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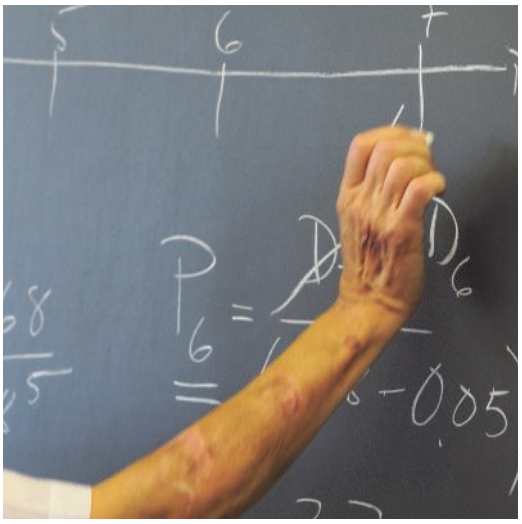

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Increasing bioethanol producers' technological innovation capacity through r&d organisation

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Increasing bioethanol producers' technological innovation capacity through r&d organisation

Abstract
The Research and Development (R&D) as company's structure unit is a key driver of technological innovation and is the most widely used in determining the technological innovation capacity of companies. The organization of R&D may be referred to as one of the key factors that have a direct effect on R&D's successful performance. Until now, there was no model allowing to estimate the effect of individual success factors on the R&D specific determinants of innovation The fresh look at the organizational factors identifying the R&D relationships with the determinants of innovation in certain industries, in this case bioethanol industry, reveals a deeper idea about the existing interactions between the objects of interdisciplinary research. The main findings of study describes interrelations between organizational factors and success of R&D activities which directly influence company' technological innovativeness in bioethanol industry.
The required data to determine R&D organisational factors as critical success factors (CSF) is collected through survey results in EU bioethanol industry. For claim verification and establishing the relationships between organizational critical success factors of R&D and determinants of technological innovation in the bio-ethanol industries study includes analyses of activities of European bioethanol producers, descriptive statistics methods, econometric analysis and data evaluation.

Keywords: *R&D, innovation, , bioethanol industry, critical success factors.*

Introduction

It is generally considered, that creating new products, processes and services is recognised as a major source of competitive advantage and technology is often the enabler of such innovations (Chiesa, 2001). The existing point of view that technological innovations are bringing the main input into industrial competitiveness, and has major support from scientific community (Zaltman et al., 1973; Tidd, 2001).

Traditionally it has been perceived that company, country or other object of study is innovative having Research and Development (R&D) activities and funds related to R&D activities. Amount of funds connected to R&D activities was the main indicator of ability to innovate. It was common to presume that R&D expenditures would lead to additional knowledge, and the dissemination of that knowledge base would result in innovations, especially products and processes (Kemp, et al., 2003). Eventually this point of view was criticized by time (Arnold & Thuriaux, 2001). It distinguishes between the input stage to the innovation process (e.g. R&D expenditures), the throughput stage (e.g. partner co-operation) and the output stage of the process (e.g. new products). Later others appeared, much more complex indicators, which define technological innovation capacity of the companies, but yet R&D is the most widely used in determining the technological innovation capacity of companies. Although, science already knows about existing positive correlations between R&D expenditure, value-added and turnover (Nadiri & Prucha, 1993) and (Mairesse & Mohnen, 2001), or that the R&D and innovation expenditures are highly correlated (Mohnen & Dagenais, 2002), it remains absolutely incomprehensible phenomenon the impact is making some direct relevance to the R&D factors, the determinants of technological innovation.

The organization of R&D may be referred to as one of the key factors that has a direct effect on R&D's successful performance. Increasing dynamism of competition is forcing R&D to change, adopt new/other forms of organizational structures. Currently the structural functions of R&D are multidimensional, with transforming, changing forms, dependent on the environmental conditions in which they are actively participating. It must be assumed that the different organizational forms, functions and other organizational aspects of R&D have a certain measurable direct impact on R&D's performance. Considering that R&D is a direct predictor of technological innovation, given conclusion allows us to assume, that certain R&D organizational factors become direct predictors of technological innovations that have dependence on environment. In this research by environment is meant the EU bioethanol industry, which currently is undergoing a change of generations in production technologies, accordingly is highly subjected to technological innovation. Since the generation of technological innovation in particular is a derivation of own R&D center, identification and evaluation of R&D organizational factors with predictable direct impact on technological innovation would increase the companies' technological innovation capacity.

This research article focuses on the identification of individual R&D organizational factors that have a direct impact on technological innovation. Therefore, determinants are set for technological innovation, characterized for EC bioethanol industry. Thus, we propose the hypothesis:

Hypothesis: Between organisational CSF of R&D activities and determinants of technological innovations in bioethanol industry the relationships are identifiable with a particular strength of impact and these relationships are not accidental.

Identified variables subjects to statistical pro-

cessing of data by using the linear regression, which is capable to determine the force influence of each identified R&D organizational factors on separate determinant of technological innovation. The article represent a model that evaluates the impact of organizational factors on the innovative capacity of the company within the bioethanol industry.

Identification of organisational CSF of R&D

Scientific literature which researches R&D activities, generally concentrates only on one or several factors separately, which are having an effect on certain phenomena, particular on the productivity or degree of innovativeness of companies expressed a certain specific determinant. Apart from the lack of an integrated approach to the factors influencing the activity of R&D, the importance of power / influence (whether this factor is generally some effect on the activity of R&D) factors individually on certain phenomenon, established only in some cases. The specifics of the industry in which R&D is active remains unrecorded.

Depending on the task set, in certain case the types of organizational structures that are being used can bring more positive effect comparing with other existing organizational structures. Brown's et. al. (2002) analysis shows that the structure of an organization can be as a major driver of R&D success. For example, those Organizational structures that are less hierarchic and less rigid comparing to the ones traditionally found in the industry are more supportive for R&D success. Or in case of considering the structure for responsibility – then both the decentralized and the centralized structures can be effective, but under different conditions (Allen, 1977; Marquis and Straight, 1965). Authors shows, that decentralized structure is effective when the flow of knowledge has to be relatively fast and the projects are of long duration. Jain et al. (2010) noted that decentralized structure is better when a lot of new information comes in and out of the project area, requiring a flexible system of organizing as well as a great deal of communication and cooperation among people participating in the project. Rothwell (1976) complements the research by indicating that when the management structure is horizontal and decentralized the main performers in R&D - the innovative individuals, are particularly effective.

The centralized structure is more effective when the projects are short-term and the flow of knowledge is not especially rapid (Jain, et al., 2010). Chiesa (2001) in his study suggests the centralization of R&D is more favourable for these determinants: 1) secrecy of technological knowledge (Rugman, 1981; Terpstra, 1977)., 2) lowering costs of coordination and control (De Meyer and Mizushima, 1989); 3) achieving economies of scale and achieving critical mass; iv) exploiting company-specific technological advantages, emerging from home market conditions, on other markets (as the international product life cycle model suggests) (Vernon, 1966).

Some of the authors notice, that there is a point to combine structures. As an example, Peters and Waterman (1988) in their research they are pointing out that excellent companies are having combined centralized and decentralized structures.

Katz and Allen (1985) researched matrix structure and proved that in cases when project managers are perceived to be controlling organizational rewards, and functional managers determine the technical content of projects more positive effects were achieved.

Chiesa (2001) puts, that in recent times there is a tendency, when companies try to concentrate on the management of technology and management level of the corporation is becoming more centralized view. By the way, research designed by Roberts (1995), confirms that corporate R&D is more research oriented and that divisions are more development oriented. Brown et. al. (2002) points out that the specific systems, such as ones that are focused on the project (project-oriented structures) may correlate with the success of R&D. Need to pay attention to the orientation of the R&D structures proposed by Chiesa (2001). Chiesa (2001) divided R&D structures in input oriented and output oriented. Input oriented should be successful practice if R&D unit is oriented by scientific discipline, technical area or activity. Output oriented should fit product line or project. The organization structures for product line helps to focus on goals such as customer focus, innovation generation, business activities integration, managerial flexibility.

As a structural form of an R&D organization in the multinationals there is geographic distribution of activities. It was noted, internationalisation, can be a key factor in accelerating company' ability to accumulate knowledge and the acquisition of unique opportunities (Prahalad&Hamel, 1990; De Meyer, 1993; Hamel&Prahalad, 1993). On the other hand Brown's et. al. (2002) research shows that it is not possible to refuse the in-house structure and, that in certain cases this system can guarantee success.

There is a suggestion to group the activities of decentralized R&D into two groups: demand factors and sup-

ply factors. It is suggested that factors like: i) technology transfer between headquarters and subsidiaries ii) need to access foreign markets; iii) need to improve a company' ability to respond to specific requirements of local markets, and iv) need to increase the proximity of product development activities to key customers (Hirschey and Caves, 1981; Granstrand et al. 1992) bring to demand factors. As for supply factors, it is invited to enrol i) increasing acceleration of technological progress, ii) the increasing costs of technology development and the international specialisation of knowledge sources (Perrino and Tipping, 1989; Howells, 1990; Sakakibara and Westney, 1992; De Meyer, 1992)

Other factors indicated political motivations and image as reasons for decentralizing R&D (Hakanson, 1992), or enhance a company' competitive image (Granstrand et al. 1992).

Brown et. al. (2002) pointing a bureaucracy as a factor that has a negative effect when operating R&D.

An important part which is dealing with organizational work of R&D centre is controlling its activities. Achieved results are often connected with control method and result monitoring. Katz and Allen noticed (1985) that effectiveness of the scientists often depends on the balance between the influence of the two supervisors. Researchers noticed that in cases like that, when the project manager was performing work related to the project, connection of which were outside the organization (i.e., the organization, the suppliers, the customers,) was mostly concerned while the functional manager was doing the inside work.

At the same time Pelz and Andrews (1966) are claiming that the best work occurred in environments that were not too tightly controlled. Individual autonomy with the condition that work will be coordinated moderately, by using individual autonomy, usually resulted in finding the best solution. Other additional types of organizational structures are for example independent, accountable substructures, such as internal entrepreneurship teams, and were shown to correlate with success (Brown, et al., 2002).

Jain et. al., (2010) noticed that in some cases there is a necessity to create other types of structures, as for example dual or even a triple hierarchy within the organization. That necessity can appear when it is required to improve the position of technical personnel. In some cases technical personnel may not want management responsibilities at higher levels, since they are losing direct connection with R&D (Jain, et al., 2010). At the same time Schriesheim and others (1977) are not agreeing with that, stating that double hierarchy generally is not bringing the desired effect, when it is necessary to resolve conflict situation between management of the organization and working professionals.

Triple hierarchy which was studied by Baumgartel (1957) and Pelz (1956) where they had noticed that in cases when management positions, in scientific and administrative practice, were taken by a person with professional or scientific education, the researchers felt safer under such management which gave organization an opportunity to achieve higher productivity and morale. Additional work that was done by other researchers (for example, Lawrence and Lorsch, 1967, Likert, 1967, Mintzberg, 1973) are complementing these researches.

It is important to mention that organization of work is playing an important role in assimilation of information. For instance, Kellers research (1994) on R&D project groups showed that the effective teams were capable of processing large amounts of information if the tasks the team had to do were non-routine.

As one of the crucial factors determining the success within the organization is organizational culture. Researchers are agreeing that certain factors of a culture can affect the success. For example Scott and Bruce (1994) identified that organizational culture supporting innovative behaviour of an individual, will be more successful comparing with other culture which is not supporting innovations. Brown et. al.(2002) research is supporting this statement. It is crucial to pay attention to the factors like tolerance of failure Brown et. al.(2002), high-quality supervisor–subordinate relations Scott and Bruce (1994), which are contributing to the development and maintenance of that culture. Jabri (1992) additionally opens elements which help to promote innovation culture. He has noticed that scientists who perceived that the tasks assigned to them were appropriate collaborated more with team members, expended more effort on the tasks.

It is important to underline that tasks must be reasonable, because satisfaction and performance of the scientists depend on it (Jain, et al., 2010). Jain et. al., (2010) also notices that cultures that are reward frequently are more effective than cultures that are not.

In each organization, in addition to routine work there must be a time when important decisions are taken. Then usually people often seek others who agree with them. Employees who are entrusted with the responsibility of deciding avoid or reject those who disagree with them. Janis (1982) believes that these tendencies result in groupthink and in major mistakes and correspondingly to poor performance.

Some organizations have seen the culture in which initially dominated the competition between employees. But some research, (see for example Rosenbaum et. al, 1980), suggests that competitiveness is often not desirable. A better result can be achieved in the cooperative conditions (Rosenbaum, et al., 1980).

R&D management has a strategy as well as the corporation. R&D strategy should be well balanced and rigged to achieve outcomes consistent with the corporation's mission and goals (Wright et al., 1996), and to fully maximize the long term gain of R&D investments (Larsson, 2004).

R&D organizations that are able to adapt elements of the strategy objectives, policies, programs to unique situation in which they are located has the opportunity to become more innovative (Jain, et al., 2010). Researches Rheem (1995) confirmed that the companies which have had long-term strategic planning are more productive than

those who don't have such a plan existing. According to Jain et. al. (2010) to achieve their goals, depending on the current situation, the R&D organization , division , or other structural unit to which belongs the R&D, must think deeply about long-term objectives and the methods of their reach . Attention must be paid to different emerging situations - from demand partners, owners that adjust to the important purposes, until there is a change in the head of the organization.

Researchers have noticed that often in research organizations horizontal strategic integration is not done well (see Jain et. al., 2010). It is assumed that this is due to the individual interests of disciplinary researchers which had arisen because of the segmentation research projects within the department. But Hax and Majluf (1996) noticed that clearly executed and the corresponding horizontal strategy may be one of the most critical ways to establish a superior competitive position.

When choosing a strategy associated with the technology Chiesa (2001) suggests paying attention to categories such as selection, timing and acquisition mode.

Possession of information has always given the advantage of companies. After all decisions are made on the basis of the available information whether a future form of competition or technological change or shape the evolution of the company. Therefore, the collection of information according to Chiesa (2001), must bear on the basis of strategy formulation.

It is necessary to emphasize the importance of factors such as portfolio diversity. Research by Henderson (1994) on 120 programmes over thirty years shows that portfolio diversity is the key to success for the research organizations. Henderson revealed that the highest productivity occurred when there were between six and ten programms. Baker et al. (1988) found that projects that disposed of additional strategies were more successful than others. At the same time was worth noting that the R&D projects must be closed before the technical implementation of technology, as well as changes occurring during implementation of the project more often lead to a negative result (Baker, et al., 1988).

Presented and grouped according to their belonging to particular activity in this section CSF of R&D related to organizational factors are listed in Annex I.

Innovation capacity measurement of bioethanol company and research methodology

Although in the last chapter the organisational critical success factors were given the systemic belonging to certain groups that have similar features, yet it is obvious that the membership is interdisciplinary in nature, represents different areas of activity in which the factors are active. Therefore organizational CSF in R&D allocated without considering the relationship between a beginning or a particular group or the medium in which they have a certain importance. The author's assumptions about the existence of certain relationships between the individual CSF and technological innovation capacity of a company raises a number of open issue for this type of research.

