Antecedents and Effects of Innovative Activities on Innovative Behaviours of Individuals: A Case of a South African Company

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Abstract--This case study focuses on the antecedents that are linked to individual innovative behaviour as well as the innovative activities mentioned in the innovation surveys that lead to innovation. A literature review was performed in order to determine the most recognised antecedents to innovative behaviour as well as to understand innovative activities of companies, based on innovation surveys, performed by individuals within the company. A survey was developed to collect data from a population of 263 employees, from which hierarchical multiple regression was used to analyse the relationships between the variables. It was determined that the significant antecedents to innovative behaviour of individuals' were: self-efficacy; challenging the status quo and having external work contacts. Similarly, the activities that were determined to lead to innovative behaviour of individuals were: intramural (in-house) R&D; acquisition of external knowledge and other preparations for product and process innovations. Although the results of this study are only representative of the company that was studied, and hence not generalizable, the results put forward in this case study provide a framework that is useful to other companies that are interested in nurturing innovation.

I. INTRODUCTION

Many companies understand that in order to continue to remain competitive in the global economy, they cannot continue to do things the same way that they have always been done. It is well understood that one of the key factors to remaining competitive is the ability of a company to innovate. There seems to be a lack of knowledge pertaining to the behaviours of individuals within the company that lead to the types of innovation that will significantly add to the success of the company going forward.

Innovation can apply to many facets of an organisation and can add value in the form of financial value, strategic value or even social value. It is about creating or improving products, processes or techniques that allow the organisation to differentiate it from its competitors.

There are 2 main classes of innovation, namely incremental and radical innovation. In order for a company to be successful, they need to embrace both types of innovation [1]. According to OECD/Eurostat [2]. Some of the benefits of innovation include:

- A gain in market advantage as a result of the development of a new product or process
- A reduction in production costs as a result of process improvements

- An increase in productivity which helps the company meet the market demand as well as potentially gain a cost advantage over its competitors
- Differentiation of products or services which influence the market demand
- Improvements in quality
- Improvements in efficiency

It is also important to understand that the minimum requirement for something to be seen as an innovation is that it is new to the company that is trying to innovate. This means that companies can learn and apply methods from other companies that are innovating successfully and still be deemed to be innovative [2].

Although companies are aware of the necessity of innovation, several fail to successfully drive innovation in a way that delivers innovative ideas. Some of the barriers experienced during the innovation process are:

- Difficulties in managing people's attention on the development of new ideas as opposed to protecting existing practices [3]
- Managing to get other individuals interested in converting an idea of an individual into reality as innovation usually requires a collective effort [3]
- Create a structured and continuous idea collection, enrichment and selection process [4]
- Motivate employees to participate in the innovation process [4]
- Finding ways of dealing with thousands of ideas [4]
- Obtain high quality ideas [4]
- Finding the right people to evaluate and filter out good ideas [4]
- Selecting the best ideas [4]
- Measure the performance at the fuzzy front end of innovation [4]

The goal of National Innovation Surveys is to allow companies to obtain a better understanding of the innovative climate of companies working in the same sector within the same country. Innovation surveys can help managers analyse the state of innovation, but they are not adequate to help companies understand the various behaviours and work activities, on an individual level, that are possibly linked to a better innovative capability of the company. By gaining a better understanding of the various behaviours of the individuals that are innovative and the types of activities that lead to innovation, management can consciously try and

encourage and reward these types of behaviours within employees and guide their involvement in activities, which ultimately should result in improved innovative performance of the company.

A. Research Problem statement

Surveys provide useful information for determining the innovative performance of countries, regions or companies but are not adequate to truly understand the behaviour of the individuals working within these companies. There is currently not enough in-depth research pertaining to the individual behaviours, the antecedents to these behaviours and the activities of the individuals that result in individual innovative performance. Case study based research, when performed consistently over time in similar sectors of industry, allows for the results to become more generalizable which ultimately enables companies to develop strategies for fostering innovation in the individuals working for them.

