materials from preceding processes further down the line.</td>
</tr>
<tr>
<td>Narasimhan et al. (1995)</td>
<td>Subassemblies and parts required for the final assembly schedule need to be pulled in small batches from the supplying work centers whenever they are required; hence “pull” is associated with JIT systems.</td>
</tr>
<tr>
<td>Ohno (1988)</td>
<td>In the pull method, the final process withdraws the required quantities from the preceding process at a certain time, and this procedure is repeated in reverse order up through all the earlier processes.</td>
</tr>
<tr>
<td>Schonberger (2007)</td>
<td>The pull system – a customer’s use as signal to produce (is a TPS basic, but one that Japanese and later Western manufacturers were tending to apply restrictively: within manufacturing).</td>
</tr>
<tr>
<td>Schönsleben (2012)</td>
<td>Value-adding takes place only on customer demand (or to replace a use of items). Each customer, through coordination with the supplier, “pulls” the order up through the process levels. The Kanban card operates as a pull signal: it entails an order release according to consumption and a (stock) replenishment order.</td>
</tr>
<tr>
<td>Seidmann (1988)</td>
<td>During the plant operation the workstations pull their input parts from the cells. According to this pull system the quantity produced by the cell is not based on estimated future requirements but simply serves to replace the parts actually withdrawn by the workstations.</td>
</tr>
<tr>
<td>Slack et al. (2007)</td>
<td>Pull is a term used in planning and control to indicate that a workstation requests work from the previous station only when it is required, one of the fundamental principles of just-in-time planning and control.</td>
</tr>
<tr>
<td>Vollmann et al. (2005)</td>
<td>A “pull” system exists when a work center is authorized to produce only when it has been signaled that there’s a need for more parts in a downstream (user) department.</td>
</tr>
</tbody>
</table>

**Supply Chain Management**

<table>
<thead>
<tr>
<th>Author and Year</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Christopher (1998)</td>
<td>Essentially, JIT is a “pull” concept, where demand at the end of the pipeline pulls products towards the market and behind those products the flow of components is also determined by the same demand…thus no products should be made, no components ordered, until there is a downstream requirement.</td>
<td>Demand “pull”</td>
</tr>
<tr>
<td>Ahn and Kaminsky (2005)</td>
<td>In a pull-based supply chain, production and distribution are demand driven so that they are coordinated with true customer demand rather than forecast demand.</td>
<td>Pull-based supply chain</td>
</tr>
<tr>
<td>Collier and Evans (2006)</td>
<td>A pull system produces only what is needed at upstream stages in the supply chain in response to customer demand signals in the downstream stages.</td>
<td>Pull system</td>
</tr>
<tr>
<td>Chopra and Meindl (2007)</td>
<td>Pull processes may be referred to as reactive processes because they react to customer demand…execution is initiated in response to a customer order.</td>
<td>Pull processes</td>
</tr>
<tr>
<td>Jammernegg and Reiner (2007)</td>
<td>The trade-off between inventory cost reduction and increased cost for resources depends on the positioning of the CODP in the supply chain process (push/pull boundary). Upstream of CODP is forecast driven…Downstream of the CODP, the process is demand (customer) driven.</td>
<td>Push/pull boundary</td>
</tr>
<tr>
<td>Klug (2006)</td>
<td>Pull logistics is a demand-driven system.</td>
<td>Pull logistics</td>
</tr>
<tr>
<td>Ng and Chung (2008)</td>
<td>The upstream of the decoupling point is where the push strategy is used and activities are based on forecast-driven planning. On the other hand, the downstream of the decoupling point is where the “pull” strategy is used and activities are based on order-driven.</td>
<td>“Pull” strategy</td>
</tr>
<tr>
<td>Simchi-Levi et al. (2008)</td>
<td>In a pull-based supply chain, production and distribution are demand driven so that they are coordinated with true customer demand rather than forecast demand…in a pure pull system, the firm does not hold any</td>
<td>Pull-based supply chain; Pure pull system</td>
</tr>
</tbody>
</table>
inventory and only responds to specific orders.

Swaminathan and Nitsch (2007)  
Another common term used in literature is the push-pull boundary. This refers to the point where production switches from being a “make-to-stock” to a “make-to-order” environment.

Push-pull boundary

Project Management

Arbulu et al. (2003)  
The aim of a ‘pull’ system is to produce only what is needed, when it is needed, and in the right quantities.

‘Pull’ system

Arbulu and Ballard (2004)  
...engineered-to-order and make-to-order products can be pulled from suppliers.

Lean supply systems

Ballard (1999)  
Pull-based systems allow work into production processes based on the state of the process...a simple type of pulling is to limit the amount of inventory that can be placed between manufacturing workstations...pulling is a technique for matching up the various elements needed to actually perform work...in general, we can say regarding pull systems that CAN overrides SHOULD.

Pull techniques

Ballard and Howell (2003)  
A pull technique is based on working from a target completion date backwards...A rule of ‘pulling’ is only to do work that releases work to someone else.

Pull scheduling; Pull technique

Ballard and Howell (1995)  
Make ready processes produce inventories of workable assignments by “pulling” forward resources needed to do that work that will best contribute to throughput at each point in time...Resources are first procured and distributed in accordance with schedules; i.e. the work was driven by schedule push. Now the driving mechanism becomes plan-pull.

Construction JIT, Plan-pull

Tommelein (1998)  
The main objective of a pull-driven approach is to produce finished products as optimally as possible in terms of quality, time, and cost, so as to satisfy customer demand...to pull means that resources must be selectively drawn from queues – but chosen so that the activity’s output is a product needed further downstream in the process, and needed more so than its output using other resources in the queue would have been.

“Pull-driven” approach

Yang and Ioannou (2001)  
A push system approach cannot ensure the continuous utilization of resources because work continuity must also “pull” preceding activities or segments to eliminate gaps...we use the term pull in applying repetitive scheduling ideas to lean construction in a new way.

Pull-system

Production-pull

At the micro-level perspective, we consider pull production in the context of shop floor operations. By considering the earliest texts that describe Just-in-Time pull systems and the Toyota Production System (e.g. Monden, 1998; Ohno, 1988) and the more current literature that makes reference to these (e.g. Schonberger, 2007), as well as a range of other articles and books from the production management domain; our second context-dependent definition of pull is Production-pull. As such, we suggest the following as a best-fit description of pull in the context of production management:

In Production-pull, value-adding activities take place in response of a specific withdrawal from an explicitly limited inventory buffer, or supermarket. The direction of information flow is the reverse direction of material flow, and production takes place in order to replenish an exact amount of consumed products and / or components.

Notice that there are three fundamental elements that make up Production-pull:

1. A withdrawal
2. An explicit limit of the inventory (supermarket)
3. The direction of information flow is opposite to the direction of material flow

Thus, we suggest that when all three elements are in play, a state of Production-pull is achieved. Again, referring back to the definition of pull retrieved from the Oxford English Dictionary, we can now add the
“remove” dimension to our definition, as we have a removal (withdrawal) from inventory that has caused motion (i.e. production), also towards the source of the force (the customer). In theory, this gives us two sources of force causing the motion, the external customer demand (Demand-pull) and the internal withdrawal (Production-pull). However, as with the original JIT Kanban system, a number of prerequisites exist for Production-pull to function effectively, particularly the need of a smooth demand for standardized products in relatively high volumes. If these prerequisites do not exist, we need an alternative context-dependent pull mechanism that can be applied at the micro-level perspective, or what we call Plan-pull.