First, there is a need to identify methods by which determinants of innovation to be measured and determining the ability of companies to innovate. The need to focus on bio-ethanol industry and the specifics of the industry, which are the active subjects of bio-ethanol, determine the choice of the determinants of innovation. Initially, in this case, we should focus on the fact that at this point in the scientific community there is no standardized method of evaluation of companies, according to which measures the ability to innovate. This issue is described in more detail in chapter Innovation measurement.

Secondly, the received database covers a spacious list of potentially useful explanatory variables. The existing situation limits the number of possible methods of analysis that allow to determine the effect of individual independent variables on the response variable. This case forces to reject modeling using multiple regression covering certain/all number of independent variables, or their groups, thereby limiting the understanding of the influence of individual variables simultaneously. To improve the quality of the results obtained a simple regression analysis is used in this paper, which allows to evaluate the influence of each variable separately mounted on the determinants of innovation in the bioethanol industries.

Innovation measurement

First of all, the variables must be measured in order to assess the degree in which the chosen variables influence the technological innovation. However, as noted by researches (Dodgson, et al., 2008, Smith, 2005) one of the greatest challenges to managing innovation is its measurement. According to Souitaris (2003) nowadays there is no such approach, which would allow to measure the innovation. Furthermore, there are known to be controversies about the correlation of variables and their relation to the rate of innovation (Downs & Mohr, 1976; Wolfe, 1994). Innovation is difficult to measure for a number of reasons. Dodgson, et al. (2008) points out the 4 main reasons: 1) some time is necessary for benefits appearing, 2) term of innovation, 3) some measurement systems measure inputs to the innovation, while others only measure outputs the benefits of an innovation often do not appear until sometime after its introduction, 4) ascertaining the source of an innovation may be complex.

This situation of emerging issues in the measurement of the determinants of innovation in the research described Souitaris (2003). The researcher argues that due to the difficulty in measuring the parameters of innovation we should pay attention to the factors that affect the discrepancy between the determinants of innovation and the degree of innovation, respectively. This situation can be subject to the origin, definition and measurement of innovation itself. In the studio, the researcher draws attention to items such as the differentiation of lineages innovation (differention by the nature of innovation) such incremental vs. radical innovation or high-cost vs. low-cost innovation. The author points out that the determinants for each of the presented types of innovations are different.

Another problem is being caused by the lack of a standard definition of technological innovation (Garcia and Calantone, 2002). The different definitions and interpretations of technological innovation have led to variations in the identified determinants. The problem is the definition of themselves and the determinants of innovation. This refers to the two main types of determinants of innovation. Found that the components of the innovation of the first type, the measurement of which can produce using actual quantitative indicators is easily transportable Souitaris (2003). They fit together in various studios and measurement of the types of parameters is uncomplicated. For example, a standardized measurement of the value of companies through a quantitative indicator of existing staff in the company (Kimberly & Evanisko, 1981) can be attributed to that of the first type. By the second type is the data that is built on the perceptions and attitudes of the respondents. According to Souitaris (2003) and it is possible to carry such data such as perceptions of the intensity of competition or attitudes towards risk-taking, as well as general and usually subjective concepts (like centralisation of power or complexity of knowledge). Although the data of the second type refers to the so -called soft variables type of their importance in determining the innovation capacity is not less important than the first type, the so-called hard variables. By the way, Souitaris (2003) also notes that the data of the second type - soft variables, often there is no unified definition. In this case, the definition is often subjective and depends 's perceptions. This author also notes that the differences in the dimensions of technological innovation arises from the fact that the studies carried out between: a) different types of companies active in various sectors of economic activity, and b) the different stages of the innovation process, and c) in regions that produce empirical research.

Despite the above mentioned uncertainties in the measurements of innovation is still possible to identify the trend towards the use of certain conventional key variables with which it is possible to carry out the measurement of indicators on companies' ability to innovate.

According to Dodgson, et al. (2008) and Smith (2005) basic indicators when measuring innovation are R&D statistics, patent data, innovation surveys, and product announcements.

Tidd (2001) draws attention to the fact that other attributes are frequently measured also, such as research funding budgets, number of researchers, number of significant inventions, number of new products, amount of published research, etc. Nelson and Winter (1982) point such factors as increased productivity and growth or lower costs. Andrew et. al (2007) provide a range of common measures related to technological innovation. These include inputs such as financial resources and people; processes such as resource efficiency, actual versus planned time to market, and milestone compliance; and output measures such as number of new products and services launched, market share growth, new product success rates, number of patents filed, and publications written.

In the Carayannis, et al. (2003) publication is presented a rather wide scope of variables that are aimed to measure the innovation. Apart from identification of the variables, the publications also suggest the typology and classification of these variables.

According to Smith (2005), there are three other important classes of indicators: 1) techno metric indicators, which explore the technical performance characteristics of products 2) synthetic indicators developed for scoreboard purposes mainly by consultants 3) databases on specific topics developed as research tools by individuals or groups.

Table 1 presents the variables that measure the degree of company's innovativeness.

Table 1. The variables that measure the degree of company's innovativeness

Source	Variables	
Oslo manual, 1997	R&D, Performance, new and improved products and processes	
Souitaris, 2003	Number of incrementally innovative products introduced in the past 3 years; Number of radically innovative products introduced in the past 3 years; Number of innovative manufacturing processes introduced in the past 3 years; Percentage of current sales due to incrementally innovative products introduced in the past 3 years; Percentage of current sales due to radically innovative products introduced in the past 3 years; Expenditure for innovation in the past 3 years over current sales. Number of patents acquired in the past 3 years.	
E. G. Carayannis, et al. 2003	Hard measurables	Patents, R&D Budget, New Products, R&D Staff, Publications, R&D, Incentives, New Features, Inventions, New Markets, Product Extensions, Conferences, CRADAs, Partnerships
	Soft measurables	Productivity, Growth, Lower Costs, Flexibility, Supply/Demand, Firm Size, Market Influence, User Benefits, ,Lower Prices, Social Enablers, Time Savers
Dodgson, et al., 2008	R&D statistics, patent data, innovation surveys, product announcements	

Source: by author, based on sources indicated in table.

As some authors of empirical researches often underestimate the complexity of innovation, it is reasonable to reconsider measuring innovation determinants only upon a certain variable.

The author of this study consider that possibility to materialize technological innovation is the company performance level leading to technological innovations and influenced by many interlinked internal and external variables forming company innovation ecosystem, which requires effective management. This fact forces cast the only definitive indicator of measurement. Instead, use of several indicators together, has filed a full measure of the ability of companies to be innovative. This assumption coincides with the assumption Souitaris (2003) on the feasibility of the use of certain portfolio of indicators to identify the general ability of companies to be innovative.

Taking into account the specifics of innovations in bioethanol industry, would be logical to take into consideration the variables that are typical for this industry and that indicate the opportunity to create innovations in comparison to other companies of the same industry. Further in the text there are given and explained the dependent and independent variables that are presented in this study.

Dependent variables

There are number of reasons why the bioethanol industry cannot be evaluated by commonly accepted variables, which were mentioned above. For example, many authors suggest to measure company innovativeness by the output of products for a certain period of time. However, in bioethanol industry, like in many other large-scale industries, competition mainly occurs on the scale of economy as a whole and is based on cost leadership strategy. The novelty in this industry is improving or creating a new process, that allows to reduce expenditure of operating costs or improve the quality of the collateral, or in some cases, by-products. That is why, it is more reasonable in bioethanol industry to measure the technological processes developed leading to the technological innovation.

Nevertheless, the speed of implementation of those technological processes is still a question. Bioethanol production process involves many interrelated technological processes. Trying to improve the process in the event of failure must stop the entire plant indefinitely. According to this, development and testing of new processes take a long time, because there have been cases where this turns company in a bankruptcy. Therefore, evaluating the number of the patents implemented in a certain period, would be a doubtful approach.

The authors of the research as the most reason-

able, consider the approach for technological innovativeness measurement in bioethanol industry, where the number of the patents (variable is coded as *Patent* in results) would be measured regardless of the fact whether the patent is actively implemented already or not, the knowledge acquired during the period of invention phase can be efficiently applied in practice on later stage of technology development. At the same time the number of patents that belong to Y02E50/00 class - Technologies for the production of fuel of non-fossil origin (coded as *Patent_c*), according to Cooperative Patent Classification, as well as the patents that have direct relation to the bioethanol industry (coded as *Patent_b*) will be measured.

Distinguishing the patents is an important aspect, as the total number of patents shows all the ongoing activities of the company, but the patents chosen according to the classification mentioned above will directly reflect the R&D activities in a particularly chosen industry's sector.

The suggested factors that are aimed to estimate what percentage of the company's turnover is invested into R&D, does not seem to be applicable: a) Data is confidential; b) R&D, often, is a rather general field where, among those related to bioethanol, are researched very diverse technologies.

This study also includes such term as company's performance expressed in production capacity (Coded as *Volume*). This figure is the expression of an almost linear dependence of the companies' turnover and thus this variable distinctly reflects company's innovation capabilities.

Next variable is – degree of innovations complexity (coded as *Techn*), which is expressed in three degrees: standard, improved or second generation. In this time period can be distinguished three main directions of technology. Standard technology means conventional bio-ethanol production technology. Improved technology allows to obtain by-products are different from the standard ones. The second generation means companies that produce ethanol from non-traditional raw materials, other variables were eliminated as not appropriate for this study and not available because of data confidentiality or evaluated as not significant. As noted by Iarossi (2006) questions on taxes, profits, and names of suppliers or clients could be the subject of distorted answers or out- right refusal.

Independent variables

The independent variables in this research are the organisational critical factors having a positive impact on the R&D and provide a positive result of the structural department. Identified with references and descriptions in the chapter "Identification of organisational CSF of R&D" CSF, number 45 composes a factor.

With the purpose of susceptibility because of a large number of identified variables, the organisational factors were grouped according to their belonging to her particular activity or having the characteristics of common features, the features of the object (see Annex I).

The study covers all the bioethanol industry in Europe. The list of the companies and the data were gathered from the database of an organization ePure (ePure, 2012). The publication of the list of participants on which the study was based is dated January 2012. ePURE represents and supports companies that produce renewable ethanol in the EU for all end-uses, i.e. fuel, potable and industrial uses. ePURE also represents companies that have an interest in ethanol production. Currently, ePURE's membership accounts for 80% of the installed renewable ethanol production capacity in Europe. This information implies that the data presented in the databases of ePure is a reliable source.

Methods

The data was collected by means of the survey. The survey was delivered by *E-mail URL embedded* – a respondent was invited by e-mail to the survey site, and the e-mail contains a URL address on which respondents click (Bradley, 1999). Respondents were redirected to the webpage *formscentral,* where was placed a questionnaire. This form of questionnaire was chosen because Web-based questionnaires have the same strength as paper self-completion questionnaires in that, in theory at least, respondents can complete the questionnaire in their own time, going away from it if they are interrupted, and returning to it later. The major disadvantage is not having an interviewer on hand to clarify questions or to repair misunderstandings. Therefore were the open-ended questions were included in the end of the paragraphs. These questions were aimed to reveal personal thoughts of respondents.

Generally, the questions were closed (or multiple choices), because using this format the respondents are restricted to a set of responses. Beside that, respondents permit the inclusion of more variables in a research study because the format enables the respondent to answer more questions in the same time required to answer fewer open- ended questions (Siniscalco & Auriat, 2005).

Identification of the variables, which have direct influence success of R&D, was up to respondents (see Annex I). After pointing out the variables that, in their view, had a positive influence on R&D the respondents had to identify

the importance of each particular variable in every subgroup. The weight of every subgroup was measured according to Likert scale, results ranging from the unimportant to the very important (five number scale). Measured CSF of R&D are presented in table and can be found in Annex II.

Since the questions concern selection of the personnel responsible for R&D and innovation strategy, the target respondents were those who actually are responsible for R&D and innovation strategy. However, in practice identification of such individuals was highly complicated by companies' confidentiality policy. The number of companies producing bioethanol in Europe is relatively small and all the technology that can possibly serve as a competitive advantage for a company is thoroughly safeguarded. Moreover, some of the companies belong to multinational corporations (e.g Cargil, where the number of employees exceeds 150 000) and have a strict internal policy and strict regulations on security and communication at all levels. These policies along with no willingness of the companies to cooperate in the research process have created additional constrains and delayed completion of the research for more than a year. Reaching out for respondents was also complicated by organizational structures of bioethanol producing companies. R&D strategy is primarily the prerogative of the top managers. This has confirmed several times in the author's research. Persons responsible for R&D strategy occupying positions such as directors, plant managers, R&D director, Director engineering, managing director, Chairman of the board, Science Innovation and administration manager and etc.

The survey was conducted in 39 companies producing bioethanol in Europe in 2012. The questionnaire was completed by 14 respondents, which accounted for 36% the total number of bioethanol producers. From the capacity point of view, it represented 32% of the bioethanol industry in Europe, at the moment of survey, with a total revenue around 1,7 billion €/year, only from product sales related to bioethanol.

To establish the relationship between the individual force variables and test the statistical significance of linkages in this paper used the methods of econometric modelling.

One of the goals of the thesis is the prediction of the facts (innovativeness of companies can) on the basis of known variables (critical factors). In this case correlation does not work, as the correlation coefficient is symmetric in the sense that Cor (Y,X) is the same as Cor (X,Y).

Regression analysis differs in an important way from correlation analysis. In regression analysis the response variable Y is of primary importance. The importance of the predictor X lies on its ability to account for the variability of the response variable Y and not in itself per se. Hence Y is of primary importance (Chatterjee & Hadi, 2006).

Regression analysis allows us to predict (forecast) one variable on the basis of other / them with a straight line, which characterizes the relationship between two or more variables. In this case, on the basis of the investigated factors predicted variables will be pointing to the innovativeness of companies. In order to establish the influence of each factor on a particular variable which predicts the innovation capacity of companies a linear regression model was utilized, which in the form of a standard deviation looks like follows:

$$Y_i = \alpha + \beta X_i + \varepsilon \qquad (1)$$

where, as in the simple linear regression model, Yi is an observed value of the dependent variable, a is the population intercept, b is the regression slope parameter for predictor Xi and e is the error associated with predictions of Y (Denis, 2011).

The hypothesis of research claims that between organisational CSF of R&D activities and determinants of technological innovations in bioethanol industry the relationships are identifiable with a particular strength of impact and these relationships are not accidental.

This is possible when $\beta \neq 0$ (Siegel, 2000), ie, in the linear model for the determinants of innovation component is saved, depending on the R&D CSF. Mathematical expression of this hypothesis has the following equation:

$$H1: \beta \neq 0 \qquad (2)$$

The sample size of thesis is small and consists of 14 respondents. Because the standard error depends on sample's size (Cohen, Cohen, West, & Aiken, 2003), a small sample size oblige to set the reduced level of significance (Sachs, 1984). Correspondingly in selecting meaningful critical factors, the significance level in this thesis was set to the level of $p < 0.1$.