B. Research objectives

The objective of this research study is to do an in-depth case study of a South African company where the behaviours and activities, linked to innovation, of individuals are considered. This will help obtain a better understanding of the types of behaviours and activities that result in innovative behaviour of individuals, which can result in greater realisation of innovation within the company.

This research would need to answer the following questions in order to meet its objectives:

- *Which antecedents of individual innovative behaviour influence the innovative behaviour of an individual within a company?*
- *Which innovation activities influence the innovative behaviour of an individual within a company?*

II. THEORETICAL FRAMEWORK

In order to answer the questions posed in section II.B, one needs to obtain a better understanding of individual innovative behaviour, antecedents that potentially lead to individual innovative behaviour as well as the activities that are undertaken by companies, and therefore individuals, that lead to individual innovative behaviour.

A. Understanding Individual innovative behaviour:

Individual innovative behaviour, often referred to in other texts as innovative work behaviour, refers to the contributions of individuals in terms of developing innovations and therefore encompasses any work activities that are carried out by the individuals in relation to the development of innovation [5]. In order for a company to become more innovative, they need to capitalise on the ability of their employees to innovate [6], since it is the characteristics and behaviours of people in organisations that are at the core of organisational innovation [7].

De Jong and Den Hartog suggest that individual behaviours relating to innovation form part of an innovation process, namely the process of initiating an innovation and ultimately the implementation phase of the innovative process. Scott and Bruce [8] take it a step further. They additionally break up the initiating and implementation components of the innovation process and refer to innovation as rather a four stage process. During this process, an individual has to undergo a variety of activities which would require different individual behaviours at the different stages. These stages can be summarised as; opportunity exploration, idea generation, idea promotion and idea realisation [5], [9], [10]. It is proposed that the stages representing innovative behaviour are heavily reliant on the initial stage of opportunity exploration being undertaken by an individual. It is therefore suggested that there is a strong link between the individual being involved in innovative activities, and hence having the chance to explore opportunities to innovate. As a result, one can argue that opportunity exploration can be removed from individual innovative behaviour and rather forms part of the activities that need to be undertaken by individuals.

B. Understanding the Antecedents to innovative behaviour:

Anderson et al. [11] suggest that in terms of the innovation of individuals, there are certain characteristics that will have an impact on the innovative behaviour of the individual. These characteristics include personality traits (how individuals act and think), motivation (what individuals want to do), cognitive ability (the ways in which individuals learn, remember, problem solve and pay attention) and job characteristics (specific job aspects such as knowledge, skills, demands and working conditions) which all have an impact on whether an individual will engage in innovative behaviour.

Due to the limited timeframe available, it is necessary to only consider the characteristics that have a large influence on individual innovative behaviour based on the outcomes of past research. The key antecedents used in the study are:

- **Self-efficacy** - one's belief in their capability to perform a given task under a variety of circumstances [12].
- **Openness to experience** - is associated with new ways of thinking and embracing change, as individuals with this trait are willing to entertain novel ideas and unconventional values. Some of the characteristics that are used to depict openness include; imaginative, original, flexible and unconventional [13].
- **Challenge the status quo / Proactivity / Taking charge** - could entail a differing of opinion on how things are done and the want to effect a functional change with respect to the ways that work is executed.
- **Intrinsic motivation -** defined as any type of motivation that comes from an individual's positive reaction to a task as opposed to the individual being motivated from some form of external source [14].

- **Divergent thinking style / Problem-solving style -** refers to the way in which an individual likes to solve problems and how they react to a problem in differing contexts. Individuals that are able to take information that has been learnt from multiple domains have a problem solving style that is characterised by novel approaches and are more likely to produce more innovative solutions

- **Autonomy -** defined as the extent to which individuals are given freedom to carry out tasks without excessive supervision. Individuals will be more inclined to innovate when they are given a sufficient amount of control over their work [15].

- **External work contacts -** Individuals that have and are able to maintain external work contacts by meeting with customers, suppliers, competitors, as well as attending conferences, training courses or being involved in collaboration projects with other companies are more likely to be involved in innovation as it stimulates incremental improvements by the individual [15].