Plan-pull

Because not all producers have a limited portfolio of standard products that are made in high volumes, we require an alternative way of thinking in terms of pull for those that produce low-volume, high variety products (often one-of-a-kind). We can call these project-based manufacturers. As such, our third and final context-dependent pull definition has its roots firmly set in the project management field. We propose the following context-dependent definition for pull in the perspective of project management:

In the case of high variety, low volume (project-based) production, Plan-pull is the appropriate pull-mechanism. The focus here is on the finished items and respective due dates, and value-adding activities take place based on a priority rule such as earliest due date (EDD) and constraint management.

Plan-pull can be exemplified by referring to two application areas. Firstly, in construction management (more notable Lean construction), a method known as phase “pull” planning is used in order to translate the project master schedule (usually based on major milestones) into a pull schedule by considering and managing constraints (in this case activities that are required to be completed before further progress can be achieved) and identifying any potential operational conflicts. The idea is to begin with the end milestone or project goal and then identify all activities that are required to achieve this in reverse order. In doing so, internal customers within the project can pull work from the internal (or indeed external) suppliers, and the sequence of activities can be carried out in just-in-time fashion.

Secondly, Plan-pull can also be operationalized and exemplified in relation to the Quick Response Manufacturing (QRM) paradigm (Riezebos, 2010; Suri, 1998), which uses high-level MRP (HL-MRP) and Paired-cell Overlapping Loops of Cards with Authorization (POLCA) as two fundamental components of production planning and control for quick response. HL-MRP is applied in order to present a simple dispatch- or release list of production orders for finished items, often organized by earliest due date (EDD). POLCA is then used as an alternative to Kanban. Like Kanban, it is a card-based pull system, yet POLCA cards authorize production based on available capacity between production cells (i.e. constraint management), as opposed to providing authorization to replenish a specific consumption of inventory (see Riezebos, 2010). It is for this reason that QRM has many successful applications in high variety, low volume producers, for example in engineer-to-order (ETO) or make-to-order (MTO) manufacturers.

Finally, in relation to the originally stated Oxford English Dictionary definition of the word “pull”, in both examples of Plan-pull we again have two “sources” of force causing motion. Firstly, at the macro-level, we have a Demand-pull, i.e. the real customer demand. This is because project-based manufacturing can be classified as make-to-order (MTO) or even engineer-to-order (ETO), which explicitly requires a true customer demand before value-adding activities are carried out. Secondly, and this time at the micro-level, we have an internal force causing production to be pulled through the system. In the case of the construction example, internal customers draw (or pull) work from their supplier/s that is required to enable them to complete their own work (i.e. pull through effective constraint management). In the QRM example, the existence of available capacity and orders requiring completion pulls materials into the system.
CONCLUSION AND FURTHER WORK

In this paper, we set out to investigate the various interpretations of the pull concept that can today be found in a wealth of extant literature. By conducting a detailed analysis of 32 texts from three different contexts: Production Management, Supply Chain Management, and Project Management; we uncovered pertinent factors and useful insights that enabled us to propose three context-dependent definitions of the pull concept, each corresponding to one of the three distinct domains: Demand-pull, Production-pull, and Plan-pull. All three of the context-dependent definitions were compared to the original meaning of the word “pull” in the Oxford English Dictionary, which enabled us to justify the relevance of each.

Furthermore, an interesting observation that was made during this investigation was the shear number of authors that used the word “pull” with the seemingly unnecessary use of inverted commas (e.g. ‘pull’ or “pull”). Though this could be completely innocent and arbitrary, it does somehow give the impression of confusion or uncertainty for the use of the term “pull” on the part of the respective author/s. As such, we hope that this work can in some way increase the understanding of the pull concept across the various domains. If not just to increase the confidence of future authors to use the terminology without the need for inverted commas, we suggest that this paper could also offer a more structured approach for educational purposes, in order to encourage future students to think beyond settling for the oversimplification of “pull equals make-to-order”.

We also suggest several topics for future research, which are relevant for both practice and theory. For example, we suggest that an interesting study could be conducted in order to identify suitable configurations of the various context-dependent pull concepts for different manufacturing strategies, e.g. make-to-stock (MTS), assemble-to-order (ATO), make-to-order (MTO), and engineer-to-order (ETO). Such a study could result in a comprehensive typology or framework for the applicability of the distinctive pull mechanisms in various environments. Furthermore, an investigation of relevant methods and tools that can be applied to support and achieve the identified pull configurations would also serve as a complementary supplement to this work.

ACKNOWLEDGEMENTS

The authors would like to acknowledge the support of the Peder Sæther Center, an International Research and Educational Collaboration between UC Berkeley and universities in Norway which provided funding for the research project OPERATION: Operational Excellence in Engineer-to-Order Manufacturing. The authors would also like to acknowledge the continued support and funding from the Research Council of Norway, through both the SFI NORMAN (Norwegian Manufacturing Future) research program; and SoundChain, a user-driven research-based innovation project in cooperation with Kongsberg Maritime Subsea in Horten, Norway.

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Incentives and Job Satisfaction: Its Implications for Competitive Positioning and Organizational Survival in Nigerian Manufacturing Industries

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This paper assessed the attitude of workers towards incentive and their satisfaction to work. A sample of 127 valid respondents selected from the managerial and non-managerial staff and data collected were analyzed using Statistical Package for Social Science (SPSS) through descriptive statistics and regression. The findings revealed that financial rewards encourage workers externally; while non-financial rewards can satisfy employees internally by making them feel like a valued part of an organization. Also, it was indicated that some employees seem to be satisfied and content with their job not because they derive pleasure from the work itself but because there are no other alternatives. The manufacturing industry needs to embark on the restructuring of jobs and responsibilities in ways that would facilitate competitive advantage without sacrificing the basic objective of the organization.