Criterion according to which companies should determine the belonging to the existing population should be based on the size of companies. According to the authors, this criteria is the most fairly represented value, indicating the companies belonging to a particular group. This grouping has the advantage over other possible identifiers because it predicts and determines the largest number of known factors interrelated with the size of companies. Such as: company size determines the technology of production (second generation bioethanol production is not yet possible at high capacity), the estimated size of funding R&D (large companies has the ability to allocate more funds for research), location (large companies producing bioethanol are mainly concentrated in the more economically developed countries), etc. To establish belonging of the sample to the population the sample means of production capacity are compared (see Table 2).

Table 2. Sample and population production capacity comparison

Variable	N	Min	Max	Mean	Std. Deviation
Population	39	5.4	1265.0	**186.2**	266.38
Sample	14	5.4	850.0	**168.6**	221.54

Source: by authors, based on ePure (2012)

Descriptive statistics show a rather close nature of both variables. Putting forward the null hypothesis, which states that the difference between mean values, between population and sample is not present, we obtain the following mathematical expression of this hypothesis:

$$H0: \mu\text{-}186.24=0 \qquad (3)$$

Here μ is mean of the population.

The carried analysis using one sample t-test shows that the difference between the average values of both variables is only 17.64 mln. Litres /Ann (< 10% from population).

Table 3. One sample t test

Variable	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Sample	-.298	13	.770	-17.64	-145.55	110.27

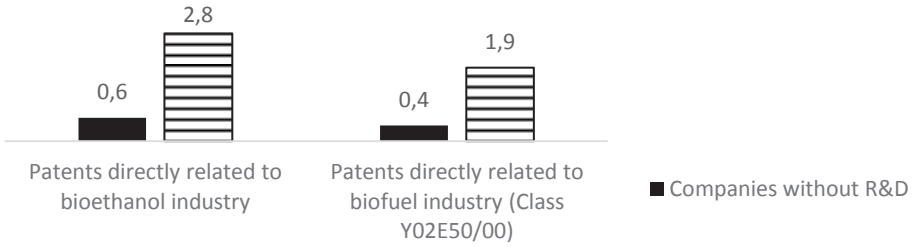
Source: by author. Test value186.24. Std error mean 59.21.

The results are listed in Table 3 indicate that the value hypothesized fall in the confidence intervals indicating a fail to reject the null hypothesis. Therefore, we can assume that the enquiry respondents will reflect the entire population of bioethanol producers in the EU.

Statistical evaluation of the data in this thesis was performed using IBM SPSS Statistics 21, graphs performed with MS Excel.

Analysis of the results produced by the survey as part of this thesis confirmed that the presence of R&D in the bioethanol industry is a predictor of technological innovation. Based on the assumption that patents are one of the main indicators for measuring the technological innovativeness of companies (Dodgson, et al., 2008), the average numbers of patents owned by companies reflect the company ability to generate innovative knowledge, which is a major predictor of the development or improvement of new products/processes.

Fig. 1 Average number of patents belonging to bioethanol producers depending on the presence of R&D and the class of patents, 2012



Source: by author, based on EPO (2012).

In the figure 1 the average number of patents (EPO, 2012) owned by bioethanol companies is shown, it is split into two groups - with and without their own R&D. Analysis was made on the data provided by the companies who participated in the survey as a part of this thesis *(n = 14; Y/N - 9/5)*.

Evaluating the obtained results from companies that have their own R&D centres and companies that don't have it was found that the ratio between the arithmetic mean values was more than 4.5 times. This result is similar in both cases - both in relation to patents belonging to bioethanol industry and patents related to the whole biofuel system. These results indicate that despite the focus on a particular industry, in this case bio-ethanol industry, in any case R&D increases technological innovativeness of companies. In some cases, existing patents in companies that do not have their own R&D centre shows that the alleged ability to generate their own knowledge without R&D centres in the bioethanol industries is less effective compared to those organizations that have R&D.

Given the versatility of companies the difference between the number of patents for companies that have their own R&D centres and companies that don't becomes even more expressed in favour of companies that do have their own R&D centres (see Fig. 2). The difference between the arithmetic mean reaches up to 7 times. Despite the fact that even the largest producers of bioethanol in some cases don't have an R&D, the fact that R&D is an obvious influential predictor for production of patents should be accepted, and is the reason what causes an increase in technological innovation capacity of the bioethanol companies.

Fig. 2. Average number of all patents owned by bioethanol producers depending on the presence of R&D, 2012

Source: by author, based on EPO (2012).

Further the text of the research presents an analysis of the results of quantitative studies of individual components, critical R&D factors, that have a direct impact on previously established in the thesis determinants of innovation in the bioethanol industries.

Population intercept α in this research will not be discussed, because in the considered set of data there are no such determinants of innovation. That is why permanent member α, should be considered just as a secondary value, needed for optimal prognosis, but it should not be interpreted literally. In that case in presented tables which are showing coefficients of simple linear regression, this value is not displayed.

It should be noted, that the analysis and interpretation of the data because of the high number of variables is not fully set forth herein. The paper presents the main and only interpreted having the highest value ratios. The models which are not statistically significant in this study are excluded and in the data collection are not given.

Effect of Organisational CSF of R&D on determinants of technological innovation

The results of descriptive statistic of this block starts with the group of factors related to the organizational structure. *Horizontal management* structure R&D was relatively highly correlated with patents in the bioethanol industries and CPC classifications. These relationships are highly significant ($p < 0.05$). Even higher correlation coefficient in this group stand out the relationship between the *flexible structure* and the dependent variables denoting the patents in the bioethanol industries and CPC classifications. Despite the very high significance, the number of respondents linked to this factor was insignificant, therefore should not rely on the data link.

Given the geographic distribution of R&D center, respondents in most cases recognized, that the positive results of R&D center, this center should be oriented *In house*. Unfortunately the results do not allow to accept the decision as directly related to the determinants of innovation in the bioethanol industries. The only factor having the highest value was expressed negative correlation between the presence of R&D center and the geographic distribution centers.

The results in the described statistics in terms of the relationship between the orientations of the organizational structure of the R&D and the dependent variables were not significant in this study. It can only be the result of an arithmetic average stress having the highest value. This factor determines the orientation of the R&D structure for the project.

In the control group of factors describing the R&D, the respondents, as the success factors of the presented method of indicating their preference for *Dual hierarchy*, where both professional and managers levels are incorporated. This choice proved to be the change and has weak relationship with the variables indicating the determinants of innovation . Significant in relation to innovation variables were two relationships - between the factor that indicates *poor control* within the R&D, and patents in the bioethanol industries and CPC classification. These coefficients are significant at $p < 0.01$.

Factors of R&D related to organizational culture show that some of these factors have a relatively high negative relationship with dependent variables, such as the relationship between *Innovative organizational culture* and the presence of R&D center. According to the survey, this factor is important for many respondents, as determined by the success of R&D. Although this relationship can't be considered significant at the standard of significance, but the high average value is impossible not to pay attention to this factor.

In the group of factor which determine the strategy, several positive and thus significant correlation coefficients are present. All the most important relationship in this group apply only to patents in the bioethanol industries and CPC classification. These factors are - *Adapting elements of strategy*, *Information gathering, Portfolio diversity.* Besides a very high correlation coefficient of 0.944 in relation to patents *Adapting elements of strategy* correlation is significant at $p <0.01$.

The last group of factors Human resource management in the unit which addresses the organizational factors have a strong correlation coefficient describing the relationship between technology and *Researchers to spend a small portion of their time of development of their own ideas*. Obviously it can be concluded that the free time allowed for the study encourages the development of new technologies.

Table 4. Regression estimate of R&D organisational CSF effects on technological innovation determinant – "Technology Degree" in EU bioethanol industry

Variables	Unstandardized Coefficients		Std. Coef.	90.0% Confidence Interval for B	
	B	Std. Error	Beta	L. Bound	Up. Bound
Researchers to spend (a small portion of their) time of development of their own ideas	0.260	0.071	0.729	0.134	0.386

Source: by author. p<0.05;

Researchers to spend (a small portion of their) time of development of their own ideas was the only regressor having a significant impact on the level of technology in the group belonging to the organizational factors (see Table 4).

Table 5. Regression estimate of R&D organisational CSF effects on technological innovation determinant – "Volume" in EU bioethanol industry

Variables	Unstandardized Coefficients		Std. Coef.	90.0% Confidence Interval for B	
	B	Std. Error	Beta	L. Bound	Up. Bound
R&D strategy is an integral part of overall company mission	41.268	21.581	0.483	2.805	79.732

Source: by author. p<0.1;

Dependence variable under the codename *Volume*, determines the size of companies and therefore the availability of resources for R&D, it was possible to establish a significant influence only in one independent variable *R&D strategy is an integral part of overall company mission* (see Table 5) Allocated variable has a relatively low importance in the presented model.

Table 6. Regression estimate of R&D organisational CSF effects on technological innovation determinant – "Patent_b" in EU bioethanol industry

Variables	Unstandardized Coefficients		Std. Coef.	90.0% Confidence Interval for B	
	B	Std. Error	Beta	L. Bound	Up. Bound
Horizontal structure	1.363	0.573	0.566	0.342	2.384
Flexible structure	3.231	0.524	0.872	2.297	4.164
Not too tightly controlled	1.916	0.468	0.763	1.081	2.751
Adapting elements of strategy	2.272	0.229	0.944	1.863	2.681
Information gathering	1.053	0.443	0.566	0.264	1.843
Portfolio diversity	1.477	0.549	0.614	0.499	2.455
Other R&D strategy	2.585	0.419	0.872	1.838	3.332
*Other organisational variables	0.993	0.519	0.483	0.067	1.918

Source: by author. p<0.05; p<0.1*

In the table 6 significant coefficients are given by a simple linear regressions indicating the influence of critical factors belonging to the organizational group for a set of determinants of technological innovation - patents belonging to the bioethanol industry. *Flexible structure* has the highest coefficient of regression in the group describing the organizational structure of R&D. In the group describing the relationship between factors of R&D strategies and patents in bioethanol industry established significant regression coefficient of factor *Adapting elements of strategy*. Regression coefficients of the critical factors *Other R&D* strategy and *Other organisational variables* affecting established determinants are associated with patents in bioethanol industries and have high coefficients of regression, but in this case, the factors are variables identified in different ways depending on the respondent. Using the regression coefficients of variables *Other R&D strategy* and *Other organisational variables* in order to determine the influence of individual factors on critical determinants of innovation is impractical.

Table 7. Regression estimate of R&D organisational CSF effects on technological innovation determinant – "Patent_c" in EU bioethanol industry

Variables	Unstandardized Coefficients		Std. Coef.	90.0% Confidence Interval for B	
	B	Std. Error	Beta	L. Bound	Up. Bound
Horizontal structure	0.846	0.383	0.537	0.163	1.529
Flexible structure	1.788	0.472	0.738	0.948	2.629
* In-house (centralized one R&D lab)	0.801	0.414	0.488	0.064	1.539
Research oriented R&D structure	1.269	0.301	0.773	0.734	1.805
Adapting elements of strategy	1.471	0.162	0.934	1.182	1.759
Information gathering	0.672	0.293	0.552	0.150	1.194
* Portfolio diversity	0.789	0.393	0.501	0.088	1.490
Other R&D strategy	1.431	0.377	0.738	0.758	2.104
* Recruitment policy	0.630	0.298	0.521	0.098	1.162
*Other organisational variables	0.640	0.341	0.476	0.032	1.247

Source: by author. $p<0.05$; $p<0.1$*

Coefficients of the regression analysis describing the effects of organizational factors on the predicted critical innovation determinant Patent_c are listed in the table 7. From the organizational structures - *Flexible structure* turned out to be the strongest predictor variable. Explanatory variable *Horizontal structure*, belonging to the group of variables in the organizational structure, also has a significant impact on predicted variable Patent_c. Predictor *In-house* that determines location of R&D centre has had a significant effect on the production of certain patents for Y02E50/00 classifications. With the group that determines the orientation of the project variable *Research oriented R&D structure* proved to be a significant predictor. It should be emphasized that the predictor *Adapting elements of strategy* that has a strong influence on the response variable. *Other strategy* should be excluded from the list of predictors of technological innovation because of the changeable variable form.

Table 8. Regression estimate of R&D organisational CSF effects on technological innovation determinant – "Patents" in EU bioethanol industry

Variables	Unstandardized Coefficients		Std. Coef.	90.0% Confidence Interval for B	
	B	Std. Error	Beta	Lower Bound	Upper Bound
*Researchers to spend (a small portion of their) time of development of their own ideas	15.104	7.511	0.502	1.718	28.490

*Source: by author. * p<0.1*

According to regression analysis an independent *variable Researchers to spend (a small portion of their) time of development of their own ideas* is identified, it has a positive impact on predicted variable which describes production of patents that have been produced throughout the multidisciplinary activities of the companies including bioethanol industry (see table 8).

The results of the authors' study allow us to affirm the existence of different types of relationships between critical factors of R&D center and innovation, or rather the various determinants of innovation. Based on the primary hypothesis put forward by the author asserts that the relationship between these variables is the rule rather than an accident, the results of the analysis using linear regression indicates that in most cases the regression coefficient is significant.

Naturally, these facts allow us to say that a hypothesis put forward by author (see Eqn. 6) is confirmed.

Accordingly, following the construction of regression model of technological innovation in the bioethanol industries reveals the dependence of the change in the form of innovative determinative from the critical factors of the R&D and regression coefficients.

$$Y \approx f(CSForg,\beta) \qquad (4)$$

where CSF_{Org} organisational critical factor of R&D (see tables 4-8)

Consequently, the results of the regression analysis indicate the degree of influence of each of the presented and subjected to factor analysis to identify determinants of technological innovation. Since each of the organisational CSF manifested R&D as a predictor of technological innovation it must be assumed that the sum of the designation of these variables will denote the overall effect on specific determinants. Accordingly, it can be argued that the innovative abilities, from here and it becomes possible to produce innovation is higher in the objects of study in which quantitative indicators at the time of their definition has the highest value. Considering conducted modelling technological innovation capacity of the companies in bioethanol industry is expressed by a model having the following mathematical equation:

$$Y = \sum_{j}^{5} \frac{\Sigma_{i}^{n_j} \beta CSForg_{ij}}{\overline{X}_j} \qquad (5)$$

In other words conducted research and created model (eqn. 5) gave companies an opportunity to identify organisational critical factors, following which they can more successfully perform technological innovation, i.e. change the company in a technical aspect, so that these changes would allow producing a new product or a process allowing the company to beat the competition.

The author suggest, the insertion of standardized coefficients in to the developed model should be avoided, as dependent variables have different scale of measurement. Standardized coefficients should be considered as a specific indicator having some power to influence with calculated significance on single, specific dependent variable, provided that we are going to compare a single dependent variable.

Summary

This research contributes to the literature dedicated to R&D organizational factors in bioethanol industry of European Union in order to find out the CSF influencing technological innovativeness capacity. Scientific literature, which studies R&D, mainly focuses on one or several factors separately, having an impact on certain conditions, in particular on productivity or a degree of innovativeness of companies expressed by certain specific determinant. Therefore, connections and their power/degree of influence are found only in some cases. These relationships in the scientific literature are isolated, not represented in the complex relations and it is not possible to determine the influence of each of them, thereby eliminating the possibility of modelling in a particular environment.