C. Understanding the Activities relating to innovative behaviour:

The activities represent a starting point i.e. they enhance the opportunity exploration stage which will need to occur before the individual goes through the remaining stages of idea generation, idea promotion and finally idea realisation. Since the activities form a crucial component of the research, all individual innovation activities listed below, taken from the metrics of innovation surveys, were considered:

Research and Experimental Development:
- **Intramural (in-house) R&D** – "Creative work undertaken on a systematic basis within the enterprise in order to increase the stock of knowledge and use it to devise new applications. This comprises all R&D conducted by the enterprise, including basic research." [2]

- **Acquisition of extramural R&D** – "Same activities as intramural R&D, but purchased from public or private research organisations or from other enterprises (including other enterprises within the group)." [2]

Activities for product and process innovations:
- **Acquisition of other external knowledge** – "Acquisition of rights to use patents and non-patented inventions, trademarks, know-how and other types of knowledge from other enterprises and institutions such as universities and government research institutions, other than R&D." [2]

- **Acquisition of machinery, equipment and other capital goods** – "Acquisition of advanced machinery, equipment, computer hardware or software, and land and buildings (including major improvements, modifications and

repairs), that are required to implement product or process innovations. Acquisition of capital goods that is included in intramural R&D activities is excluded." [2]

- **Other preparations for product and process innovations** – "Other activities related to the development and implementation of product and process innovations, such as design, planning and testing for new products (goods and services), production processes, and delivery methods that are not already included in R&D." [2]

- **Market preparations for product innovations** – "Activities aimed at the market introduction of new or significantly improved goods or services." [2]

- **Training** – "Training (including external training) linked to the development of product or process innovations and their implementation." [2]

Activities for marketing and organisational innovations:
- **Preparations for marketing innovations** – "Activities related to the development and implementation of new marketing methods. Includes acquisition of other external knowledge and other capital goods that is specifically related to marketing innovations." [2]

- **Preparations for organisational innovations** – "Activities undertaken for the planning and implementation of new organisation methods. Includes acquisition of other external knowledge and other capital goods that is specifically related to organisational innovations." [2]

III. CONCEPTUAL MODEL

The model presented in Fig. 1 suggests that there is a positive link between the antecedents to innovative behaviour to individual innovative behaviour as well as a positive link between the individual being involved in innovative activities and the individual's innovative behaviour. As can be seen in the model, the opportunity exploration stage forms part of the activities that individuals are involved in. It can be argued that the working environment influences the opportunity for an individual to explore ideas as the activities that individuals are involved in are closely tied to their job requirements.