INTRODUCTION

The concept of incentive has become the cornerstone for attracting, encouraging and retaining efficient employees in the organization. Every worker receives a pay or reward in exchange for the work they do. Traditionally, organizations often believe that pay is the greatest motivating factor for higher performance from employees. Economically, man works and earn money which is then used more directly to satisfy needs, usually physiological for purchasing food, shelter, and clothing as well as for acquiring other good things of life. Employers also have the ideology that to get the best from employees it is pertinent to offer them more money. Hence, some workers believe in money, while others believe in other incentives like recognition, job security, group cohesiveness, enabling environment, training, etc., Bennett and Minty (2005) adduce that incentives can be viewed from two broad perspectives. They are financial incentives and non-financial incentives. The study of Kreitner and Kinicki (2001) revealed that financial incentives has a short term result in encouraging and stimulating workers for higher
performance. Dorenbosch, De Reuver & Sanders (2006) indicated that financial reward goes a long way in determining how effective and committed a worker will contribute to organizational goal and objectives. According to Salau, Falola and Akinbode (2014), the financial incentives given to workers comprises bonus, increased salary/pay, fringe benefits, profit sharing, and other payment packages. According to Rothwell & Kazanas (2004), salary/wages and other payment packages play a critical role in workers’ motivation and commitment while Lawler (2003) asserted that non-financial incentive give long term motivational effect. Greenberg and Baron (2003) posited that the packages in non-financial reward include enabling work environment, workers participation in management, job enrichment, flextime, enabling authority, promotion, consistent employment relations, good labour-management relations, etc. Cook & Crossman (2004) also argued that employer-employee relations play a strategic role in improving workers’ involvement, high performance, commitment and retention. McDonald, Harrison, Checkland, Campbell & Roland (2007) pointed out that poor relationship with a line manager can be the push factor behind an individual’s decision to quit the job or leave the organization. Among several other factors responsible for employees leaving organizations are lack of training, development and career opportunities. Even when people stay for a year or more, it is often the case that their decision to leave later was taken in the first few weeks of employment. Most managers in many industrial settings do not adequately understand the principle and basis of individual differences for motivating employees for higher performance. Numerous studies have been made on the relationship between incentives and job satisfaction, as well as a wide range of variables to support organizational effectiveness. These studies on workers incentives and satisfaction have broadly been extended to both developing and developed nations of the world cutting across different professions. A study was conducted in Singapore using different industrial sectors to assess the role of incentives in facilitating job satisfaction. Others include Greenberg and Baron (2003) which focused on the significant influence of pay and other monetary-related variables on labour turnover; employee engagement and their job satisfaction level in the banking sector (Kinicki and Williams, 2003). Dawal and Taha (2006) also examined the various factors affecting job satisfaction in two automotive industries; Rothwell & Kazanas (2004) assessed these factors using the manufacturing industries; and Lew and Liew, (2006) examined the antecedents of employee’s needs on their job satisfaction. It could be inferred from above that not much research has been conducted on the relationship between all of these constructs. In this regard, this study is to contribute to the existing knowledge particularly in the sphere of organizational behaviour. A thorough understanding of ‘what’, ‘how’ and ‘why’ incentive is important in achieving high performance from employees will enable employers, managers, consultant, researchers, etc. in Nigerian manufacturing sectors to adopt, adapt and integrate strategic changes towards Competitive Positioning and Organizational Survival. However, this paper seeks to assess the attitude of workers towards incentive and their satisfaction to work. And also to explore its implications for competitive positioning and organizational survival in Nigerian manufacturing industries.

Drawing from its problem statement, the study provided answers to the following research questions.

1. To what extent has non-monetary incentives been impactful on workers’ satisfaction?
2. In what ways has monetary incentives been used to reduce employees intention to leave?
3. To what extent has Incentive influenced employees’ satisfaction and retention in the manufacturing sectors?
4. To what extent has incentives and workers’ satisfaction influenced competitive positioning and organizational survival?

LITERATURE REVIEW

Several studies have examined the relationship between the costs and effects of incentives and how it has affected employees’ satisfaction and commitment. Salau et al. (2014) studied the adoption of financial incentive in motivating employees for higher performance at a state hospital. Scheepers (2009) also examined the extent to which incentive systems affected the motivations of employees. Al-Nsour (2012) examined the indispensable role financial and non-financial incentives played on organizational
performance. Nelson and Quick (2005) analyzed the role of pay on job satisfaction. Kaya (2007) determined the major factors that are responsible for influencing employees’ satisfaction. The findings of the study revealed that fringe benefits such as paid holidays, sick leave and housing loans are the major determinants meaning that non-financial incentives were more effective than financial incentives in terms of the attitudes of employees. The study carried out by Coşkun & Dulkadiroğlu (2009) also indicated that non-financial incentives are given much importance than financial incentives. Their studies pointed out that such factors improves employees in the areas of promotion and appreciation and improving work place opportunities which have significant effects on job satisfaction statistically. The study carried out by Clark, 1997; Sousa-Poza and Sousa-Poza, 2000; Gazioglu and Tansel, 2006; Skalli et al., 2007 also argued that employees satisfaction is determined by working hours and the physical work environment. Conversely, Adeyeye (2009) studies argued that managers are more motivated by non-financial incentives and the employees are more motivated by financial incentives. Arnolds and Venter (2007) made effort to understand the economic principle of individual differences in motivating workers at selected manufacturing and clothing retail firms. The findings revealed that fringe benefits such as paid holidays, sick leave and housing loans are the major determinants of employee motivation and retention. McDonald et al. (2007) examined the effects of monetary incentives on effective service delivery system. Alwabel (2005) also highlighted the roles of monetary and non-monetary incentives in improving performances.

Monetary Incentives

The use of monetary reward has become indispensable in stimulating employees’ performance. In every organization, especially in the manufacturing sectors, the use of pay, bonus, compensation, profit sharing, etc has played a major role in motivating and retaining workers for higher performance and commitments (Osibanjo, Adeniji, Falola, and Heirsma, 2014). Studies have indicated that when salaries of workers are paid consistently, then it motivates them for to work willingly without the use of coercion, while the absence of this leads to intention of workers to leave, absenteeism, labour turnover, pilfering, lower commitment and morale. Monetary incentive is mostly use to encouraged competent people to join and remain in the organization and to motivate employees to achieve high level of performance (Falola, Ibidunni and Olokundun, 2014; Oribabor, 2000; Ogunbameru, 2004; Robbins, 2005). A study by Greenberg and Baron (2003): which focused on the significant influence of pay and other monetary-related variables on labour turnover affirmed that when workers who exerted greater efforts to performance and commitment are not adequately compensated and motivated financially, they tend to leave or quit the job. It is believed that a well-paid employee will see no reason to leave or quit his/her present job. Organizations’ that seek competitive and distinctive advantage must give ample room for increased pay, bonuses and higher wages and hence ensure organizational retention (Kinicki and Kreitner, 2003). People work for organizations in exchange of money to satisfy their immediate needs. The pay which comes in exchange for work done gives employees a sense of satisfaction and eventually facilitates employee retention. So, for organization to survive and be productive, the employees must be attracted, rewarded and retained (Burgess Simon, & Ratto Marisa, 2003; Cheng & Ho, 2001; Bartlett, 2001). Salary has played a major role in encouraging workers especially in the manufacturing industry. Though salary may not be a controlling variable to employee satisfaction and retention, it influences decision to join, stay or quit the organization. Akintoye (2000) sees salary as a controlling factor in job satisfaction. Lawler, 1973 opined that pay is one of the greatest motivating factors. Bartlett (2001) and Cornelius (2001) are also of the opinion that organizations with a motivating pay may create a center of attention and keep hold of qualified personnel and thereby recruiting costs. When workers are well paid, they become reluctant to change jobs (Nelson and Quick, 2005). Therefore, it becomes imperative that for any organization to achieve success, the monetary variables should be deliberately designed to be attractive and enticing and thus create the desire to join and remain with the organization.