Development of technological innovation processes, for a new generation of bioethanol production as well as for conventional, is a knowledge-intensive process, which requires the possession of special knowledge and training - accumulates in the R&D function. Identify critical factors R&D having direct links with the determinants of innovation, defining a coherent innovation of companies is becoming a necessity conducive to sustainable competitiveness.

Systematic overview of factors contacting with R&D, therefore creates uncertainty direct effect on the R&D, showed that facts published in the scientific literature have a vast population. Nevertheless, such a large variation of factors involved in all areas of the R&D require some organizing, allowing to further their processing system.

Derived determinants of innovation in the bioethanol industries - the capacity of companies, since R&D center, the level of technological innovation, the number of patents and their relationship to critical factors allow the use of econometric methods study to identify the coefficients indicate the action force established relationships, the total value of which determines the technological innovation capacity of companies in general bioethanol industries.

The empirical study of this thesis, has discovered and presented existing connections between innovation determinants and critical factors of R&D, with defined values which indicate virtue of certain groups and R&D critical factors on a certain innovation determinant in bio-ethanol industry, it allows to use established relationships in various types of models describing the dependence of the innovativeness of companies from critical factors R&D.

The developed model allows to identify CSF given the specificity of the R&D industries would allow companies to identify and strengthen its innovative capabilities. Since ethanol is a product that has a standardized quality parameter, the cost of the final product is a key parameter used in nodule struggle.

As the large scale chemical production is very much similar in its specifics to bioethanol industry, would be fairly to state that this research is equally important for these industries.

References

Allen, T. J., 1977. *Managing the Flow of Technology: Technology Transfer and the Disseminationof Technological Information within the Research and Development Organization.* Cambridge: MIT Press.

Andrew, J. P., Sirkin, H. L., Haanaes, K. & C, M. D., 2007. *Innovation 2007: A BCG Senior Management Survey,* Boston: Boston Consulting Group..

Arnold, E. & Thuriaux, B., 2001. *Innovation and enterprise creation: statistics and indicators. Proceedings of the conference held at Sophia Antipolis, 23 and 24 November 2000.* Luxembourg, European Communities.

Baker, B., Murphy, D. & Fisher, D., 1988. Factors Affecting Project Success. In: D. I. Cleland & W. King, eds. *Project Management Handbook.* s.l.:John Wiley & Sons, Inc, pp. 902-919.

Baumgartel, H., 1957. Leadership style as a variable in research administration. *Administrative Science Quarterly,* 2(3), pp. 344-360.

Bradley, N., 1999. Sampling for Internet surveys: an examination of respondent selection for Internet research. *Journal of the Market Research Society,* 41(4), pp. 387-395.

Brown, K., Schmied, H. & Tarondeau, J. C., 2002. Success factors in R&D: A meta-anlysis of the empirical literature and derived implications for design management. *Design Management Journal,* 2(1), pp. 72-87.

Carayannis, E. G., Gonzalez, E. & Wetter, J., 2003. The Nature and Dynamics of Discontinuous and Disruptive Innovations from a Learning and Knowledge Management Perspective. In: L. R. Shavinina, ed. *The International Handbook on Innovation.* s.l.:Elsevier Science Ltd., pp. 115-138.

Chatterjee, C. & Hadi, A. S., 2006. *Regression analysis by example.* 4 ed. New Jersey: John Wiley & Sons, Inc..

Chiesa, V., 2001. *R&D strategy and organisation. Managing Technical Change in Dynamic Contexts.* London: Imperial college press.

Cohen, J., Cohen, P., West, S. & Aiken, L., 2003. *Applied Multiple Regression/Correlation Analysis for Behavioral Sciences.* 3 ed. London: Lawrence Erlbaum Associates.

De Meyer, A., 1992. Management on international R&D operations. In: O. Granstrand, L. Hakanson & S. Sjölander, eds. *Technology management and international business: internationalization of R&D and technology.* Chichester: John Wiley and Sons, pp. 163-178.

De Meyer, A., 1993. Management of an International Network of Industrial R&D Laboratories. *R&D Management,* 23(2), pp. 109-120.

Denis, D. J., 2011. *Multiple Linear Regression Using SPSS Part II.* [Online] Available at: http://psychweb.psy.umt.edu/denis/datadecision/front/stat_II_2011/psyx_521_multiple_regression_part_II.pdf [Accessed 12 04 2013].

Dodgson, M., Gann, D. & Salter, A., 2008. *The Management of Technological Innovation: Strategy and Practice.* New York: Oxford University Press Inc..

Downs, G. W. & Mohr, L. B. J., 1976. Conceptual issues in the study of innovation.. *Administrative Science Quarterly,* Volume 21, pp. 700-714.

Drucker, P. F., 2002. The Discipline of Innovation. *Harvard Business Review,* Issue August, p. 95–103.

EPO, 2012. *European Patent Office.* [Online] Available at: http://www.epo.org/.[Accessed 2012].

ePure, 2012. [Online] Available at: http://epure.org/statistics/info/Productioncapacityinstalled1.[Accessed 23 01 2012].

European Commission, 2006. *Ricardis: Reporting Intellectual Capital to Augment Research, Development and Innovation in SMEs,* Brussels: European Commission.

Galbraith, 1952. *American Capitalism: The Concept of Countervailing Power.* NY: Houghton Mifflin.

Garcia, R. & Calantone, R., 2002. A critical look at technological innovation typology and innovativeness terminology: a literature review. *The Journal of Product Innovation Management,* Volume 19, pp. 110-132.

Granstrand, O., Hakanson, A. & Sjolander, S., 1992. *Technology Management and International Business - Internationalization of R&D and Technology.* Chichester: John Wiley & Sons.

Hakanson, L., 1992. Locational Determinants of Foreign R&D in Swedish Multinationals. In: O. Granstrand, A. Hakanson & S. Sjolander, eds. *Technology Management and International Business - Internationalization of R&D and Technology.* Chichester: John Wiley & Sons, pp. 97-115.

Hamel, G. & Prahalad, C. K., 1993. Strategy as stretch and leverage. *Harvard Business Review,* 71(2), pp. 75-84.

Hax, A. C. & Maljuf, N. S., 1996. *The Strategy Concept and Process: A Pragmatic Approach.* 2 ed. Englewood Cliffs: Prentice Hall.

Henderson, R., 1994. The Evolution of Integrative Capability: Innovation in Cardiovascular Drug Discovery. *Industrial and Corporate Change,* 3(3), p. 607–630.

Hirschey, R. & Caves, R., 1981. Research and Transfer of Technology by Multinational Enterprises. *Oxford Bulletin of Economics and Statistics,* 43(2), pp. 115-130.

Howells, J., 1990. The Location and Organisation of Research and Development: New Horizons. *Research Policy,* 19(2), pp.

133-146.
Iarossi, G., 2006. *The power of survey design : a user's guide for managing surveys, interpreting results, and influencing respondents.* Washington: The International Bank for Reconstruction and Development/The World Bank.
Jabri, M. M., 1992. Job satisfaction and job performance among R&D scientists: The moderating effects of perceived appropriateness of task allocation decisions. *Australian Journal of Psychology,* 44(2), pp. 95-99.
Jain, R., Tiandis, H. C. & Weick, C. W., 2010. *Managing research, development, and innovation.* 3rd ed. New Jersey: John Wiley & Sons, Inc.
Janis, I. L., 1982. *Groupthink: Psychological Studies of Policy Decisions and Fiascoes.* 2 ed. Boston: Cengage Learning.
Katz, R. & Allen, T. J., 1985. Project performance and the locus of influence in the R&D matrix. *Academy of Management Journal,* Issue 28, pp. 67-87.
Keller, R. T., 1994. Technology-information processing fit and performance of R&D project groups: A test of contingency theory. *The Academy of Management Journal,* 37(1), pp. 167-179.
Kemp, R. G. M., Folkeringa, M., de Jong, J. P. J. & Wubben, E. F. M., 2003. *Innovation and firm performance. Research Report H200207,* Zoetermeer: SCALES.
Kimberly, J. R. & Evanisko, M. J., 1981. Organisational innovation: The influence of individual, organisational and contextual factors of hospital adoption of technological and administrative innovations. *Academy of Management Journal,* 24(4), pp. 689-713.
Larsson, A., 2004. *How can R&D strategy be shaped, integrated and monitored to support corporate strategy?.* [Online] Available at: http://epubl.ltu.se/1402-1773/2004/095/LTU-CUPP-04095-SE.pdf. [Accessed 07 12 2013].
Lawrence, P. B. & Lorsch, W. J., 1967. *Organization and Environment: managing differentiation and integration.* Boston: Division of Research, Harvard Business School .
Likert, R., 1967. *Human Organization: Its Management and Value.* New York: Mcgraw-Hill .
Mairesse, J. & Mohnen, P., 2001. *To Be or not To Be Innovative: An Exercise in Measurement.* Cambridge, MA.: NBER Working Paper 8644, December 2001, National Bureau of Economic Research.
Marquis, D. G. & Straight, D. L., 1965. *Organizational Factors in Project Performance, No 133-65,* Cambridge: Massachusetts Institute of Technology.
Mintzberg, H., 1973. *The Nature of Managerial Work.* New York: Harper & Row.
Mohnen, P. & Dagenais, M. J., 2002. Towards an Innovation Intensity Index. The Case of CIS-I in Denmark and Ireland. In: A. Kleinknecht & P. Mohnen, eds. *Innovation and Firm Performance. Econometric Explorations of Survey Data.* London: Palgrave, pp. 3-30.
Nadiri, M. & Prucha, R., 1993. *Estimation of the depreciation rate of physical and R&D capital in the US total manufacturing sector, NBER Working Paper 4591.* Cambridge: National bureau of economic research.
Nelson, R. & Winter, S. G., 1982. *An Evolutionary Theory of Economic Change.* Cambridge: The Belknap Press of Harvard University Press.
Ortega-Argiles, R., Potters, L. & Voigt, P., 2009. *R&D-intensive SMEs in Europe: What do we know about them?.* Luxembourg: IPTS Working paper on Corporate R&D and Innovation No. 15/2009, European Communities.
Pelz, D. C., 1956. Some Social Factors Related to Performance in a Research Organization. *Administrative Science Quarterly,* 1(3, Special Issue on the Administration of Research), pp. 310-325.
Pelz, D. C. & Andrews, F. M., 1966. *Scientists in Organizations: Productive Climates for Research and Development.* New York: John Wiley&Sons.
Perrino, A. & Tipping, J., 1989. Global management of technology. *Research Technology Management,* 32(3), pp. 12-19.
Peters, T. J. & Waterman, R. H., 1988. *In Search of Excellence-Lessons from America's Best Run Companies..* New York: Harper & Row.
Prahalad, C. K. & Hamel, G., 1990. The Core Competence of the Corporation. *Harvard Business Review,* 68(3), pp. 79-90.
Rheem, H., 1995. Improving productivity: The importance of R&D. *Harvard Business Review.*
Roberts, E., 1995. Benchmarking the Strategic Management of Technology--I. *Research Technology Management,* 44(January-February).
Rosenbaum, M. E. et al., 1980. Group productivity and process: Pure and mixed reward structures and task interdependence. *Journal of Personality and Social Psychology,* 39(4), p. 626–642.
Rothwell, R., 1976. *Innovation in Textile Machinery: Some Significant Factors in Success and Failure.* Bringhton, Sussex: SPRU Occasional Paper Series No2, SPRU.
Rugman, A., 1981. Research and Development by Multinational and Domestic Firms in Canada. *Canadian Public Policy,* 7(4), pp. 604-616.
Sachs, L., 1984. *Applied Statistics.* 2 ed. New York: Springer-Verlag New York Inc..
Sakakibara, K. & Westney, E., 1992. Japan's Management of Global Innovation: Technology Management Crossing Borders. In: *Technology and the Wealth of Nations.* Stanford: Stanford University Press, pp. 327-344.
Schriesheim, J., Von Glinow, M. A. & Kerr, S., 1977. Professionals in bureaucracies: A structural alternative. In: P. C. Nystrom & W. H. Starbuck, eds. *Prescriptive Models of Organizations.* New York: North-Holland, pp. 55-69.

Scott, S. G. & Bruce, R. A., 1994. Determinants of Innovative Behavior: A Path Model of Individual Innovation in the Workplace. *Academy of Management Journal,,* 37(3), pp. 580-607.
Siegel, A. F., 2000. *Practical business Statistics.* s.l.:Irwin McGraw-Hill.
Siniscalco, M. T. & Auriat, N., 2005. *Questionnaire design.* Paris: International Institute for Educational Planning/.
Smith, K., 2005. Measuring Innovation. In: J. Fagerberg, D. Mowery & R. R. Nelson, eds. *The Oxford handbook of Innovation.* New York: Oxford University Press Inc., pp. 148-177.
Souitaris, V., 2003. Determinants of Technological Innovation:Current Research Trends and Future Prospects. In: L. V. Shavinina, ed. *The International Handbook on Innovation.* s.l.:Elsevier Science Ltd., pp. 513-528.
Sundbo, J., 2005. Foreword. In: P. Trott, ed. *Innovation Management and New product development.* Harlow: Pearson Education Limited, p. 5.
Terpstra, V., 1977. International Product Policy: the Role of Foreign R&D. *Columbia Journal of World Business,* 12(4), pp. 24-32.
Tidd, J., 2001. Innovation management in context: Environment organizational and performance. *SPRU Science and Technology Policy Research,* Volume Working paper no. 55.
Trott, P., 2005. *Innovation management and new product development.* Harlow: Pearson Education Limited.
Vernon, R., 1966. International Investment and International Trade in the Product Cycle. *The Quarterly Journal of Economics,* 80(2), pp. 190-207.
Wolfe, R. A., 1994. Organisational innovation: Review, critique and suggested research directions. *Journal of Management Studies,* 31(3), p. 405–431.
Wright, P., Kroll, P. & Parnell, J., 1996. *Strategic Management Concepts and Cases.* New Jersey: Prentice Hall, Inc..
Zaltman, G., Duncan, R. & Holbek, J., 1973. *Innovations and organizations.* New York: John Wiley.

Annex I. Independent variables of Organisational CSF in R&D.