Table 1 details the various main hypotheses to be tested based on the relationships between (1) the innovative activities of individuals and their innovative behaviour and (2) the antecedents and the innovative behaviour of individuals. The last hypothesis is added to further investigate the impact of innovative activities on innovative behaviour in South African context. It is shown in the previous South African innovation survey that companies conduct very limited innovation activities as compared to developed countries [16].
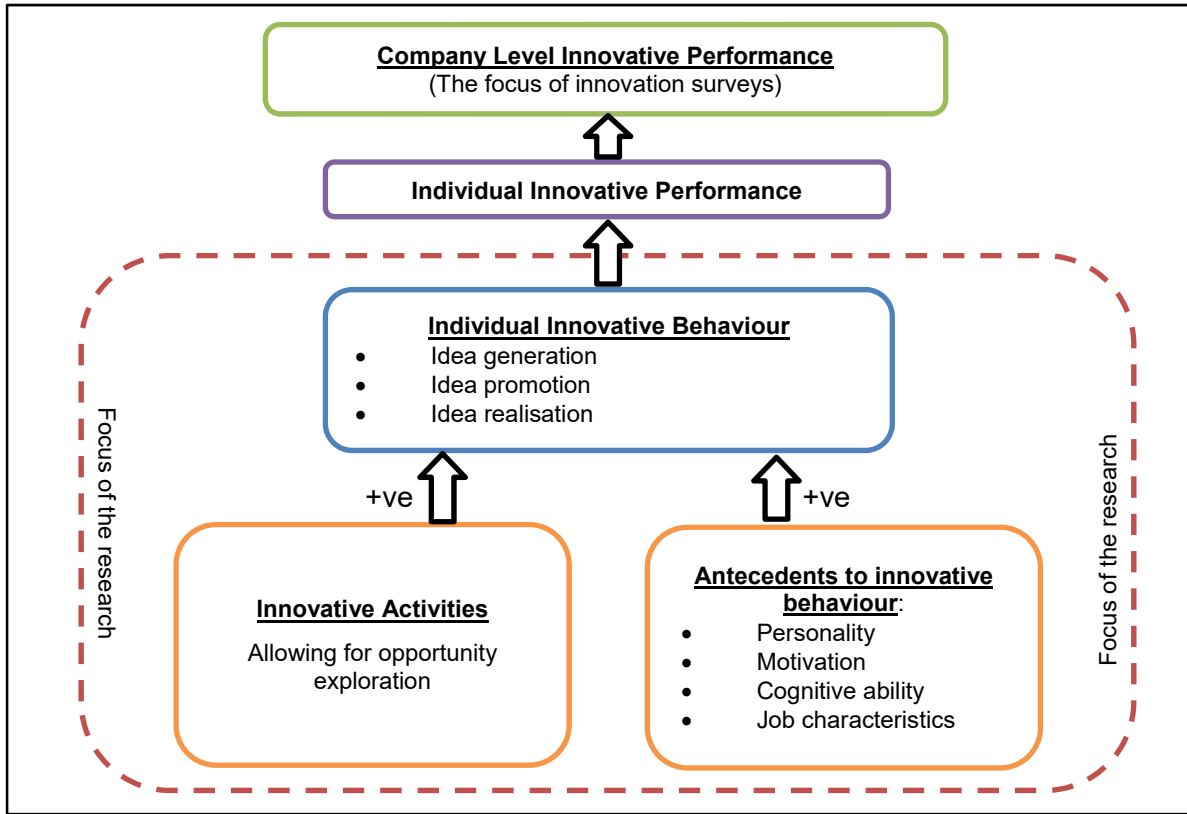
Figure 1: Conceptual model and integrated framework

TABLE 1: HYPOTHESES TO BE TESTED

No.	Hypothesis	Characteristics
H_1	Individuals with high self-efficacy show higher innovative work behaviour	Antecedent - Personality
H_2	Individuals that demonstrate openness to experience show higher innovative work behaviour	
H_3	Individuals that challenge the status quo show higher innovative work behaviour	
H_4	Individuals that are intrinsically motivated show higher innovative work behaviour	Antecedent - Motivation
H_5	Individuals that like to solved problems by generating creative solutions show higher innovative work behaviour	Antecedent - Cognitive Ability
H_6	Individuals that have autonomy to carry out tasks without supervision show higher innovative work behaviour	Antecedent - Job Characteristics
H_7	Individuals that interact with individuals from outside of the organisation show higher innovative work behaviour	
H_8	Individuals involved in internal R&D activities show higher innovative work behaviour	Innovation Activities
H_9	Individuals involved in the acquisition of extramural R&D show higher innovative work behaviour	
H_{10}	Individuals that are involved in the acquisition of external knowledge show higher innovative work behaviour	
H_{11}	Individuals that are involved in the acquisition of equipment and machinery show higher innovative work behaviour	
H_{12}	Individuals that are involved in the market preparations for product and process innovation show higher innovative work behaviour	
H_{13}	Individuals that train or are involved in the acquisition of training show higher innovative work behaviour	
H_{14}	Individuals involved in creating procedures or technical preparations show higher innovative work behaviour	
H_{15}	As compared to antecedents, innovation activities show less impact on innovative work behaviour.	For South African context

IV. RESEARCH METHOD OR APPROACH

A non-experimental, case study which utilises a questionnaire survey (quantitative), interviews (qualitative) and company data for primary, secondary and tertiary sources for data collection respectively was chosen as the research method. This process of utilising multiple sources of data as evidence to back up conclusions is referred to as triangulation.