Non-Monetary Incentive

Non-monetary incentive has also played an indispensable role in encouraging employees physically, emotional and psychological. Non-monetary incentives are rewards that an individual experiences and are
directly related to the job itself (Falola, et al, 2014; Kinicki and Williams, 2003). Psychological rewards are responsibility, achievement, autonomy, personal growth, challenge, complete work and feedback components of the job. Physical rewards are training, welfare services, flextime, promotions, interpersonal relationships, conducive environments, job enrichment, etc. Studies also indicated that non-monetary incentives are also important factors that help in influencing the satisfaction and retention level of an employee. Greenberg and Baron (2003) and Friedman (2005) are also of the opinion that organizations with adequate provisions of the non-monetary variables create a center of responsiveness and attention which helps in retaining competent, knowledgeable, experienced and trained personnel. Training comes in when some employees are found to be deficient in the performance of their duties (Cheng & Ho, 2001; Lawal, 2005 and; Lawler, 2003). This training will then serve as a means of encouraging such employees to acquire and obtain more specific skills, capacities, knowledge, information and talents that will be needful in their subsequent tasks. However, it has been observed that when both the managers and the managed are well trained, the attainment and realization of corporate goals will be assured. Several studies (Rothwell & Kazanas, 2004); Salau, Falola and Akinbode, 2014) indicated that employees are often motivated and satisfied with jobs only when it gives them the freedom and opportunity to make use of their skills and abilities without any arbitrary coercion. The environment also goes a long way in determining the performance of an employee. It is observed that a conducive environment gives room for higher performance, productivity and commitment, as well as recognition and flextime, which creates avenues for their enrichment and self-development (Muchinsky, 2006). In the Nigerian manufacturing sector, employees are given feedback on their level of performance within a realistic period and are supported to improve their performance through adequate training and developmental programmes. Numerous studies like Cook & Crossman, 2004; Caruth & Humphreys, 2008; McDonald Ruth, Harrison Stephen, Checkland Kath, Campbell Stephen & Roland Martin (2007) stated that employees get motivated to work when they get frequent promotions and job security in their workplace; while some also argued that factors such as promotion, training and career development, as well as appreciation and improved work environment give employees greater opportunities and that these will either directly or indirectly influence their satisfaction on the job. When high performances are recorded for employees, it must be supported with a basis for recognition and promotions. Effective labour management relations has also been seen as a strategic determination to facilitate industrial harmony, affection, recognition, friendliness & freedom that is crucial for efficient performance capable of enhancing organizational effectiveness (Lawal, 2005). Some studies added that when jobs are enriched workers tend to be highly motivated and this helps in reducing their intention to leave and absence from work (Nelson and Quick, 2005; Rothwell & Kazanas, 2004; Balogun and Obasan, 2007). Job enrichment and developmental needs are also requisites to enhancing workers capability, reasoning faculty and competence (Bennett and Minty, 2005) which will improve organizational performance (Barrett & O’Connell, 2001; Adeyeye, 2009; Aluko, 2007; Anugwon, 2005; Al-Nsour Marwan 2012) and as well help in gaining competitive edge (Balogun and Obasan, 2007). However, when developing strategy for motivating people, the management of the manufacturing sector needs to consider the value needs of individual employee.

Influence of Incentive on Job Satisfaction
Incentive has been a shared factor influencing the performance of employees at workplace. Numerous studies argued that there are different factors that lead to employees’ satisfaction and also explain what really motivates them for distinctive advantage. Over the years, the means of identifying these factors has been a major concern for management bearing in mind that human needs are unlimited and their wants are insatiable. Studies revealed that when organizational rewards are not the actual needs of employees, job dissatisfaction and lower commitment tends to appear. This corroborates with the findings of Kinicki and Kreitner (2003) that when the sincere needs and supplications of the employees are not taken into consideration and managed properly, then displeasure, discontent and pilfering prevails and this facilitates unattractive state of the mind towards work. Rothwell & Kazanas (2004) discovered that organizational effectiveness becomes vague the moment an employee feels displeased, disgruntled or discouraged about how things are done. However, it becomes necessary for organizations to put in place the best strategies that
will help to decrease the depressing factors, bearing in mind the principle of individual differences when it comes to satisfying their (employees) needs and requirements. Several factors have been identified to influence high job satisfaction in the workplace; amongst these are career development and progression, opportunities for growth, communication, training and other work related issues (Bennett and Minty, 2005). Invariably, several studies have also revealed that low compensation and rewards (monetary or non-monetary) are the most common reason given for dissatisfaction. Burgess Simon, & Ratto Marisa (2003) stated that employees feel they are satisfied only when they derive pleasure from their job, and this feeling influences their attitude to work which eventually leads to greater performance. Studies indicated that there are various dynamic ways of motivating worker for efficiency and effectiveness; amongst these are pay, interpersonal relationship, sense of achievement, etc. (Salau, et al., 2014)”. In the world of business, the relationship between incentives and job satisfaction cannot be undervalued, the two variables depend on each other but respond in different ways to increased employees engagement, participation and retention, competence, commitment and involvement.

Related Theoretical Underpinnings

Herzberg’s two-factor theory explained how best employees’ needs can be met and satisfied. The study argued that the factors leading to job satisfaction are separate and distinct from those that lead to job dissatisfaction; hence, the term two-factor theory which simply refers to motivators which are related to job content. Herzberg revealed that the job content or the motivators focus on task significance, task identity and the notion a worker has on his/her job. It includes the following: the work itself, respect, advancement, a sense of achievement and responsibilities. On the other hand, Herzberg recognized the second factor as the hygiene factors which are related to the job context. The job context refers to the environment in which the job is performed. It also includes: Company policy and procedure, supervision and administration, pay, working conditions and relationship with superior and co-workers. The equity theory has argued that employees are not concerned about what they are paid; rather they are much more concerned about what others are paid. More often than not, when an individual has a sense of inequality or when he/she perceives that his reward is not commensurate with his contribution when compared with that of other colleagues, it may lead to absenteeism, pilfering, dissatisfaction, etc. By implications, incentive scheme should be equitable i.e. reward should be proportionate to individual contribution, training and ability. This idea/school of thought has been viewed as the theory of neo unitary theory of industrial relation with strong emphasis on industrial democracy and equity in managing employee-employer relations. The particular feature of this theory is that it upholds high sense of employee welfarism. It appears to have emerged in some organizations during 1980s (Faringherm and Plinth 1983). In essence equity theory uses a greater deal of “income” in strategic ways to obtain compliance from employees and hence prevent possible strained relations between employee and employer. The expectancy theory also states that the reward organizations offer go a long way in determining the expectancy needs of employees. According to Charles Brain, expectancy depends on pay, the attractiveness of reward in terms of the value individual has for pay. Employees believes that their pay should be commensurate with each individual’s efforts and contribution.

Significance of the Study

Incentives comes in many forms and what motivates one individual is not necessarily the same for their team members. Therefore, it is important to understand how motivation and satisfaction differ among individuals and how these differences affect the overall drive and determination of a team toward achieving a goal. To better understand the complexities of motivation researchers over the years have developed a number of theories which try to explain why people behave the way they do and also try to predict what people actually will do, based on these theories. Overall, this research will depict the consequences of labour turnover when teams lack motivation by examining areas such as task, structure, goals, and members. This study also intends to contribute to the existing body of knowledge and the findings, suggestion and recommendation will help other researchers, students, administrators, managers and other practitioners to understand how employees should be rewarded and satisfied through needs
identification. This study gave attention to the effectiveness of incentives and job satisfaction in achieving competitive positioning and organizational survival using some selected manufacturing companies in Lagos. However, as discussed in the literature reviewed above, we propose the following model depicted in figure 1.