Group	Code	Independent variables
Type of organisational structure	A01	Centralized
	A02	Decentralized
	A03	Combined
	A04	Horizontal (few or no levels of intervening management between staff and managers)
	A05	Divisions (groups each organizational function into a division. Each division within a divisional structure contains all the necessary resources and functions within it)
	A06	Matrix structures (groups employees by both function and product)
	A07	Individual autonomy
	A08	Flexible
	A09	Other
Geographic location of the R&D	B01	Geographic distribution of R&D labs
	B02	In-house (centralized one R&D lab)
Orientation of the organizational structure of R&D	C01	Project-oriented structure
	C02	Input oriented structure (oriented by research discipline, technical area or activity)
	C03	R&D structure is organized by product line
	C04	Research oriented (research analyses properties, structures, and relationships with a view to formulating and testing hypotheses, theories or laws)
	C05	Development oriented (installing new processes, systems and services, or to improving substantially those already produced or installed)
Type of organisational control	D01	Dual hierarchy (both professional and managers levels are incorporated)
	D02	Triple hierarchy (managers, professionals and professionals with administrative status)
	D03	Influence of the two supervisors
	D04	Not too tightly controlled
	D05	Internal entrepreneurship teams (independent, accountable structures)
	D06	Other
Organisational culture	E01	Innovative organizational culture
	E02	Tolerance of failure
	E03	Competitiveness between employees
	E04	Groupthinking
	E05	Other
R&D strategy	F01	Long-term strategic planning
	F02	Long-term objectives
	F03	R&D strategy is an integral part of overall company mission
	F04	Adapting elements of strategy (objectives, policies, programs)
	F05	Horizontal strategy (expands business into different products, processes that are similar to current lines)
	F06	Information gathering
	F07	Technology strategy (selection, timing, acquisition mode)
	F08	Portfolio diversity
	F09	Other
Human resource management	G01	Recruitment policy
	G02	Explicit career plan
	G03	Incentives to motivate personnel
	G04	Motivation through job security
	G05	Keeping a researcher at the innovation stage (individual goes through number of stages in a given position. At first socialization stage, then innovation and stabilization stage)
	G06	Job rotation
	G07	Researchers to spend (a small portion of their) time of development of their own ideas
	G08	Other
Other	J01	Other

Annex II. Descriptive statistics and correlations of variables in analysis

Variables	Min	Max	Mean	S.D.	Techn	Volume	Patents_b	Patents_c	Patents
Techn	0.0	2.0	.4	.6	1				
Volume	5.4	850.0	168.6	221.5	.086	1			
Patents_b	0.0	14.0	2.0	4.0	-.031	-.016	1		
Patents_c	0.0	8.0	1.4	2.6	.057	-.073	.967**	1	
Patents	0.0	226.0	20.2	59.5	.310	.884**	-.086	-.088	1
A01	0.0	5.0	1.4	2.0	.351	.213	-.249	-.251	.334
A02	0.0	0.0	.0	.0	.[a]	.[a]	.[a]	.[a]	.[a]
A03	0.0	5.0	2.1	2.0	-.267	-.349	.343	.385	-.278
A04	0.0	5.0	.6	1.6	.132	.008	.566*	.537*	-.083
A05	0.0	0.0	.0	.0	.[a]	.[a]	.[a]	.[a]	.[a]
A06	0.0	4.0	1.0	1.7	-.355	-.069	.318	.226	-.144
A07	0.0	0.0	.0	.0	.[a]	.[a]	.[a]	.[a]	.[a]
A08	0.0	4.0	.3	1.1	-.162	.080	.872**	.738**	-.030
A09	0.0	3.0	.2	.8	-.162	.301	-.073	-.151	-.093
B01	0.0	3.0	.4	.9	-.234	.231	-.146	-.217	-.092
B02	0.0	5.0	3.2	1.6	.148	-.084	.443	.488	.135
C01	0.0	5.0	3.0	2.0	.179	.209	.210	.306	.280
C02	0.0	5.0	.4	1.3	-.162	-.037	-.145	-.151	-.098
C03	0.0	3.0	.2	.8	-.162	-.050	-.145	-.151	-.020
C04	0.0	5.0	.4	1.3	.292	-.203	-.073	-.151	-.093
C05	0.0	5.0	2.1	2.3	-.038	-.112	.136	.017	-.265
D01	0.0	5.0	3.5	1.2	-.052	-.141	.100	.166	.122
D02	0.0	0.0	.0	.0	.[a]	.[a]	.[a]	.[a]	.[a]
D03	0.0	0.0	.0	.0	.[a]	.[a]	.[a]	.[a]	.[a]
D04	0.0	4.0	.8	1.6	-.302	-.040	.763**	.773**	-.067
D05	0.0	0.0	.0	.0	.[a]	.[a]	.[a]	.[a]	.[a]
D06	0.0	4.0	.3	1.1	-.162	.301	-.073	-.151	-.093
E01	0.0	5.0	3.0	2.0	.119	.284	-.029	-.044	.157
E02	0.0	5.0	2.3	2.1	-.196	-.137	.329	.315	-.282
E03	0.0	0.0	.0	.0	.[a]	.[a]	.[a]	.[a]	.[a]
E04	0.0	5.0	2.3	2.4	.080	-.448	-.113	.032	-.292
E05	0.0	3.0	.2	.8	-.162	.301	-.073	-.151	-.093
F01	0.0	5.0	1.6	2.3	.305	-.447	-.227	-.209	-.225
F02	0.0	5.0	1.6	2.2	.118	-.346	-.255	-.200	-.188
F03	0.0	5.0	2.5	2.6	.351	.483	.225	.200	.285
F04	0.0	5.0	.6	1.6	-.237	-.001	.944**	.934**	-.060
F05	0.0	5.0	.6	1.6	.132	-.076	-.094	-.040	-.077
F06	0.0	5.0	1.3	2.1	-.367	-.105	.566*	.552*	-.157
F07	0.0	5.0	1.6	2.3	.094	-.053	-.219	-.209	-.189
F08	0.0	5.0	.6	1.6	-.237	-.040	.614*	.501	-.088
F09	0.0	5.0	.4	1.3	-.162	.080	.872**	.738**	-.030
G01	0.0	5.0	1.5	2.1	.028	-.220	.427	.521	-.139
G02	0.0	4.0	.3	1.1	-.162	-.050	-.145	-.151	-.020
G03	0.0	2.0	.3	.7	-.239	-.212	-.214	-.222	-.140
G04	0.0	5.0	1.3	2.0	-.088	.348	-.353	-.367	.502
G05	0.0	4.0	.3	1.1	-.162	-.024	-.145	-.151	-.098
G06	0.0	0.0	.0	.0	.[a]	.[a]	.[a]	.[a]	.[a]
G07	0.0	4.0	1.1	1.8	.729**	-.247	.394	.396	-.144
G08	0.0	4.0	.3	1.1	-.162	-.050	-.145	-.151	-.020
J01	0.0	5.0	1.2	1.9	.121	.162	.483	.476	.286

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

*. Correlation is significant at the 0.05 level (2-tailed).

a. Cannot be computed because at least one of the variables is constant.

Development of the Vannsimpco Leadership Survey: A delination of hybrid leadership styles

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Abstract

The study of leadership is often attempted from various disciplinary perspectives; studies, therefore, mimic the limited interests and leadership styles delineated by scholars working in business, education, community development, and sociological fields. Instruments like the commonly used Multifactor Leadership Questionnaire (MLQ) also tend to be written from a supervisor's viewpoint, which limits their utility as a tool for comparing perceptions of subordinates to those of their supervisors. Because of those limitations, a more versatile bi-lateral instrument with blended leadership styles was developed. The instrument is titled the Vannsimpco Leadership Survey (VLS). The rationale for its development and a discussion on its validation are included in the pages that lie ahead. Also, the results of the reliability test on the VLS are reported. A Pearson' Product Moment Correlation r produced a significant result, ($r[108] = .91$, $p < .001$).

Keywords: leadership style inventory, business, education, blended leadership

Introduction

With increasing globalization of economic systems which invariably invites greater competition in the marketplace, organizations are pressed to find and exploit the most efficient systems. Leadership is a method transmitted through formal and informal communication channels, and although it has been defined for many years, there is a lack of consensus on the styles of leadership that are practiced in the real world. For instance, sociologists focus on issues of power and control, symbolic meanings, or how organizations form and function. Business managers are more likely to examine leadership behaviors from a "bottom line" and "ethical" standpoint, while educators justifiably relate leadership effectiveness to student learning outcomes. The present study involves the creation of a new leadership survey form that incorporates ideas from several disciplines with an eye toward capturing the blending of styles used by situational leaders. As is shown shortly, the researchers' review of the literature suggests that while there are a number of leadership surveys in use, arguably the most commonly used instrument is the Multifactor Leadership Questionnaire (MLQ). Several factors limit transformational leadership's appeal in a business model. It relies upon stereotypical leadership styles that, in short, portray the transformational leader as the ideal and the transactional leader as detached and unconcerned about staff. The stereotyping is even more pronounced with respect to autocratic leaders; they are portrayed as cold as and even harsher than transactional leaders. It is the contention of the authors that such depictions do not reflect the manner in which most organizations are managed. Indeed, it is quite possible that a leader could practice a hybrid form of, for example, autocratic-transformational or democratic-transactional leadership styles; moreover, if a leader follows Ken Blanchard's Change Model or Malcolm Knowles' construct of from pedagogy to andragogy, many new initiatives clearly demand a leadership model that is didactic during their unfolding. Clearly that leadership style can be portrayed as autocratic.

In the pages that lie ahead, a discussion on the nature of leadership styles and their delineations are presented. Next, the development of the Vannsimpco Leadership Survey (VLS) is discussed along with its validation and its test of reliability. The paper concludes with a summary and recommendations for further study and widespread application of VLS.

Multifactor Leadership Questionnaire (MLQ)

The Multifactor Leadership Questionnaire (MLQ) is considered valid across cultures, different organizational types, and leadership levels (Bass & Avolio, 2004). The MLQ is a self-administered survey instrument, and consists of descriptive questions about different styles of leadership (Avolio, Bass, & Jung, 1995). These questions measure transformational, transactional, and laissez-faire styles of leadership. Ozaralli (2003) reported the MLQ is "the best validated measure of transformational and transactional leadership" (p.338). The original MLQ was first published in 1985 (Bass, 1985).

There have been various revisions to the MLQ instrument. An earlier model of the MLQ, known as MLQ 8-Y, measured eight dimensions of leadership consisting of four dimensions of transformational leadership (charisma, inspiration, individual consideration, and intellectual stimulation), three dimensions of transactional leadership (contingent reinforcement/reward, management-by-exception-active, and management-by-exception-passive), and a single dimension of Laissez-Faire leadership (passive leadership) (Bass & Avolio, 1989; Hartog, Van Muijen, & Koopman, 1997). There were several criticisms of this earlier MLQ instrument. One of the most notable issues dealt with the discrimination between management-by-exception-passive and Laissez-Faire leadership (Bass, 1985; Hartog, Van Muijen, & Koopman, 1997; Yammarino & Bass, 1990).

The current form of the MLQ is formally known as the MLQ 5x. The MLQ 5x contains the "full range leadership theory" consisting of five transformational leadership subscales, two transactional subscales, and two passive subscales of Laissez-Faire (Bass & Avolio, 2004). Transformational Leadership style is measured by the common 5-I's: Idealized Attributes, Idealized Behaviors, Inspirational Motivation, Intellectual Stimulation, and Individualized Consideration. The transactional Leadership management styles includes: Contingent Reward, and Management-by-Exception-Active. Finally, the Laissez-Faire Leadership style includes: Laissez-Faire Passive/Avoidant and Management-by-Exception (MBE)-Passive (Barbuto, 2005). This version of the MLQ attempted to rectify the issue of Laissez-Faire and management-by-exception-

passive, which was formerly considered a transactional factor.

The current version of the MLQ, the MLQ 5x has also garnered criticism from researchers, including the revision of current factor models. Alonso, Saboya, and Guirado (2010) reported through meta-analysis that the following four factors: transformational leadership, developmental/transactional leadership, corrective leadership and avoidant/passive leadership are better fit than Bass' categories. Reviewing extensive literature on the MLQ, Muenjohn, and Armstrong (2008) noted that diverse results were reported by many researchers on the validity of the MLQ. Finally, Keshtiban (2013) argues that the MLQ is outdated and does not consider current broader analysis of leadership components.

Global Leadership and Organizational Behavior Effectiveness (GLOBE)

While the MLQ remains a popular assessment of leadership styles in the US, a group of researchers examined leadership on the global scale in 2001. The GLOBE project, developed by House, Hanges, Javidan, Dorfman, and Gupta (2004), encompassed 62 societal cultures and examined 6 leadership dimensions (House et al., 2004). Those leadership dimensions include: charismatic, or value based; team oriented; self-protective; participative; humane oriented; and autonomous. A follow-up study by Suryani, Vijver, Poortinga, and Setiadi, (2012) reported that in Indonesia the GLOBE questionnaire assessed universal leadership styles (charismatic, team-oriented, and self-protective styles). Additionally, practical implications of GLOBE research includes identification of universal traits of leadership effectiveness (integrity, charismatic-visionary, charismatic-inspirational, team-builder) (Javidan, Dorfman, de Luque, & House, 2006; Javidan & Dastmalchian, 2009).

Leadership Style Scale (LSS)

There is currently only one leadership style instrument designed to measure the hybrid factors of autocratic, democratic, transactional, transformational, and laissez-faire leadership. The LSS was developed by Tas, Celik and Tomul (2007) and aimed to measure leadership style of school administrators with 59 items. The LSS has five dimensions: autocratic leadership (10 items), democratic leadership (13 items), laissez-faire leadership (11 items), transformational leadership (15 items) and transactional leadership (10 items). The coefficient of internal consistency of the scale was determined to be .87. While the LSS covers the hybrid leadership factors, it is limited to piloting and administration to educational leaders (Inandi, Tunc, & Gilic, 2013).

In summary, the development of leadership style instruments is an area of debate and continued research. Through a review of literature, no hybrid forms of leadership surveys exists that encompass a variety of leadership factors without bias or an emphasis on one leadership factor, or one workplace setting.

Other Leadership Style Instruments

There are various leadership style instruments available electronically, although most are not referenced in scholarly peer reviewed journals. One such instrument is the Hay Group Inventory of Leadership Styles Diagnostic. This self-administered survey provides the following leadership style results: the Directive style; Visionary style, Affiliative style, Participative style, Pacesetting style; and Coaching style (Garrick, 2006). Other free self-administered questionnaires are available through online search engines free of charge to participants; however, the pilot testing information is more difficult to attain.

Current Research on Leadership Styles

Effective leadership is significantly related to job well-being in the workplace (Kuoppala, Lamminpaa, Liira and Vainio, 2008; Lopez, Green, Carmody-Bubb, & Kodatt, 2011). Most research in leadership styles focuses on one dimension of leadership style (i.e. transformational vs. transactional; or autocratic vs. democratic) related to effectiveness or employee satisfaction. For instance, Rowald and Heinitz (2007) determined that transformational leadership was related to larger profit margins than other leadership styles, and Hetland (2007) reported that transformational leadership has also been positively correlated to professional efficacy. While employees reported lower job-related tension working under a leader purporting a democratic leadership style (Omolayo, 2007).

In a study of school administrators, Inandi, Tunc, and Gilic, (2013) discovered a negative relationship between autocratic or laissez-faire leadership styles and resistance to change. However, instruments designed to measure various leadership styles in isolation have been available for decades, but lack the component to evaluate combinations of leadership style in a condensed format for use in a variety of settings. The lack of an instrument generated the development of Vannsimpco, a multi-dimensional leadership style instrument.

Leadership Styles

The Vannsimpco Leadership Survey (VLS) attempts to combine various leadership traits into more realistic and applicable categories. It assumes that most leaders cannot be described in monolithic terms of transformational, transactional, democratic, autocratic, and/or laissez-faire. Rather, leaders employ a hybrid of various styles based upon their contextual situation. A brief overview and critique of each style is therefore necessary in order to understand the conceptual framework underpinning the Vannsimpco.