A survey was chosen as the primary source for data collection as it allows for large amounts of data to be collected in the relatively short timeframe that is available during the study. The data collected in the survey allows for correlation analysis as well as regression analysis to be performed in order to determine if relationships exist between the dependent and independent variables.

Since the survey would be presented to all individuals working for the company, it was important that the questions were not ambiguous. As a result, it was necessary to run a pilot test of the questionnaire to establish the validity and reliability of the results.

Innovative work behaviour is relevant to all individuals within the company; therefore participation in the survey was not restricted to employees of specific departments. There are various divisions in the company, and all divisions are involved in some form of activity that could result in innovative outcomes. The company has 350 employees which includes the members of staff that work at the various branches throughout the world. The majority of the branches are located in South Africa with the other 2 branches located in Australia and Nigeria. Most of the employees are located at the head office; where the design, procurement of raw materials and manufacturing takes place, so for the purposes of the study only the staff at the head office will be involved.

The difficulty with choosing a population that includes all employees working at the head office branch is that the survey questions presented will need to be clearly understood by individuals with various levels of education within the company.

As there are 263 employees working at the head office branch, a sample size of just over 155 employees would need to be obtained for a confidence level of 95% with a 5% precision.

The survey was presented in the form of an online survey as this was deemed to be one of the fastest ways to collect and collate data.

Multi-item scales were composed from various sources that found positive correlations with the antecedents to innovative behaviour and the actual innovative behaviour of the individual in order to measure the various constructs. It was important that the measures were taken from well cited literature that was most relevant (and most recent if possible) for this study on innovative behaviour. Multi-item scales were also developed for the activities. These measures were developed by taking the items listed in the innovation surveys and creating constructs that rather relate to the individual performing the activity (Table 8 in appendix).

V. RESULTS

IBM's SPSS Statistics tool was utilised to carry out the statistical analysis of the survey results. After distributing the survey and collecting responses, a total of 197 surveys were filled in by the employees. 170 valid surveys were obtained for analysis as in some cases the respondents did not complete the full survey, which meant that these 27 responses had to be rejected from the study.

A. Reliability test

Cronbach's Alpha was determined for each variable to ensure that it falls within an acceptable level of reliability. Table 2 details the Cronbach's Alpha for the various variables in the study.

B. Descriptive statistics on demographic data

Before taking an in-depth look at the results of the survey, it is necessary to consider the categorical data in order to ensure that there are no obvious biases in the demographics of the individuals that took part in the survey. Although the results of the study are specific to the company, the results can be skewed or biased based on the sample collected.

TABLE 2: RELIABILITY - CRONBACH'S ALPHA

Variable	Cronbach's Alpha in this study
Self-efficacy	0.868
Openness to experience	0.749
Challenge the status quo	0.885
Intrinsic motivation	0.850
Divergent thinking style / Problem-solving style	0.556[1]
Autonomy	0.771
External work contacts	0.805
Involvement in innovative activities	0.888[2]
Individual innovative behaviour	0.937

[1] When analysing the reliability of the questions posed for Divergent thinking style / Problem-solving style, the overall Cronbach's Alpha with all items included was determined to be 0.422. By excluding the item "I like tasks that require little thought once I have learned them" resulted in Cronbach's Alpha of 0.556; thus improving the reliability of the items measuring this variable.

[2] The innovative activities section of the survey included 11 questions pertaining to the employee's involvement in various activities at work. These questions were in order to determine the Cronbach's Alpha for these categories.

TABLE 3: FREQUENCY COUNTS OF THE DEMOGRAPHIC DATA

Measure	Information	Comment
Gender	59% male & 41% female	No obvious bias
Age	60% aged 25 – 44	No obvious bias, follows distribution similar to that of the South African working population
Highest level of education	35% graduated from high school 28% postgraduate diploma	Expected outcome based on the skill requirements of a manufacturing company
Department	35% in Product Assembly Remainder fairly evenly spread in other departments	Can have a major impact on the results of the study as these individuals are not necessarily exposed to the innovation activities listed
Work experience	24% less than 5 years 32% 5 to 10 years	A large majority of the staff has more than 5 years working experience, this increases the probability of them having been exposed to innovation at some point in their careers

C. Descriptive statistics of independent and dependent variables

Table 4 details the results of the analysis and as can be seen in the data, the standard deviations for all variables were relatively low when compared to the mean. There are some measurements that are worth noting:

- The three highest means measured were for intrinsic motivation, divergent thinking style / Problem solving style and Openness to experience respectively. All of these variables are linked to antecedents rather than innovative activities.
- The standard deviations were lower for all antecedents when compared to the innovative activities.