**FIGURE 1**  
**CATEGORIZATION OF INCENTIVES PACKAGE**

![Diagram of Categorization of Incentives Package]

*Source: Model was developed by the researchers (2014)*

**Research Hypotheses**

Based on background to the study and research questions, the following were formulated:

H₁: There is no significant relationship between attitude of workers towards financial and non-financial incentive

H₂: Incentive scheme is not likely to influence employees’ satisfaction and retention in the manufacturing sectors

**MATERIALS AND METHODS**

A descriptive survey design method was used in carrying out this study in some selected firms. Due to time and budgetary constraints, the study team focused on two areas i.e. Ikeja and Victoria Island of Lagos Metropolis in Nigeria.

Methods used for collection of data included, structured questionnaire, open ended- semi structured interviews (face to face as well as telephone interviews), and finally participant observation. Prior to field visits and focus group discussions, team members reviewed relevant documentation regarding pay scales, allowances and benefits of employees in the selected manufacturing firms. Randomly selected management teams and researchers were also interviewed. Detailed discussions were held with employees on challenges they faced in their work. This led to a sample of 150 respondents selected from both management and non-managerial staff through the stratified and simple random sampling techniques. The existing departments include: Purchasing & Supply, Audit, Engineering & Production, Accounting and Finance, Admin and Records and Security & Stores. Data were collected through self-
administered questionnaires. This study comprises four sections in the questionnaire (A, B, C, D). Section A comprised of personal data of respondents, section B involved information regarding the extent of changes in the structure of incentive scheme, section C showed the factors responsible for the effectiveness of the incentive scheme and section D comprised of the impact of incentive scheme on organizational effectiveness. The data collected was analyzed using statistical package for social science (SPSS) through descriptive statistics and regression.

RESULTS AND DISCUSSIONS

The findings with the description of the respondents’ bio-data information focuses on results obtained from the survey through the administering of questionnaire. A total of 150 questionnaires were administered but 127 were regarded as valid; therefore these 127 questionnaires were analyzed and interpreted using chi-square and cross tabulation.

Socio-Demographic Characteristics of Respondents

Table 1 indicates that 70% of the respondents were male while 30% were female. The age group indicates that 7% of the respondents belonged to the age-group of 25 years and below, 53% of the respondents were aged 25-35 years, 36-45 years representing 32%, while only 10 respondents were above 46 years representing 8%. The importance of age to this study cannot be overemphasized because each age group has peculiar needs and their reaction to social needs and employment conditions also differ from one to another. It was observed from the data that the response of employees in the age group 25-35 years to organizational expectations differed remarkably from those in the age bracket of 36-45 years. Also, this invariably shows that a larger percentage of the work force of the organization is made up of younger persons.

### Table 1

**Distribution of Respondents Characteristics**

<table>
<thead>
<tr>
<th>Sex</th>
<th>Frequency</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>89</td>
<td>70</td>
</tr>
<tr>
<td>Females</td>
<td>38</td>
<td>30</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>127</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age</th>
<th>Frequency</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 years and below</td>
<td>9</td>
<td>07</td>
</tr>
<tr>
<td>25-35 years</td>
<td>67</td>
<td>53</td>
</tr>
<tr>
<td>36-45 years</td>
<td>41</td>
<td>32</td>
</tr>
<tr>
<td>46 years and above</td>
<td>10</td>
<td>08</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>127</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Marital status</th>
<th>Frequency</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single</td>
<td>59</td>
<td>46</td>
</tr>
<tr>
<td>Married</td>
<td>61</td>
<td>48</td>
</tr>
<tr>
<td>Separated</td>
<td>07</td>
<td>06</td>
</tr>
<tr>
<td>Divorced</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>127</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Educational Qualification</th>
<th>Frequency</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSCE</td>
<td>04</td>
<td>03</td>
</tr>
<tr>
<td>OND/NCE</td>
<td>43</td>
<td>34</td>
</tr>
<tr>
<td>B.Sc/B.Ed/B.A</td>
<td>57</td>
<td>45</td>
</tr>
<tr>
<td>Others</td>
<td>23</td>
<td>18</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>127</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration in organization</th>
<th>Frequency</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-5 years</td>
<td>68</td>
<td>54</td>
</tr>
</tbody>
</table>
The marital status indicates that 46% of the respondents were single, 48% were married, and 6% was separated. It therefore implies that majority of the employees are married and have families to cater for. In terms of educational qualifications, the results show that just 3% of the respondents had SSCE, 34% had OND/NCE, and a total of 45% of the respondents had B.Sc/B.Ed/B.A while only 18% had other degrees such as M.sc and Ph.D. It is thus apparent that employees of the organization are to a reasonable degree literate, as no respondent returned his questionnaire for want of literacy; more so only 3% of the respondents had only SSCE. It was observed from the data analysis that 54% of the respondents indicated they have served for not more than 5 years in the Organization, 32% have served for 6-10 years, 9% have served between 11-15 years and 5% have served between 16-20 years.

### TABLE 2
**DESCRIPTIVE STATISTICS ON THE ATTITUDE OF EMPLOYEES’ TOWARDS NON-MONETARY INCENTIVE**

<table>
<thead>
<tr>
<th>Descriptive Statistics</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Variance</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Conducive environment enhances employee commitment</strong></td>
<td>127</td>
<td>4.60</td>
<td>.581</td>
<td>.337</td>
<td>-1.627</td>
<td>.215</td>
</tr>
<tr>
<td><strong>Adequate Recognition from supervisors enhances loyalty of employees</strong></td>
<td>127</td>
<td>4.07</td>
<td>.580</td>
<td>1.082</td>
<td>-1.046</td>
<td>.215</td>
</tr>
<tr>
<td><strong>Employees get motivated to work when they get frequent Promotions in the work place</strong></td>
<td>127</td>
<td>4.28</td>
<td>.835</td>
<td>.697</td>
<td>-1.491</td>
<td>.215</td>
</tr>
<tr>
<td><strong>Good Relationship with subordinates brings about higher performance</strong></td>
<td>127</td>
<td>3.87</td>
<td>.839</td>
<td>.704</td>
<td>-.888</td>
<td>.215</td>
</tr>
<tr>
<td><strong>For improved competitive positioning, Feedback is necessary</strong></td>
<td>127</td>
<td>3.66</td>
<td>.961</td>
<td>.924</td>
<td>-1.015</td>
<td>.215</td>
</tr>
<tr>
<td><strong>Valid N (listwise)</strong></td>
<td>127</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Hypotheses Testing

The hypotheses formulated in this study were tested and they guided the arrangement of the tables. Each hypothesis focuses on the variables identified. In analyzing the data, the statistical method employed involved the use of chi square test which tries to establish the relationship between two variables (dependent and independent) and the strength of association between them. A summary of the main findings follows each hypothesis and in addition, where required sustained by demographic data.