Transformational

The darling of the leadership studies discipline, the transformational leadership method was first elaborated upon through the historical research of Burns (1978) and, later, Bass (1985). According to these works, effective transformational leadership transcends the limitations imposed by followers and organizational structure. As Burns (2003) explains, transformational leaders "cause a metamorphosis in the form or structure, a change in the very condition or nature of thing, a change into another substance, a radical change in outward form or inner character" (p. 24). These leaders achieve their results through personal charisma, charm, clear vision, and passion. Followers of transformational leaders believe themselves valued as an individual, and often feel empowered to perform better.

Transformational leadership assumes institutions need, and require, a transformation; that innovation is always preferable to the status quo, and that followers are eager to be have personal and intimate relationships with their leaders. In many ways, this definition explains as much about the researchers' world view as it does the leadership he or she is purporting to study. If one believes in the need for constant innovation for the sake of innovation, it makes sense why transformation leadership is appealing. Yet, innovation is not always required or desired. Many followers or organizations may not want transformation or to form emotional connections to their leader, perceiving this attempts to establish emotional bonds as poor management or emotional manipulation. Furthermore, followers may misconstrue the emotional appeals of transformational leaders and become overly dependent upon their leader for personal validation (Stone, Russell, & Patterson, 2003). Transformational leadership can be used by leaders who lack moral guidance and seek to wield the "dark side of charisma" (Yukl, 1989) for less than desirable reasons. Although some advocates maintain that "authentic transformational leadership foster the moral values of honesty, loyalty, and fairness," nevertheless, one cannot ignore how the traits of the transformational leader have been used for nefarious purposes. It is this realization, demonstrated through historical experiences that should place some caution upon the degree to which transformational leadership is celebrated by educators and business leaders.

Transactional

First explicated by Max Weber in the early twentieth century, leaders who exercise transactional leadership use a quid-pro-quo approach to leading others. They tend to be task-oriented leaders, more concerned with managing followers, maintaining the chain of command, and achieving results rather than change. Many studies on transactional leadership stress how transactional leaders believe followers must be monitored closely. Because of their result-oriented style, transactional leaders motivate their followers through a rewards/punishment system. Critics of transactional leadership accuse it of being rigid and casting blame upon the followers and not the leader. Others assert that leading through rewards appeal only to the selfish interests of the followers, thereby creating low-motivated workers (Bass & Bass, 2008). This is criticism is apt if the rewards offered are minimal or unworthy of the effort required to obtain them. Yet, in situations where the rewards offered are desirable and worthy, the role self-interest in the transactional relationship can become a strong motivation for achieving success. At the same time, and despite critics' assertions to the contrary (Bass & Bass 2008), followers motivated to obtain better rewards and can bring great things to organizations. This potential of such self-interested rewards leading to greater organization success was first acknowledged as early as 1705 in Bernard Mandeville's work, Fable of the Bees.

Democratic

As the name implies, democratic leaders seek advice and input from their followers. Democratic leaders motivate their followers by engaging their followers, listening to their ideas, and treating both the individual and their ideas as equals. Under such a leader, organization hierarchy becomes unimportant or non-existent. With such a belief in their equality, followers are motived to work harder because they trust they have an equal share of the success of the organization (Lewin, Lippit & White, 1939). Bass and Bass maintain that democratic "leadership is considerate, democratic, consultative and participative, employee-centered, concerned with people, concerned with maintenance of good working relations, supportive and oriented toward facilitating interaction, relationship oriented, and oriented toward group decision making" (Bass & Bass, 2008, p. 441).

At the same time, however, democratic leadership has several shortcomings. A democratic leadership style does not respond well to emergency situations when quick, decisive, and energetic leadership is necessary. Because it consumes time to weigh equally all advice, democratic leadership is cumbersome and slow. At the same time, equating all ideas as equal ignores the wisdom that accounts from institutional memory or longevity of position-holding. Democratic leadership also assumes that all followers possess a deep knowledge of internal workings, goals, and expectations of the entire organization. Furthermore, a leader may pose as democratic in order to placate followers but has no real intention of truly implementing the ideas of others. Ironically enough and often downplayed in the literature, in order to have a truly democratic leadership style requires someone willing to exert their will upon the group to maintain order and keep conservations and ideas germane.

Autocratic

Leaders who embrace an autocratic style concentrate all decision-making with themselves. Relying upon their own discernment, autocratic leaders believe that a clear demarcation between follower and leader must exist for effective management. Under such leadership, organizational hierarchy is strong and followers understand where all decision-making rests (Lewin, Lippit, & White, 1939).

The common perception of autocratic leadership is that it is the natural embodiment of Machiavelli's famous dictum: "it is better to be feared than love, if one cannot be both" (Machiavelli, 1998, p 67). Without question, this style of leadership can be "arbitrary, controlling, power-oriented, coercive, punitive, and close-minded," (Bass & Bass 2008) thereby leading followers to resent the leadership. Not all autocratic leaders are arbitrary dictators, however. In their seminal study on the topic, Lewin, Lippit, and White (1939) noted some benefits to autocratic leadership, mainly that followers had clear understandings of what leadership excepted from them. At the same time, and assuming that the leader is not arbitrary, the this style can be of benefit to an organization composed of working professionals, who have little desire to participate in leadership decisions and seek only do their job. Knowing that someone will make those decisions can become a benefit and motivator to self-motivated employees who wish simply to work to the best of their abilities.

Laissez-faire

Borrowing from the economic theory of the same name, laissez-faire leaders take a "hands off" approach to leadership. They believe that followers know their particular role and job better than they do, and, thus, should be left alone. As such, followers of a laissez-faire leader assume a greater role in the organizational structure. If done poorly, Laissez-faire leadership can produce severe dysfunction of an organization. Because of the passive nature of the leadership, followers can lose motivation and become increasingly unproductive, thereby creating large degree of apathy from followers. At the same time, however, in an organization composed of self-motivating and highly competent followers, the degree of freedom offered by this approach can lead to great results.

Situational Leadership

Situational leadership does not confine itself to one method of leadership. Rather, it permits the leader to employ various leadership methods to different situations and groups, allowing the context of events to shape the leadership's methods. Although it lacks the in-depth study that all other leadership methods have received, it is nevertheless perhaps the most applicable to real-word situations. Given the distinctiveness and fluidity of various group dynamics, situational leadership methods can allow the leader to apply different methods as needed (Hersey & Blanchard, 1969).

Methodology

As shown in the proceeding overview of the literature, most scholars focus on delineating transactional; transformational; laissez-faire, which is referred to as avoidant/passive in the MLQ instrument, as the most commonly measured and perhaps understood leadership styles. Some scholars, especially those in workplace sociology, concentrate on democratic, autocratic, laissez-faire, expressive and instrumental styles (Tischler, Henry, & Mendelsohn, 1999). The review of the literature also suggests that the academic background of the scholar influences the leadership styles and indeed organizational paradigms he or she considers important. While not abundantly clear in the literature, logic suggests that some managers may embrace a blend of leadership styles; this would certainly be the case if the leader is driven by a philosophy that values situational leadership. It would make sense that a manager might well be autocratic in some situations and more democratic in other settings. He or she might also have a "good bedside manner" with an "iron fist in a velvet glove" while maintaining control of decision-making. Some leaders, on the other hand, may employ a democratic leadership style because of their empowered workforce (i.e., unionized plants) demands it. In such cases, the manager may be more instrumental (task oriented) rather than expressive (people centered). In other words, it might be problematic to think of the democratic leader as the only type of administrator who is considered to be a good "people person." Despite some depictions of autocratic leaders as being harsh and uncaring, they could in fact be charismatic and inspirational.

The MLQ (Multifactor Leadership Questionnaire) has limitations in accomplishing an accurate depiction of leadership as it unfolds in most real-world settings; nevertheless, it continues to be arguably the most widely used instrument in delineating leadership styles and practices. In addition to not measuring hybrid forms of leadership the MLQ is hampered by its limited range of leadership styles: transactional, transformational, avoidant/passive, and outcomes of leadership. Clearly this last form is not a leadership style; certainly, any desired outcomes in the workplace may be influenced by a host of other organizational and even local to global cultural and social forces. With respect to the present study, the MLQ offers little insight into the use of hybrid leadership styles. Their absence in the MLQ led to the belief among some scholars that a better, more comprehensive instrument (survey) was needed. Vann's discussions with colleagues at the University of the Cumberlands (UC), regional business leaders and school administrators, as well as faculty at the SBS Swiss Business School in Zurich, crystalized

the notion that a more practical instrument should be developed.

Informed by feedback collected during those dialogues, a new instrument was developed, titled the Vannsimpco Leadership Survey (VLS). It was established to gain greater insight into the use of a broader range and blending of leadership styles, which, in effect, should capture a more nuanced use of situational leadership practices. VLS was developed by University of the Cumberlands' Barry A. Vann, Jennifer A. Simpson, and Aaron N. Coleman in collaboration with SBS Swiss Business School. The instrument seeks to fill a major void in the literature on applied practices in business and organizational development (see Appendix A).

While the dialogues with leaders in the field that are mentioned above established the instrument's validity, its reliability was established in a pilot study conducted by Vann, the instrument's senior developer, at the University of the Cumberlands in the summer of 2014. An eclectic body of leaders who were taking part in a leadership seminar at UC was asked to participate in the pilot study. Eleven seminar participants took part in the pilot study; they included business managers, professors, and college administrators. Reliability was established by a Pearson's Product Moment Correlation r. Data generated for the pilot study resulted from the administration of the VLS on two separate occasions among the same study participants. A correlation test comparing the first administration and second administration scores produced a statistic in a favorable range, ($r\ [106] = .91$, $p < .001$).

These data suggest that the VLS is a reliable and valid instrument that has the potential to be used in a variety of business and organizational settings. Its design facilitates its use among administrators to measure their perceptions of their leadership styles. The wording in the instrument also allows for its administration to be used to delineate the perceptions of staff and subordinates relative to their supervisors' leadership styles.

Summary

The Vannsimpco Leadership Survey (VLS) seeks to move leadership studies away from the institutional bias towards transformational leadership and the rigid, one-style-only, understanding for leadership methods. Real-word leadership application employs a hybridization of the various forms of leadership. After significant testing and data collection conducted at the University of the Cumberlands and in conjunction with the Swiss Business School, a Pearson's Product Moment correction r reported a favorable range, ($r\ [106] = .91$, $p < .001$), thereby making the VLS a dependable and effective instrument for testing leadership.

The development of the Vannsimpco Leadership Survey (VLS) has implications for future researchers analyzing relationships between leadership style and effectiveness. The VLS could be paired in a correlational study with an instrument to measure professional efficacy, job satisfaction, or other measures related to professional success. The universality of the VLS allows researchers in virtually any setting to gather data to make decisions regarding leadership initiatives, training, and employment. The possibilities are limitless for innovative leaders and researchers to better understand current leadership styles of members of their selected populations.

References

Alonso, F., Saboya, P., & Guirado, I. (2010). Transformational and transactional leadership: An analysis of the factor structure of the Multifactor Leadership Questionnaire (MLQ) in a Spanish sample.Psicothema, 22(3), 495-501.

Avolio, B. J., Bass, B. M., & Jung, D. I. (1995). Construct validation and norms for the multifactor leadership questionnaire (MLQ-Form 5X). New York: Center for leadership studies, Binghamton University, State University of New York.

Barbuto Jr, J. (2005). Motivation and transactional, charismatic, and transformational leadership: A Test of Antecedents. Journal Of Leadership & Organizational Studies (Baker College), 11(4), 26-40.

Bass, B. M. (1985). Leadership and performance beyond expectations. New York: Free Press.

Bass, B. M. & Avolio, B. J. (1989). Manual for the multifactor leadership questionnaire. Palo Alto, CA: Consulting Psychologists Press.

Bass, B. M. & Avolio, B. (2004). Multifactor leadership questionnaire technical report. Center for Leadership Studies. Redwood City, CA: Mind Garden.

Bass, B. & Bass R. (2004). The bass handbook of leadership: Theory, research, and managerial applications. New York: Free Press.

Bodla, M. A. & Nawaz, M. M. (2010). Comparative study of full range leadership model among faculty members in public and private sector higher education institutes and universities. International Journal of Business and Management, 5, (4); 208-214.

Burns, J. M. (1978). Leadership. New York: Harper & Row.

Burns, J. (2003). Transforming leadership. New York: Atlantic Books.

Conger, J. A., & Kanungo, R. N. (1987). Toward a behavioral theory of charismatic leadership in organizational settings. Academy Of Management Review, 12(4), 637-647.

Garrick, L. (2006). Senior careers development service: Supporting guide-Hay group inventory of leadership styles diagnostic. Hay Group.

Hartog, D., Van Muijen, J. J., & Koopman, P. L. (1997). Transactional versus transformational leadership: An analysis of the MLQ. Journal Of Occupational & Organizational Psychology, 70(1), 19-34.

Hersey, P. and Blanchard, K. H. (1969). Life cycle theory of leadership. Training and Development Journal, 23 (5), 26–34.

Hetland, H., Sandal, G.M., & Johnsen, T.B. (2007). Burnout in the information technology sector: Does leadership matter? European Journal of Work and Organizational Psychology, 16 (1), 58-75.

House, R. J., Hanges, P. J., Javidan, M., Dorfman, P.W. & Gupta, V. (2004). Culture, leadership, and organization: The GLOBE Study of 62 Societies. Thousand Oaks, CA: Sage.

Inandi, Y., Tunc, B., & Gilic, F. (2013). School administrators' leadership styles and resistance to change. International Journal Of Academic Research, 5(5), 196-203. doi:10.7813/2075-4124.2013/5-5/B.30

Javidan, M., Dorfman, P.W., de Luque, M.S., & House, R.J., (2006). In the eye of the beholder: Cross cultural lessons in leadership from project GLOBE. Academy of Management Perspectives 20(1), 67-90.

Javidan, M., & Dastmalchian, A. (2009). Managerial implications of the GLOBE project: A study of 62 societies. Asia Pacific Journal Of Human Resources, 47(1), 41-58.

Keshtiban, A. (2013). The challenges and benefits of the multi-factor leadership questionnaire (MLQ), in terms of gender and the level of analysis: A critical review of current research. Proceedings Of The European Conference On Management, Leadership & Governance, 58-65.

Kuoppala, J., Lamminpaa, A., & Liira, J. (2008). Leadership, job well-being, and health effects – A systematic review and a meta-analysis. Journal of Occupational and Environmental Medicine,50 (8).

Lewin, K., Lippit, R. & White, R.K. (1939). Patterns of aggressive behavior in experimentally created social climates. Journal of Social Psychology, 10, 271-301.

Lopez, D., Green, M., Carmody-Bubb, M., & Kodatt, S. (2011). The relationship between Leadership Style and Employee Stress: An Empirical Study. International Journal Of Interdisciplinary Social Sciences, 6(3), 170-181.

Machiavelli, N. (1998). The Prince translated by Harvey C. Mansfield. Chicago: University of Chicago Press.

Mandeville, B. (1714). Fable of the bees: Or, private vices, public benefits. Oxford: Clarendon Press.

Muenjohn, N. & Armstrong, A. (2008). Structural validity of the multifactor leadership questionnaire (MLQ), capturing the leadership factors of transformational-transactional leadership. Contemporary Management Research, 4 (1), 3-14.