TABLE 4: MEANS & STANDARD DEVIATIONS (N = 170)

	Mean	Standard Deviation
Innovative Behaviour	2.79	1.02
Intramural (in-house) R&D	3.15	1.15
Acquisition of extramural R&D	1.86	1.11
Acquisition of machinery, equipment & other capital goods	1.68	1.08
Acquisition of other external knowledge	2.15	1.28
Training	2.30	1.13
Market preparations for product innovations	2.22	1.26
Other preparations for product and process innovations	2.14	1.38
Self-efficacy	3.70	0.66
Openness to experience	3.95	0.69
Challenge the status quo	3.66	0.71
Intrinsic motivation	4.02	0.96
Divergent thinking style / Problem solving style	3.99	0.60
Autonomy	3.90	0.97
External work contacts	2.03	0.95

TABLE 5: CORRELATIONS AMONG VARIABLES (N=170)

Variables	1	2	3	4	5	6	7	8	9	10	11
1. Innovative behaviours	1.000										
2. Age	-0.100	1.000									
3. Work experience	0.103	0.737**	1.000								
4. Self-efficacy	0.641**	-0.282**	-0.132*	1.000							
5. Openness	0.321**	-0.358**	-0.343**	0.529**	1.000						
6. Challenge	0.671**	-0.143*	0.068	0.647**	0.435**	1.000					
7. Intrinsic motivation	0.196**	-0.007	-0.007	0.316**	0.265**	0.314**	1.000				
8. Divergent thinking	0.398**	-0.159*	-0.103	0.610**	0.504**	0.404**	0.260**	1.000			
9. Autonomy	0.308**	0.139*	0.260**	0.337**	0.092	0.403**	0.238**	0.141*	1.000		
10. External contacts	0.427**	-0.026	0.266**	0.352**	-0.016	0.363**	0.073	0.145*	0.334**	1.000	
11. Innovative activities	0.635**	-0.090	0.124	0.472**	0.145*	0.534**	0.217*	0.320**	0.254**	0.514**	1.000

*: $p < 0.05$
**: $p < 0.01$

D. Correlation Analysis

Correlation analysis was performed in order to determine if there are relationships between the variables used in the study. Table 5 details the results of the analysis showing the correlation coefficient between the variables.

- Self-efficacy has a positive and significant linear relationship with innovative behaviour (r=0.641)
- Challenge the status quo has a positive and significant linear relationship with innovative behaviour (r=0.671)
- Innovative activities have a positive and significant linear relationship with innovative behaviours (r=0.635)

E. Regression Analysis

Regression analysis is a statistical technique for exploring the relationships between dependant variables and independent variables. In this study, the conceptual framework focuses on the relationships between (1) the innovative activities of individuals and their innovative behaviour and (2) the antecedents and the innovative behaviour of individuals. In order to determine the strength of the relationship (and its significance), one approach is to apply hierarchical multiple regression to test and analyse various models to better understand the relationships between the control, independent and dependent variables. Although the conceptual framework focuses specifically on the relationships between innovative behaviours with innovative activities and antecedents to innovative behaviour, other studies were created to analyse additional relationships that may exist in the data. These alternate studies help in analysing the managerial implications in the idea generation, idea promotion and idea realisation stages of innovative behaviour.

Each analysis firstly looks at the effect of the control variables on innovative behaviour. The second and sometimes the third component of the study then considers the addition of the variables we are interested in and the change in the explanation of the variation in the individuals' innovative behaviour.