Hypothesis 1

There is no significant relationship between attitude of workers towards monetary and non-monetary incentive

The Skewness and kurtosis are of primary importance because they are indicative of extent to which variables are not normally distributed. Kline, 1998 posited that Skewness above 3.0 and kurtosis above 10 indicate serious departures from normality in a distribution. With this criteria, none of the variables posed any problem of normality. However, from table 2, conducive environment has played a vital role. Conducive environment enhances employee commitment (Mean = 4.60; SD= 0.581). The level of recognition given to workers cannot be under estimated as most of the staff adduced that adequate recognition from supervisors enhances their loyalty (Mean= 4.07; SD= 0.580). In addition, most of the respondents agreed that they get motivated to work when they get frequent promotions in their work place (Mean= 4.28; SD= 0.835). Meanwhile it was also discovered that Good Relationship contributes to higher performance. It was observed that majority of the respondents reiterated that they have the cordial relationship and freedom to decide how best to perform their task (Mean= 3.87; SD= 0.839). Almost the same set of respondents affirmed the significance of feedback mechanism on their performance (Mean= 3.66; SD= 0.961). The implication of this is that the feedback mechanism serves as a means of identifying their strengths and weaknesses. Therefore, it would be concluded that the attitude of workers towards non-monetary incentives significantly influence their level of satisfaction and commitment to work.

| TABLE 3 |
| DESCRIPTIVE STATISTICS ON THE ATTITUDE OF EMPLOYEES’ TOWARDS MONETARY INCENTIVE |

<table>
<thead>
<tr>
<th>Descriptive Statistics</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Variance</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Statistic</td>
<td>Statistic</td>
<td>Statistic</td>
<td>Statistic</td>
<td>Std. Error</td>
<td>Statistic</td>
</tr>
<tr>
<td>Steady payment of Salary increases my performance</td>
<td>127</td>
<td>4.54</td>
<td>.627</td>
<td>.393</td>
<td>-1.443</td>
<td>.215</td>
</tr>
<tr>
<td>Am entitled to other Benefits apart from my salary</td>
<td>127</td>
<td>4.07</td>
<td>.580</td>
<td>.336</td>
<td>-.498</td>
<td>.215</td>
</tr>
<tr>
<td>The organization gives Bonuses for high performance</td>
<td>127</td>
<td>3.57</td>
<td>.914</td>
<td>.835</td>
<td>-.614</td>
<td>.215</td>
</tr>
<tr>
<td>Profit sharing in my organization is equitably fair</td>
<td>127</td>
<td>2.54</td>
<td>1.045</td>
<td>1.091</td>
<td>.626</td>
<td>.215</td>
</tr>
<tr>
<td>Valid N (listwise)</td>
<td>127</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Field Survey, 2014
However, from table 3, steady and regular payment of salary has played a vital role in influencing performance. Regular payment of salary enhances employee performance and commitment (Mean = 4.54; SD= 0.627). It was observed that employee are entitled to other benefits apart from their salary (Mean= 4.07; SD= 0.580). In addition, most of the respondents agreed that the organization gives them bonuses for high performance (Mean= 3.57; SD= 0.914). Meanwhile it was also discovered that profit sharing contributes to higher performance. But the reverse is the case here. It was observed that majority of the respondents reiterated that profit sharing in my organization is equitably fair (Mean= 2.54; SD= 1.045). Therefore, apart from the low level of profit sharing which could results in absenteeism and intention to leave, it can be concluded that attitude of workers towards monetary incentives significantly influence their level of commitment to work and this will ultimately influence competitive advantage and organizational survival.

H02: Incentive scheme is not likely to influence employees’ satisfaction and competitive edge in the manufacturing sectors

**TABLE 4**

DESCRIPTIVE STATISTICS SHOWING THE ROLE OF MONETARY AND NON-MONETARY INCENTIVES ON EMPLOYEES’ SATISFACTION AND COMPETITIVE ADVANTAGE

<table>
<thead>
<tr>
<th>Descriptive Statistics</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salary serve as inducements to getting commitment from employees</td>
<td>4.54</td>
<td>.627</td>
<td>127</td>
</tr>
<tr>
<td>Bonuses and other benefits given to employees have positive effects on job commitment</td>
<td>4.68</td>
<td>.547</td>
<td>127</td>
</tr>
<tr>
<td>Employees get motivated and satisfied to work when they get frequent promotions in the work place</td>
<td>4.28</td>
<td>.835</td>
<td>127</td>
</tr>
<tr>
<td>The level of recognition and affection given to an employee determines his/her level of retention</td>
<td>3.91</td>
<td>.618</td>
<td>127</td>
</tr>
<tr>
<td>Consistent and adequate training and development serves a way of promoting competitive advantage</td>
<td>3.75</td>
<td>.797</td>
<td>127</td>
</tr>
</tbody>
</table>

Source: Field Survey, 2014

**TABLE 5**

CORRELATIONS SHOWING THE RELATIONSHIP BETWEEN INCENTIVES (MONETARY AND NON-MONETARY, EMPLOYEES’ SATISFACTION AND ORGANIZATIONAL SURVIVAL

<table>
<thead>
<tr>
<th>Correlations</th>
<th>Salary</th>
<th>Bonuses &amp; fringe benefits</th>
<th>Training &amp; Development</th>
<th>Recognition and Affection</th>
<th>Promotion</th>
</tr>
</thead>
<tbody>
<tr>
<td>SALARY</td>
<td>Pearson Correlation</td>
<td>1</td>
<td>.423**</td>
<td>.492**</td>
<td>.328**</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
<td>.016</td>
</tr>
<tr>
<td></td>
<td>Sum of Squares and Cross-products</td>
<td>49.51</td>
<td>18.276</td>
<td>32.441</td>
<td>15.976</td>
</tr>
<tr>
<td></td>
<td>Covariance</td>
<td>.393</td>
<td>.145</td>
<td>.257</td>
<td>.127</td>
</tr>
</tbody>
</table>
### RESULTS AND DISCUSSIONS

One of the main research questions of this study focused on ascertaining the extent of incentives given to employees and which of these motivate them the most for higher performance. The findings revealed that monetary incentives which include salary, profit sharing, bonuses and fringe benefits often significantly influence employees' satisfaction and organizational survival in the manufacturing sectors.

The result of the analysis above indicated that correlation is significant at the 0.01 level (2-tailed) and at the same time significant at the 0.05 level (2-tailed) meaning that incentive significantly influence employees' satisfaction and organizational survival in the manufacturing sectors.
improve employees’ performance. But at the same time some respondent argued that it also leads to unscrupulous attitude, increase employees’ intention to leave, labour turnover and fosters greed and discontent. It was observed that money was seen in the manufacturing sectors as the greatest and topmost motivational force in bringing out the best from employees; while some staff of the same industries argued that there should be a balance between intrinsic and extrinsic motivation advising that employers should pay greater attention to intrinsic motivation. That means as the salaries and other bonuses are increasing, management should also design and enrich jobs that provide prospects and opportunities to make choices, improve skills and abilities, do work that matters and build consistent industrial harmony and peaceful cohesion. The findings revealed that employees are given both the financial and non-financial incentives; but employees in the selected manufacturing industries adduced that they are motivated to some extent but not fully satisfied because the monetary values are not commensurate with their contribution and also inadequate to satisfy their needs. Buchanan and Huczynski (2004) corroborated this in their work that unhappy employees are not motivated to work hard or give 100% of their efforts over a long period of time. Therefore, it is important for the workers to feel satisfied doing their jobs and also have great value for their efforts. In the same vein, Greenberg, S. and Baron, D. (2003) also argued that unhappy employees who are motivated by fear of job loss do not give 100% of their effort for very long. Drawing from structured interview which addressed the issue of fringe benefit among employees, it was revealed that out of the 40% who agreed that they were satisfied, a majority of them made statements such as “half bread is better than none”. It was also realized that 55.3% of the employees were willing to choose another job if the opportunity was given to them because the profit sharing is not equitably distributed. This indicates that some of the employees seem to be satisfied and content with their job not because they derive pleasure from the work itself but because there are no other alternatives; so they prefer to stay in the available employment. The respondents also affirmed that they are to some extent satisfied with the present jobs because it affords them the opportunity to apply their skills, abilities, and freedom as well as adequate training and seminars which creates avenues for their enhancement and self-development. On the other hand, majority of the employees agreed that the selected manufacturing companies promote them as at when due and yet 60% of them are still not satisfied with their jobs. This evokes question about the direct relationship between promotion and job satisfaction; but on the other hand, Kreitner and Kinicki (2007) argued that satisfaction with promotion assess employees’ attitude towards the organization’s policies and practices. Interestingly, it was observed that older workers tend to be more satisfied with their jobs than younger workers. Incentives to a large extent influenced employees’ satisfaction and retention in the manufacturing sectors thereby leading to competitive positioning and organizational survival