Omolayo, B. (2007). Effect of leadership style on job-related tension and psychological sense of community in work organizations: A case study of four organizations in Lagos State, Nigeria Bangladesh e-Journal of Sociology. 4 (2), 30-37.

Ozaralli, N. 2003. Effects of transformational leadership on empowerment and team Effectiveness , Leadership & Organization Development Journal, 24(6) ,335-344.

Rowold, J., & Heinitz, K. (2007). Transformational and charismatic leadership: Assessing the convergent, divergent and criterion validity of the MLQ and the CKS. Leadership Quarterly, 18(2), 121-133. doi:10.1016/j.leaqua.2007.01.003

Stone, A.G., Russell, R,F. and Patterson, K. (2003). Transformational versus servant leadership: A difference in leader focus. Leadership & Organization Development Journal, 25(4), 349-361.

Suryani, A. O., Vijver, F. R., Poortinga, Y. H., & Setiadi, B. N. (2012). Indonesian leadership styles: A mixed-methods approach. Asian Journal Of Social Psychology, 15(4), 290-303. doi:10.1111/j.1467-839X.2012.01384.x

Tas, A., K. Celik & E. Tomul, 2007. Leadership styles of principals in elementary schools where the new program is implemented in Turkey. J. Pamukkale Univ. Facul. Educat., 22: 85-98.

Tischler, H. & Mendelsohn, R., (1999). Introduction to sociology. (Fort Worth: Harcourt Press).

Yammarino, F. J. & Bass, B. M. (1990). Long-term forecasting of transformational leadership and its effects among naval officers: Some preliminary findings. In K. E. Clark & M. B. Clark (Eds), Measures of Leadership. West Orange, NJ: Leadership Library of America.

Yukl, G. (1989). Managerial leadership: A review of theory and research. Journal of Management, 15, 251-289.

Vannsimpco Leadership Survey Key

Transactional Questions

_____1 Supervisors should make it a point to reward staff for achieving organizational goals.
Strongly Disagree 1 Disagree 2 Neutral 3 Agree 4 Strongly Agree 5

_____2 Supervisors should let staff members know what to expect as rewards for achieving goals.
Strongly Disagree 1 Disagree 2 Neutral 3 Agree 4 Strongly Agree 5

_____3 Supervisors should set deadlines and clearly state the positive or negative consequences of staff members' not meeting defined goals.
Strongly Disagree 1 Disagree 2 Neutral 3 Agree 4 Strongly Agree 5

Democratic Questions

_____4 Supervisors should give staff authority to make important decisions.
Strongly Disagree 1 Disagree 2 Neutral 3 Agree 4 Strongly Agree 5

_____5 Supervisors should seek input from staff when formulating policies and procedures for implementing them.
Strongly Disagree 1 Disagree 2 Neutral 3 Agree 4 Strongly Agree 5

_____6 To solve problems, supervisors should have meetings with staff members before correcting issues.
Strongly Disagree 1 Disagree 2 Neutral 3 Agree 4 Strongly Agree 5

Autocratic Questions

_____7 It is the supervisor's ultimate responsibility for whether the organization achieves its goals.
Strongly Disagree 1 Disagree 2 Neutral 3 Agree 4 Strongly Agree 5

_____8 Supervisors should make quick decisions in times of urgency and be more deliberate in making decisions during times of less urgency.
Strongly Disagree 1 Disagree 2 Neutral 3 Agree 4 Strongly Agree 5

_____9 Supervisors should assign specific tasks to key staff members in order to achieve specific goals.
Strongly Disagree 1 Disagree 2 Neutral 3 Agree 4 Strongly Agree 5

Autocratic-Transformational

_____10 Supervisors should provide the goal for the organization and allow staff to work towards achieving the goal, making sure to offer them feedback concerning their efforts.
Strongly Disagree 1 Disagree 2 Neutral 3 Agree 4 Strongly Agree 5

_____11 Supervisors should retain control of decision making, but they should encourage high morale so followers can more effectively implement change.
Strongly Disagree 1 Disagree 2 Neutral 3 Agree 4 Strongly Agree 5

_____12 Supervisors are responsible for the operation of the organization or department, which includes the development of the competencies and commitment of personnel.
Strongly Disagree 1 Disagree 2 Neutral 3 Agree 4 Strongly Agree 5

Autocratic-Transactional

_____13 In addition to having responsibility for decision-making, it is essential for a supervisor to provide incentives and disincentives for staff with respect to work they have done on assigned projects.
Strongly Disagree 1 Disagree 2 Neutral 3 Agree 4 Strongly Agree 5

_____14 Supervisors should state clearly the incentives and disincentives to followers while maximizing oversight on the most critical decisions.
Strongly Disagree 1 Disagree 2 Neutral 3 Agree 4 Strongly Agree 5

_____15 Supervisors make the key decisions for the organization and get most of the credit or blame, but they should make sure that their promises for rewards and disincentives made to workers are kept.
Strongly disagree 1 Disagree 2 Neutral 3 Agree 4 Strongly Agree 5

Democratic-Transformational

_____16 Supervisors should provide opportunities for staff members to be involved in decision making while serving as mentors during times of change.
Strongly Disagree 1 Disagree 2 Neutral 3 Agree 4 Strongly Agree 5

_____17 Supervisors should be open to others' ideas, yet he or she should guide employees to become stronger workers.
Strongly Disagree 1 Disagree 2 Neutral 3 Agree 4 Strongly Agree 5

_____18 Supervisors should be highly concerned about developing staff's ability to contribute to making important organizational decisions.
Strongly Disagree 1 Disagree 2 Neutral 3 Agree 4 Strongly Agree 5

Democratic-Transactional

_____19 Supervisors should be comfortable working with groups to seek their input in making decisions while providing incentives and disincentives for the quality of their work.
Strongly Disagree 1 Disagree 2 Neutral 3 Agree 4 Strongly Agree 5

_____20 In order to make decisions, supervisors should discuss issues with all of the staff members while considering which incentives and disincentives should be used in response to the quality of their work.
Strongly Disagree 1 Disagree 2 Neutral 3 Agree 4 Strongly Agree 5

_____21 Supervisors should be concerned about building consensus among staff members while making sure they understand the timelines, as well as their benefits and penalties in relation to achieving goals.
Strongly Disagree 1 Disagree 2 Neutral 3 Agree 4 Strongly Agree 5

Transformational

_____22 Supervisors should rely on personal influence and relationship building rather than on position or title to get staff to do work tasks.

Strongly Disagree 1 Disagree 2 Neutral 3 Agree 4 Strongly Agree 5

_____23 Supervisors should develop strategies to develop the staff's competence and commitment.

Strongly Disagree 1 Disagree 2 Neutral 3 Agree 4 Strongly Agree 5

_____24 Supervisors should look for ways to develop the strengths of staff members.

Strongly Disagree 1 Disagree 2 Neutral 3 Agree 4 Strongly Agree 5

Laissez-faire

_____25 Supervisors' jobs are to read reports and "see the big picture;" nearly all of their work should involve little or no direction of the staff members who make point of contact decisions.

Strongly Disagree 1 Disagree 2 Neutral 3 Agree 4 Strongly Agree 5

_____26 Staff members should be hired with skills necessary to make decisions in the workplace. If staff members need direct supervision, they should not be working in the organization.

Strongly Disagree 1 Disagree 2 Neutral 3 Agree 4 Strongly Agree 5

_____27 Supervisors should hire competent and committed staff members, which relieves the "manager" from making most of the day-to-day decisions.

Strongly Disagree 1 Disagree 2 Neutral 3 Agree 4 Strongly Agree 5

Nokia's position in the global communication marketplace

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Abstract

Nokia is a global leader in mobile communications whose products have become an integral part of the lives of people all around the world. After over a decade of leading the mobile industry, Nokia, between 2007 and 2012, has fallen behind its competitors who have more recently entered the market. The gap between Nokia, and the competition has increased significantly and Nokia is now struggling in an effort to try to regain its role as a global competitor.

In this article, we are trying to understand what has happened, what the current situation is, and what Nokia could do to return to full profitability and leadership in the current, global marketplace. In order to do that, we have attempted to analyze Nokia's business-level positioning strategy, including market positioning of its strategic business units, as well as how the positioning strategy influences the competitive and/or cooperative dynamics of the industry. Additionally, we will analyze Nokia's corporate-level strategy, identifying the businesses the company is in and is considering entering, how they are related or unrelated, and whether and how they create additional value.

Keywords: *Nokia, Business, Communications technologies, Disruptive technologies, Telecommunication Industry,*

Introduction

Within its nearly 150-year history, Nokia has evolved from its origins in the paper industry to become a world leader in mobile communications. Today, Nokia brings mobile products and services to more than one billion people from virtually every demographic segment of the population. (Savov 2012)

In 1967, the merger of three Finnish companies (whose histories were rooted back to 1865), operating in wood-pulp mill, manufacturing rubber products, and manufacturing telephone and power cables, formed the current Nokia Corporation under the laws of the Republic of Finland. Nokia entered the telecommunications equipment market in 1960 producing radio-transmission equipment. (Nokia 2012) In 1982, Nokia introduced the first fully digital local telephone exchange in Europe, and in the same year it introduced the world's first car phone. The technological breakthrough of GSM was followed by world first GSM call made with a Nokia phone over the Nokia-built network of a Finnish operator in 1991, and in the same year Nokia won contracts to supply GSM networks in other European countries. Nokia's strategic core business of telecommunications was developed with the goal of establishing leadership in every major global market. (Bugsense 2013) Basic industry and non-telecommunications operations were then divested.

Mobile communications evolved rapidly during the 1990s and early 2000s, creating new opportunities for devices in entertainment and enterprise use. Mobile devices began increasingly to support the features of single-purposed product categories, such as music players, cameras, pocket computers and gaming consoles. (Gardiner 2008)

In 2007, Nokia's joint venture with Siemens AG, to form Nokia Siemens Networks (NSN), combined Nokia's communications and networks business and Siemens' carrier-related operations for fixed and mobile networks. (Nokia 2012) In 2011 NSN then acquired the majority of the wireless network infrastructure assets of Motorola Solutions.

Also in 2011, Nokia announced and began implementing a new strategy for its Devices & Services business, including its partnership with Microsoft to build a new global mobile ecosystem with Windows Phone serving as the primary smartphone platform, and changes to Nokia's leadership team and operational structure. The aim of which was to accelerate the speed of execution in the intensely competitive mobile products market.

In recent years, Nokia has supported its development of services and software capabilities with acquisitions of key technologies, content and expertise: Navteq, a leading provider of comprehensive digital map information and related location-based content and services (Dediu 2012); Novarra, whose technology has formed the basis of a new, more powerful mobile browser available for Nokia's latest feature phones and Asha full touch smartphones, and Scalado, whose technologies are strengthening Nokia's position in mobile imaging and supporting its broader strategic goals. (Bloomberg 2012)

As part of Nokia's efforts to concentrate on services that make up their core business, it has also made strategic cuts, including the recent sale of most of its stake in the luxury goods business Vertu. Additionally, since shifting focus onto mobile broadband and services, NSN has made a number of divestments of non-core assets, including the sale of its microwave transport business, the sale of its fixed line Broadband Access business and the divestment of the assets of the non-core IPTV business. (Nokia 2013)

Nokia (2012) now has four operating and reportable segments for financial reporting purposes: Mobile Phones (within Nokia's Devices & Services business), Smart Devices HERE, and NSN.

- Smart Devices focuses on Nokia's most advanced products, including Lumia smartphones powered by the Windows Phone operating system.
- Mobile Phones focuses on Nokia's most affordable products, including Asha full touch smartphones powered by the Series 40 operating system.
- HERE develops location-based products and services for a broad range of devices and operating systems, including Lumia smartphones.
- Nokia Siemens Networks (NSN) is a leading global provider of telecommunications infrastructure, with a focus on the mobile broadband market. Following the completion of the acquisition that Nokia made in to acquire 50% ownership of Siemens AG, the subsidiary has been renamed to be Nokia Solutions and Networks with abbreviation unchanged at NSN.

Nokia's Strategic Problems

For a decade and a half leading up to 2012, Nokia was the world's leading mobile phone company. It was a pioneer in the smartphone market, literally introducing most current mobile device users to the smartphone, with its initial Symbian Series 60 devices, in 2002.

In 2007, Apple introduced the iPhone, which changed the very definition of what a smartphone should be. (Burrows 2008) More and more users switched to pocket-sized, mini-computers with multi-touch screen instead of feature phones with small screen and low responsiveness. Samsung moved quickly into the smartphone industry while Nokia failed to respond to the iPhone and the shifting consumers demand, it did not want to give up its relatively successful smartphone platform, as it was very difficult to react to the changes when it was already a leading player. Samsung not only moved quickly, it also began development on multiple platforms including Android, Windows and its own Bada OS. When Nokia finally entered into a strategic partnership with Microsoft to produce new product for Windows Phone platform, it was already too late; Samsung and Apple had already taken over the lion's share of the smartphone market. (Arthur 2012)

Nokia also faced difficulties in the low-end segment, (Ibid) being attacked by local manufactures in developing markets such as China and India. There, thousands of micro-vendors, when added up, posed a threat in the low-end market segment. Nokia's products were very fragmented, and they did not have a flagship product until the Lumia series, which was introduced relatively recently.

Nokia now faces the strategic problem of how to gain back its position, market share, and profitability. A comprehensive analysis of Nokia smartphone's business may help to produce outcomes for Nokia in its next step.

Nokia's Business-Level Positioning Strategies

Most of Nokia's positioning strategies are needs-based, except for the NSN division, which was positioned as variety-based. With its Mobile Phone division, Nokia pursued a low cost strategy. (Agung 2013) By leveraging its advantage of economies of scale and moving its facilities to low-labor-cost and low-trade-barrier countries such as China, India, and Vietnam, Nokia successfully produced low-cost-for-low-price phones while maintaining its standard quality and durability. (Maier and Ewing 2013)

For Smart Devices and HERE services, Nokia competes on a differentiation strategy. One of the first moves it tried to differentiate itself from others, was the selection of Windows Phone as its primary OS platform. With Windows Phone, Nokia has implemented its advanced technologies such as free streaming music, mapping and navigation software, improved camera and image processing, and augmented reality layers of local information. In hardware, Nokia introduced the Lumia series with the best phone-based camera to date. The built-in, 41-megapixel camera featured on the Lumia 1020 can be considered a disruptive technology that may, in the near future, affect the compact camera industry. (Hashmi 2013)

By divesting the luxury brand Vertu, which focuses on wealthy, high-end users, in order to fund its smartphone business, Nokia expresses its strong commitment to focus on the development of the smart devices, which Nokia believes will have a stronger future.

Nokia map and navigation applications based on HERE platform are considered better than Google Maps and Apple maps in term of data-rich preciseness. (Kazmucha 2012) By the beginning of 2013, 190 countries were covered by Nokia maps data in more than 50 languages. 110 countries have its navigation data and 26 countries use data from Nokia maps to build traffic alerts.