1) Activities and Innovative behaviour:

For the relationship between innovative behaviour and innovative activities, the results of the hierarchical multiple regressions show that the control variables affect the innovative work behaviour to a significant degree and explain 15.4% of the variation in individuals' innovative behaviour. When adding the activities to the analysis, the F-value is still significant showing a well-fitting regression model. The added variables along with the control variables now explain 48.0% of the variation in individuals' innovative behaviour. The addition of the activities in the model added 32.6% to the explanation of the variance in the dependent variable and the change of the F-value (Δ F-value) indicates a significant improvement in the model. Looking closer at the activity variables, the activities that explain most of the variation in individuals' innovative behaviour were intramural (in-house)

R&D activities (β=0.327, p<0.01) and other preparations for product and process innovations (β=0.263, p<0.01).

2) Antecedents and Innovative behaviour:

For the relationship between innovative behaviour and the antecedents to innovative behaviour, three models were developed and evaluated. The first model looks at the relationship between the control variables and innovative behaviour. In the second model; self-efficacy, openness to experience, challenge the status quo and divergent thinking style were added to the analysis, which the author believes are inherent personality traits that are not easily altered or influenced by the working environment, but can be encouraged through management style. In the final model; intrinsic motivation, autonomy and external work contacts are introduced. The author feels that these remaining antecedents can be altered depending on how the manager sets out the specific job requirements.

Since the control variables are the same for both antecedents to innovative behaviour and innovative activities, the result stays the same. When adding the antecedents relating to personality traits, the F-value is still significant showing a well-fitted regression model. The added variables along with the control variables now explain 55.7% of the variation in individuals' innovative behaviour. The addition of the antecedents in the model added 40.4% to the explanation of the variance in the dependent variable and the change of the F-value (Δ F-value) indicates a significant improvement in the model. Looking closer at the antecedent variables, the antecedents that explain most of the variation in the individuals' innovative behaviour were Self-efficacy (β=0.385; p<0.01) and Challenge the status quo (β=0.392; p<0.01). Finally, the antecedents that are believed to be influenced by management style and job characteristics were included. These antecedents do not have a significant effect on individuals' innovative behaviour and only added 1% to the explanation of the variance in the dependent variable in the model.

3) Other meaningful relationships

In the conceptual model presented in Figure 1, individual innovative behaviour consisted of three stages, namely; Idea Generation, Idea Promotion and Idea Realisation. In order to determine and understand the relationships between (1) the innovative activities of individuals and idea generation, idea promotion and idea realisation and (2) the antecedents and idea generation, idea promotion and idea realisation, various models were developed and hierarchical multiple regressions were performed.

Idea Generation:

The activities that explain most of the variations in the idea generation stage were intramural (in-house) R&D activities (β=0.402; p<0.01), acquisition of other external knowledge (β=0.140; p<0.05) and other preparations for product and process innovations (β=0.208; p<0.01).

The antecedents that explain most of the variations in the idea generation stage were self-efficacy (β=0.197; p<0.05), challenge the status quo (β=0.395; p<0.01) and external work contacts (β=0.152; p<0.05).

Idea Promotion:

The activities that explain most of the variations in the idea promotion stage were intramural (in-house) R&D activities (β=0.184; p<0.1), training (β=0.145; p<0.1) and other preparations for product and process innovations (β=0.213; p<0.05).

The antecedents that explain most of the variations in the idea promotion stage were self-efficacy (β=0.339; p<0.01), challenge the status quo (β=0.356; p<0.01) and external work contacts (β=0.138; p<0.1).

Idea Realisation:

The activities that explain most of the variations in the idea generation stage were intramural (in-house) R&D activities (β=0.298; p<0.01) and other preparations for product and process innovations (β=0.289; p<0.01).

The antecedents that explain most of the variations in the idea realisation stage were self-efficacy (β=0.436; p<0.01) and challenge the status quo (β=0.309; p<0.01).

F. Hypothesis testing

The results of the analysis help to determine whether the hypotheses that were presented in Table 6 can be supported or rejected based on the significance of the beta value associated with each independent variable.