**MANAGERIAL IMPLICATIONS AND RECOMMENDATIONS**

Based on the empirical data generated and analyzed in the course of this study, certain logical conclusions were reached: both monetary and non-monetary rewards increase employees attitude to work; while some workers see pay as the greatest stimulating drive to higher performance, others sees non-financial rewards as the only means by which the organization can make them feel like a valued part of an organization and showing them that they are appreciated. Although fringe benefits and other conditions of service exist in the Organization, the content of such benefits and schemes are perceived inadequate. The study observed the following: accessibility to loan without interest, regular payment of salary, inconsistent payment of fringe benefits, (such as leave, transport, furniture allowances, etc.) and irregular issuance of bonuses. Others are adequate training with equitable welfare services, irregular promotions, good interpersonal relationships and conducive physical environments. The organization is of the notion that what motivates an employee should equitably influence others. By implication, if an employee needs recognition or affection and increase in salary was given, this might not bring out the best in him as most of them (respondents) indicated in the questionnaire that their salaries are regular and consistent but they needed to be treated as human beings and not machines. Most of the respondents pointed out that although the salary is not commensurate with their input, they had to stay since they have not gotten employment elsewhere;
while some adduced that no matter what they will still be working with the organization because it gives room for career advancement. A larger percentage of the respondents affirmed that at times inconsistent payment of fringe benefits brings to them depression, fatigue, mental and psychological stress and intention to leave even when they have nowhere to go. Other stated adverse outcomes are sabotage, pilfering/stealing, which affects productivity level.

Therefore, the unique differences in individual workers in terms of potentials, initiative and creativity should be identified with a view to developing them to the fullest. Other benefits should be kept at par with needs, requirement and satisfaction of the employee. The organization should design new work procedures which would stipulate the hours of work, over time payment, equitable profit sharing and other incentives/allowances. To achieve competitive advantage and distinctive positioning, workers should be given fair opportunity for promotion, training and privilege to participate in decision makings in their organization. It is on this basis that private organizations thrive, and as a result promote effective human resource development and utilization.

REFERENCES


Organizational Change Management in a Strategic Perspective

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The change management is currently recognized as one of the main factors governing a company’s success. Due to that perspective, the purpose of this work is to exemplify strategies that allow organizations to define change actions avoiding problems, trauma and dissatisfaction in the employees. The work developed is characterized as active, explorative and descriptive using the case study as its research strategy. Data gathering was performed in an organization during its preparation to receive the change – performed in a planned, authorized and documented manner – which successfully implemented the Enterprise Resource Planning – ERP, achieving significant result for the company in terms of processes enhancement and quality, besides establishing the sustainability positioning.

INTRODUCTION

The division of work has evidenced positive and negative points. Upon arrival of machinery and factories, each member of the family started to play a different role, women and children were employed to operate the machines while men were dedicated to heavy services (Cruz, 2009). The human life experienced deep changes, manual production gave place to mass production; rural society was replaced by the urban one and Humanism bowed down to Rationalism – affecting the entire system of values and beliefs (Morgan, 1986).

Although every organization wishes to, at least, survive the uncertainties of such a competitive marketplace, beyond survival they also intend to grow, place themselves ahead of competition, conquer stability for their business and reduce, as far as possible, their vulnerability (Mandelli, Lucas, Viveiros, 2003). And in order to have it realized as planned, the organizations must be ready to receive the changes, otherwise they will not be surviving in the market.
The approach of a subject matter like the Organizational Change in a Strategic Perspective is nowadays extremely important, as the researched subject is precisely the reality that the organizations in general have been facing.

The corporate world has been changing in a speedy manner and, many times, surprisingly as well. Everywhere, huge efforts are dedicated to understand better the organizations and help them adapt to the new outlooks (Wood Jr., 2009).

The factors influencing the organizational change include nature of the work, competition, globalization, government, laws, new industries, financial market, technology, market trend, arrival of information society and the uncertainty of the future (Morris, Bainbridge, 1996), (Freire, 2000).

The companies capable of effectively reacting to the changes, in a positive manner, become more dynamic, adaptable and proactive towards the new scenarios being presented.

Information technology is the vehicle used by the organization to comply with its declared mission and to reach its targets. As technology is quickly changing, the organizations and the managers face the challenge of keeping the pace with those changes and, meanwhile, sustaining the institutional balance. That is a point for discontinuity (Robbins, 2005).

It is not so easy anymore to predict the future based on the past, therefore, it is very hard for the organizations to manage changes in information technology based on the historical performance indicators. In addition to that challenge, there is the fact that there are many other factors acting as conductors for organizational change besides the actual changes in technology, such as the social and political trends and the competition dynamics. In the core of all that, there is the need for management aimed at controlling the change factors inside the organization.

But in order to have efficient and conscious change, management of the necessary strategic resources is essential and determinant to achieve minimally level of comfort over the process.

To reach the intended success, the companies have to use well-structured change management, counting with strategies that prepare them for change, avoiding problems, traumas and dissatisfaction for the process players (personnel).

In this new reality faced, there is no more room for the companies to continue with the thinking by simple forms, ready to use success formulas or home recipes. The organization must be analyzed in a deep and integrating manner, aiming to handle change in an intelligent and well-planned form.

In the path to implement the change, companies face several obstacles: paralyzing bureaucracy, provincial policies, low level of trust, lack of teamwork, lack of leadership in intermediate management, human fear for the unknown – the new, the different (Kotter, 1999).

And, in order not to have disappointing and terrifying efforts dedicated to perform the changes, resulting into wasted resources, it will be necessary to use strategies that prepare the organizations for the change.

But, how can change be observed through strategic perspective, engaging the individuals involved in the process, as experience has been showing that change in the organizations has been generating reasons for internal competition, instead of mutual cooperation?

Therefore, the scope of this work is related to change management in the process of implementing the Enterprise Resource Planning - ERP.

THEORETICAL GROUNDS

According to Mandelli, Lucas, Viveiros et al. (2003), change means breaking the existing, moving from one to another role.

Change management is a quick process to control the life cycle of all the changes (strategic, operational) in an IT environment (Sullivan, 2008). One purpose of the change management is to coordinate and plan changes, mitigating the negative impacts of change in the production environment, keeping integrity of the system. The change management scope includes all sorts of changes, strategic and operational. Each organization should define the changes covered by this process.
The purpose of the change management is to standardize methods and procedures to handle the change inside the organization, in an effort to reduce change impact on the service quality and daily operations of the organization. It includes incorporation of methods and practices that were identified as the best practices.