With NSN, Nokia bets on Focus strategy. During 2011 and 2012, NSN pursued a policy of prioritizing markets such as Japan, Korea and the United States, as these markets typically offer vendors more value than other markets. (Nokia 2012) In general, developed markets provide relatively high margins while emerging markets, where end-users and therefore mobile operators are often more financially constrained, provide lower margins.

Nokia positions itself as the world's leading mobile broadband specialist by focusing on this specific market, dedicating itself to world-class innovation to meet its customers' needs, and achieving quality of such an exceptionally high level that it would become a key differentiator for NSN. To meet the aim of becoming a mobile broadband powerhouse, NSN has focused, both in terms of technology and geography. It has also put a strong emphasis on quality and innovation as important differentiators. The goal of strong commitment to Research and Development is to help fix the 'real world' problems that mobile operators face and to provide the advanced technology that will give them a leading edge in competitive markets. (Nokia 2013)

Nokia's Corporate Strategy

The current Nokia Corporation has come a long way from the group's origins. In the 1990s the demand for telecommunication equipment prompted Nokia to strive to be the global leader in this area. All non-core businesses were divested from 1989-1996. At this point, the company was involved in building Europe's GSM mobile networks. (Nokia 2012) During the 1990s and 2000s the company became more involved in providing a complete solution for the mobile communication market.

Nokia's corporate strategy is based on multimarket business activities. It has three main businesses (mobile devices, HERE, and NSN) and 4 business units for purposes of financial reporting. (Nokia 2013) The three businesses focuses on different aspects relating to mobile devices, telecommunication infrastructure, and location based products/services. Nokia's corporate strategy (as of November 2011) is to restructure and focus on mobile broadband and services. (SeekingAlpha.com 2012)

Nokia Siemens

Nokia's 25 billion Euros entrance into the telecommunication infrastructure industry was through a joint venture with Siemens. The deal was for 50% ownership from both Nokia and Siemens. It created the third largest competitor in the telecommunication market in 2007. The market leaders include Ericsson and second place Alcatel Lucent. (Zacks Equity Research 2013)

The telecommunication infrastructure business has always been one of Nokia's areas of interests since the days of producing radio transmission equipment in the 1960s. The presence of the company in this market provides additional value to their other business units. The mobile devices and location-based products/services benefitted from Nokia Siemens continual support of mobile network operators. Nokia Siemens' ability to provide quality infrastructure and services to these operators allows them to better utilize the products and services of Nokia's other business units. (Trading Economics 2014)

In applying the ownership test to this business unit, both Nokia and Siemens AG have different areas of business. This makes the complete acquisition of Siemens AG by Nokia (or vice versa) not a possibility. Nokia's specialty was providing equipment, solutions and services for network operators and corporations. Siemens specialty is in electrical engineering and electronics. The combined tangible and intangible assets made a case for ownership through acquisition for both companies.

In 2013, Nokia purchased the remaining ownership of the joint venture from Siemens as part of its strategy to focus on mobile broadband and services. The move was spurred on by the difficulties of integrating the two businesses over the course of their partnership. Among the reasons cited was Siemens' decentralized management and Nokia's on going dependency on its Espoo head quarter. Nokia Siemens purchase of Motorola's wireless network infrastructure was similar because it included many tangible assets that could not have been acquired by means on a contractual relationship. The 900 million USD purchase effectively made Nokia the 3rd largest provider of mobile network infrastructure in the United States and the leading non-Japan leader in the Japan market. The acquisition also made Nokia the 2nd largest provider worldwide.

HERE

Nokia entered into the location mapping business by acquiring Smart2Go's mapping and route planning software in 2005. The software was a free application available to download onto Nokia S60 and Windows Mobile 5.0 phones. In 2007 Nokia made their biggest acquisition at that point with the $8.1 billion purchase of Navteq a Chicago based provider of digital maps. In 2012 Nokia further expanded their location mapping services by acquiring 3D maps provider, Earthmine. The acquisition was labelled as a move to fight Apple to booster smart phone sales and profitability. In 2012 Nokia renamed their Nokia Map service to HERE. Competition to buy Navteq also came from Google and Microsoft. The acquisition of the largest provider of digital maps seemed like the correct decision for Nokia at that time in order to secure their position as the leading provider of location and map services.

Microsoft

The strategic partnership with Microsoft could be seen as a step for Nokia to become less vertically integrated. Nokia's multiple operating systems and eco-systems have been their weakness in competition with Apple and Google. Here, Nokia gets the Windows Mobile OS onto their phones and Microsoft has a partner with strong distribution networks and mobile device manufacturing capabilities. Microsoft acquires the rights (non-disclosed details) to use Navteq's maps in their Bing Map product. Most importantly the partnership allows for Nokia to differentiate their phones by means of extensions and customizations to the software. (Allan 2012)

Because contractual agreements between Microsoft and Nokia were possible, it did not pass the ownership test. This was also partly due to government regulations barring the joint ventures and mergers of the two companies. (Asymco 2014)
Findings and Recommendations
Recommendations for each of the business of Nokia are as following.

Mobile Phones

Continued prioritization of Nokia's efforts to focus on the smart phone business with more R&D spending in developing an own OS will allow them to gain independence from OS suppliers as well as utilizing its competitive advantage in hardware manufacturing to strategically gain back market share reserving for the long term strategic move of their own OS introduction in the coming years. (Stienberg 2013)

Nokia should continue the partnership with Microsoft to provide financial stability while researching for the next disruptive ecosystem. Competing in the growing smart phone market continues to be Nokia's best course of action. In order to compete in this market, it needs to adopt a viable operating system. There is only really one option for Nokia at this point; the Windows Mobile OS. The option of using Android as its operating system was considered a possibility back in 2010 but it was decided against because of Samsung's dominance leaving little room for other competitors. Currently Nokia's handsets accounts for 75% of all Windows Mobile units shipped. As of July 2013, Nokia will no longer produce Symbian based phones, opting to rely on the Windows Mobile OS. (Singh 2013)

Innovative technologies: Nokia should create its differentiation from competitors by embedding its innovative mobile technologies into its smart devices. Two new technologies that Nokia has developed and can be implemented to its smart devices in the near future are the Indoor navigation and radio-wave-based wireless charging technologies. (Perez 2013) The Indoor navigation technology provides precise indoor location information on a handset without GPS. It satisfies the location-based service needs, which has become the standard for a smart phone, and at the same time cuts down the cost of GPS chipset.

Design: Nokia should also focus on the design because for many people a smart phone is not just a smart phone, it's also a symbol of stauts and a form of personal expression. A cheap plastic case may ruin the value of a high-tech and feature-rich smart phone. Not only should it focus on hardware design, the User interface also needs to be improved. The Windows phone's user interface is generally considered to be less user-friendly than that of Android or iOS. (Mobithinking.com 2014)

Manufacturing: Because the price gap between smart phones and feature phones is shortening, Nokia should compete in the mid-end market of smart phone by producing lower priced Lumia devices with Android OS and basic features. It may also consider entering the tablet market as tablets will soon replace PCs in the near future.

HERE Businss Unit

Continue to further build HERE (its location/map service business, so that to utilize the competitive advantages to increase the market share in not only smart phone base supply but also in other niche markets. Nokia maps based on HERE platform is the biggest in the world. The maps industry is a blue ocean to help Nokia regain the lead position in market. (Kelion 2012, Manjoo 2013, Sheed 2012)

Nokia Solutions and Systems Networks (NSN)

Continue to develop Nokia Solutions and Systems Networks (formerly Nokia Siemens Network) to compete in the mobile communication infrastructure market. The acquisition of Siemens' 50% stake made NSN the 2nd largest in terms of revenue in this market. Based on the previously mentioned capabilities NSN is in the position to be Nokia's most profitable business unit. The focus for NSN should be prioritizing markets such as Japan, Korea and the United States, as these markets typically offer vendors more value than other markets. Nokia also has a large portfolio of patents that could be packaged together to be sold to other manufacturers and service providers of network architectures to finance Nokia's other operations. (Kharif 2008) In general, developed markets provide relatively high margins while emerging markets, where end-users and therefore mobile operators are often more financially constrained, provide lower margins.

Conclusion

Smartphone sales are going up steadily. According to certain predictions, smartphones will account for 78% of total global handset shipments by 2016. (Millar 2013) As the prices decrease, more and more users switch from feature phones to smartphones. With the advantage of an open platform and enriched ecosystem, Android phones will gain dominance the market, but the Windows Phone is also well-placed through Nokia to take a larger market share if it can keep its dominant position in the Windows phone segment.

The trend of moving toward 4G technology, would also greatly benefit NSN, as the main telecoms player that has a division in charge of developing and installing networks and wireless technologies for operators; thus, they can be the first to exploit this opportunity in conjunction with developing smartphones that will be able to fully use the 50 Mbps speeds that these new networks provide. With NSN's leader position in such technology trend development, Nokia sees big potential benefits that its subsidiary may enjoy, from this trend.

BIBLIOGRAPHY

Agung, C. (2013) Value Chain and competitive Advantage of Nokia Corporation, http://cagung10.blogspot.com/2013/06/value-chain-and-competitive-advantage.html

Allan, F. (2012) Nokia missed the boat with early prototypes that hinted at the Apple iPhone and Apple iPad, www.phonearena.com, [Online] http://www.phonearena.com/news/Nokia-missed-the-boat-with-early-prototypes-that-hinted-at-the-Apple-iPhone-and-Apple-iPad_id32425

Arthur, C. (2012) Feature Phones Dwindle as Android Powers Ahead in Third Quarter, theguardian.com, [Online] http://www.theguardian.com/technology/2012/nov/15/smartphones-market-android-feature-phones

Asymco (2014) Nokia Welcomes Android Users, asymco.com [Online] http://www.asymco.com/?s=Nokia&submit=Go

BBC (2011) India Census: population goes up to 1.21bn., BBC.com, [Online] http://www.bbc.co.uk/news/world-south-asia-12916888

Bloomberg, (2012) Nokia commands 35% share of basic phone market thanks to 'Asha', The Economic Times, [Online] http://articles.economictimes.indiatimes.com/2012-08-23/news/33342275_1_nokia-s-asha-sami-sarkamies-asha-phones

Bugsense.com (2013) Android VS Windows Phone from a developer's scope, [Online] http://blog.bugsense.com/post/26918984231/android-vs-windows-phone-from-a-developers-scope

Burrow, P (2008) How to Spend Apple's Cash, Business Week, [Online] http://www.businessweek.com/stories/2008-07-29/how-to-spend-apples-cash

Dediu, H (2012) How much do maps cost and what are they worth? [Online] http://www.asymco.com/2012/12/18/how-much-to-maps-cost-and-what-are-they-worth/

Gardiner, B. (2008) The Smartphone Smackdown: who satisfies customers best? Wired.com [Online] http://www.wired.com/2008/04/the-smartphone/

Hashmi, S. (2013) Micromax Is Entering Windows Phone Market & What It Means For Nokia? WindowsPhoneDaily.com, [Online] http://www.windowsphonedaily.com /2013/07/micromax-is-entering-windows-phone-market-nokia.html

Kazmucha, A. (2012) HERE Maps by Nokia vs. Apple Maps vs. Google Maps app update, imore.com, [Online] http://www.imore.com/here-maps-nokia-vs-ios-6-maps-vs-other-mapping-solutions-redux

Kelion, L. (2012) Nokia Map Digitises Streets to Battle Google's Threat, BBC.com, [Online] http://www.bbc.co.uk/news/technology-20497719

Kharif, O. (2008) That iPhone Nano Rumour, Business Week [Online] http://www.businessweek.com/stories/2008-12-28/iphone-nano-case-unveiled-dot-dot-dot-wheres-the-iphone-nano

Maier, A., Ewing A. (2013) Nokia Siemens Said to Weigh 8,500 Job Cuts as Sales Wane, Bloomberg.com, [Online] http://www.bloomberg.com/news/2013-08-07/nokia-siemens-said-to-weigh-8-500-job-cuts-as-sales-wane.html

Manjoo, F (2013) Google, Apple, Nokia, and the Quest for the Perfect Map, fastcompany.com, [Online] http://www.fastcompany.com/3004339/google-apple-nokia-and-quest-perfect-map

Millar, M. (2013) Market for feature phone apps is low-tech goldmine, BBC.com, [Online] http://www.bbc.co.uk/news/business-22390444

Mobithinking.com (2014) Global mobile statistics 2014 Part A: Mobile subscribers; handset market share; mobile operators, [Online] http://mobithinking.com/mobile-marketing-tools/latest-mobile-stats/a#smartphone-shipments

Nokia (2012) Nokia Annual Report 2012

Nokia (2012) Nokia Annual Report on Form 20-F 2012

Nokia (2012) Nokia Siemen Networks Annual Report 2012

Nokia, (2012) Nokia sharpens strategy and provides updates to its targets and outlook, [Online] at http://press.nokia.com/2012/06/14/nokia-sharpens-strategy-and-provides-updates-to-its-targets-and-outlook/

Nokia (2013) Nokia Corproration Q4 and full year 2012 Interim Report, [Online] http://press.nokia.com/2013/01/24/nokia-corporation-q4-and-full-year-2012-interim-report/

Perez, S. (2013) Apple's App Store Hits 50 Billion Downloads, 900K Apps, $10 Billion Paid To Developers; iTunes Now With 575M Accounts, TechCrunch.com, [Online] at http://techcrunch.com/2013/06/10/apples-app-store-hits-50-billion-downloads-paid-out-10-billion-to-developers/

Savov, V. (2012) Digital ecosystems: an in-depth comparison, theverge.com, [Online] http://www.theverge.com/2012/4/18/2956951/ecosystem-comparison-amazon-apple-facebook-google-microsoft-sony

SeekingAlpha.com (2012) Nokia Management Discusses Q3 2012 Results-Earnings call transcript, [Online] http://seekingalpha.com/article/932781-nokia-management-discusses-q3-2012-results-earnings-call-transcript?page=2

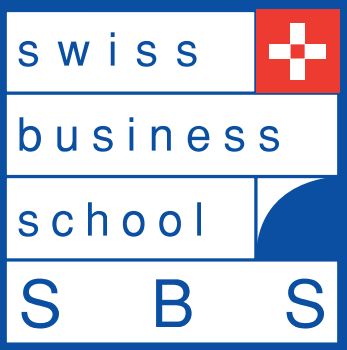
Sheed, S. (2012) Nokia face-off to the competition on Maps as Apple arrives late, WPDownUnder.com, [Online] http://www.wpdownunder.com/?p=6412

Singh, S. (2013) Nokia Q2 2013 Results: Smartphone & Feature Phone Strategy Still Unsustainable, Tech-Thought.com, [Online] at http://www.tech-thoughts.net/2013/07/nokia-smartphone-feature-phone-strategy-unsustainable.html#.Ufali7_KDzI

Stienberg, J (2013) This Is How Much Nokia Made From Patents Last Year, seekingalpha.com, [Online] http://seekingalpha.com/article/1448021-this-is-how-much-nokia-made-from-patents-last-year

Trading Economics (2014) Vietnam Population, [Online] http://www.tradingeconomics.com/vietnam/population

Zacks Equity Research (2013) Nokia Extends Feature Phone Family, Yahoo.com, [Online] at http://finance.yahoo.com/news/nokia-extends-feature-phone-family-183003184.html



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