The best practice can be defined as a set of techniques and methods that always result into superior results when compared to other techniques and methods (BusinessDictionary.com). The change must result into improvement of the organization daily functions (Sullivan, 2008).

The change can trigger two mechanisms, the first one being the identification of a new model and, in fact, it requires an analysis by the point of view of the others, enabling an action according to standards that are different from your own. The second one is scrutinizing of the scenario, consisting of the search for information that can add concepts to the learning in order to redefine which was previously conceived as an ideal model.

The third phase, the one of stabilization of the actual changes and interconnection to the organization’s operational and ordinary processes, is crucial to assure that no retreat to the initial phase is verified. There are two different mechanisms associated: the personal refreezing and the relational refreezing.

However, the resistance to change can be increased by feelings, pains such as fear, uncertainty, distrust, discomfort and intolerance for the individual (or group) as it causes a perception that the space in the organization is experiencing changes and that it is necessary to break paradigms. And when transcended to the personal level, resistance can cause several physiological (anxiety, irritability, stress, insomnia, etc.) and psychological (poor attention, anguish, forgetting, distraction, etc.) reactions.

The key to reduce resistance is to take it to a healthy threshold and to guarantee that changes can be seen as beneficial through active action of the elements towards building of the new structuring (Huse, 1996).

There are several approaches and concepts related to change, some of them focusing the organizational structure, others focusing the process itself, the required speed, the human behavior, the company’s history, among others, but, irrespective of the focus, it is common sense that change has become fundamental, notwithstanding the motive, whether it is aimed for costs saving, improvement of products and services quality, increased productivity, etc., change implies existence of strategies that enable management that supports the excessive change and assures its effectiveness.

However, in order to tailor a culture that enables change, it is first necessary to decipher the one existing in the organization. A way to discover the type is by bringing out the basic presuppositions, which assumed specific standard is referred to as the cultural paradigm. For that, it is necessary to investigate some categories (Schein apud Fleury and Fischer, 1996):

Being aware of the culture existing in the organization allows creation of an engine capable of controlling its operation, simplifying the understanding between the company and the stakeholder in the sense of an understanding being defined between what one wishes and expects from the other (Nora, 2009).

The term ‘process’ is also closely linked to the reengineering movement, in this aspect, although “not being very proud of the way used by many companies to perform their reengineering” (Davenport, 2002, p. 132).

**METHODOLOGY**

This is a qualitative research, as it seeks, by observing procedures, strategies and applications of the Change Management, as well as by knowledge reflected in the theory, to make pragmatic interpretation of those phenomena and assign them meanings in inductive manner.

This study is aimed at providing more familiarity with the bibliography and material facts through contact with the researched company, by means of a questionnaire answered by people who had practical experiences with the surveyed problem, it is also aimed at exposing the characteristics of the balance sheet methodologies currently used, in order to enable us classify it as exploratory and descriptive.
The same research can be simultaneously framed into several categories, to the extent that it observes the requisites inherent to each type, as the types of research presented in the several categories are not exhaustive (Silva, 2003).

The method used in this study was the Inductive one which, by essence, goes from the particular to the universal. Through the use of books and articles renowned by the academic community and also by observing specific and relevant situation experienced by the researched company, the work tried to extract generalizations for the researched problem.

This study has adopted, with the purpose of performing random research, the non-probability sample type. At random, 20 stakeholders of Demiton - Comércio de Produtos Esportivos Ltda. Company were selected, male and female genders, within the age range from 25 to 53 years old and who had contact with the implementation Project of the Enterprise Resource Planning - ERP.

According to the technique elected for this research, the case study, the option made was to use questionnaire for data gathering, using it in the most adequate possible manner aiming to achieve the best possible results to meet the purposes of the research.

This text was prepared in wording understandable to the informant and accessible for the understanding of the studied population. Formulation of questions must avoid the possibility of doubtful interpretation, or yet of suggesting or inducing the answer. Ideally, each question should be focused on only one matter, which shall be analyzed by the informant. The questionnaire has to contain only questions related to the research objectives (Young, Lundberg, 1998).

To best use the potential of the case study, besides the standard answer options ("Totally", "Partially" and "Not applicable") the “justification” field was also used so that the informant could describe the reason for his/her answer.

ERP IMPLEMENTATION PROJECT

The company Demiton established a partnership with the global leader in systems for supply of new integrated management applications. The contract included a consulting company, the largest IT Latin-American company, who was the integrator of the technological solution.

Implementation of the Enterprise Resources Planning (ERP) was intended at significantly contributing for integration of the company’s processes, enabling promptness to attain strategic data and effectively assisting the company’s managers in the decision making process.

In order to successfully implement the relevant project, the methodology suggested by the contracted consulting company was applied.

RESEARCH RESULTS

To measure efficacy of the adopted methodology, as well the strategies used by Demiton Company in the implementation project of the ERP, a questionnaire was randomly applied for the company’s stakeholders.

From the twenty (20) questionnaires distributed, fifteen (15) were returned, which represented approximately seventy-five percent (75%) of the sample universe, characterizing sampling average deemed to be normal, according to the Case Study adopted technique.

The sample handling method was based on descriptive measures. All the content was investigated and the results presented below were achieved (See Table 1).
### TABLE 1
SYNTHESIS OF RESULTS

<table>
<thead>
<tr>
<th>QUESTIONS</th>
<th>AGREEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TOTAL</td>
</tr>
<tr>
<td>Contracting of Consulting Company</td>
<td>93%</td>
</tr>
<tr>
<td>Adopted Strategy</td>
<td>80%</td>
</tr>
<tr>
<td>Communication Strategy</td>
<td>67%</td>
</tr>
<tr>
<td>Impacts Strategy</td>
<td>66%</td>
</tr>
<tr>
<td>Training Strategy</td>
<td>73%</td>
</tr>
<tr>
<td>Processes</td>
<td>87%</td>
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<tr>
<td>Change Management</td>
<td>77%</td>
</tr>
</tbody>
</table>

### CONCLUSION

The achieved results matched the problematic of the research and the purpose of the work. The research clarified the theory about Change Management in a Strategic Perspective through case study that provided practical examples about how to manage a change, also encompassing the issue of human resources engagement and the matter of cooperation among the individuals concerned in the process.

Based on the results achieved by the research, it has become evident that the strategies adopted by the company to implement the new technology, primarily to temporarily create a Change Management area, mitigated risks and errors, conquered collaboration and engagement of the concerned individuals, being extremely important for the study’s success.

As this was a qualitative research and working limited to one case study that, although being very expressive in the researched universe, it does not allow reaching a definitive conclusion, but only indications and recommendations.

On the other hand, it has provided empiric basis which, added to the theoretical ground, can be used as example to other companies.

The case study evidenced the company’s concern to apply best management practices, which is the case of Change Management streamlined with the worldwide trend of the companies intending to survive in the current market.

The future of information technology management will present additional challenges to the managers, moreover with challenges in safety matters.

Vulnerability in access to the identities of clients who perform online deals and in the green computing matters, are in the thoughts of the entire technology area and users as well. Both will mean the need to dedicate great attention to the way of guaranteeing transactions with the clients. It requires more capacity from the technology professionals to implement the necessary safety required to protect their clients’ basis and stimulating them to have greener computer habits. For the organizations, that means budget planning project which includes professional development for the information technology personnel, which may be the subject for future studies.
REFERENCES