VI. CONCLUSIONS AND RECOMMENDATIONS

The goal of this study was to obtain a greater understanding of the antecedents to innovative behaviour (personality traits) and innovative activities that lead to greater individual innovative behaviour, as it is the individuals within the companies that have the necessary traits that lead to innovation and actually perform the activities that lead to innovation.

Looking at the significant activities and antecedents that result in individual innovative behaviour, it implies, in this particular case that in order for the company to be more innovative managers would need to cultivate these traits within employees or similarly ensure that employees are involved, to some extent, in the activities that result in innovative behaviour.

When considering the activities that employees are involved in, the manager has a direct influence in the employees' involvement. This suggests that in order to increase individual innovative behaviour, the manager needs to involve the employees in activities that are significantly related to innovative behaviour.

TABLE 6: RESULTS OF THE HYPOTHESIS TESTING

No.	Hypothesis	Standardised beta coefficient (significance)	Hypothesis
H_1	Individuals with high self-efficacy show higher innovative work behaviour.	0.361***	Supported
H_2	Individuals that demonstrate openness to experience show higher innovative work behaviour	-0.017 (p=0.814)	Rejected
H_3	Individuals that challenge the status quo show higher innovative work behaviour	0.389***	Supported
H_4	Individuals that are intrinsically motivated show higher innovative work behaviour	-0.037 (p=0.539)	Rejected
H_5	Individuals that like to solved problems by generating creative solutions show higher innovative work behaviour	-0.007 (p=0.927)	Rejected
H_6	Individuals that have autonomy to carry out tasks without supervision show higher innovative work behaviour	-0.031 (p=0.621)	Rejected
H_7	Individuals that interact with individuals from outside of the organisation show higher innovative work behaviour	0.123*	Supported
H_8	Individuals involved in internal R&D activities show higher innovative work behaviour	0.327***	Supported
H_9	Individuals involved in the acquisition of extramural R&D show higher innovative work behaviour	-0.001 (p=0.993)	Rejected
H_{10}	Individuals that are involved in the acquisition of external knowledge show higher innovative work behaviour	0.134*	Supported
H_{11}	Individuals that are involved in the acquisition of equipment and machinery show higher innovative work behaviour	-0.091 (p=0.226)	Rejected
H_{12}	Individuals that are involved in the market preparations for product and process innovation show higher innovative work behaviour	0.048 (p=0.579)	Rejected
H_{13}	Individuals that train or are involved in the acquisition of training show higher innovative work behaviour	0.086 (p=0.257)	Rejected
H_{14}	Individuals involved in creating procedures or technical preparations show higher innovative work behaviour	0.263***	Supported
H_{15}	As compared to antecedents, innovation activities show less impact on innovative work behaviour.	-	Rejected

*: p<0.1; **: p<0.05; ***: p<0.01

A. Focus on Activities

1) Intramural (In-House) R&D

Based on the results of the study, intramural (in-house) R&D is significantly related to individual innovative behaviour. The following questions were presented to the respondents of the survey that were considered to be linked to intramural R&D:

> *"Part of my job involves doing research so that I can develop better products or processes."*

This implies that managers need to encourage employees to research topics that affect their working environment or the jobs that they perform. By being more in tune with new technologies that can be used in innovative ways, the ways things are done by other companies, as well as having a greater understanding of the way the world is changing, employees will be more empowered to make meaningful suggestions to improve products or processes in their direct line of work.

The following questions focus specifically on the manager involving employees in the innovation process:

> *"I am asked to contribute ideas that could lead to new innovative products being developed."*
> *"I am asked to contribute ideas that could lead to significant improvements in processes."*

This means that employees do not necessarily think about innovation in the working environment and may need to be encouraged. It suggests that in order to obtain innovative ideas from employees, managers are required to continuously ask employees to be aware and look for things around them that could be improved, even if they are only incremental improvements. Many employees may feel that their innovations are only worthwhile if they are radical innovations, but it is up to the manager to push for any type of innovation that adds value to the company. This may involve the manager having to keep asking questions and posing challenges to the employees to think of alternative ways of doing things.

2) Other preparations for product and process innovations

The activity of other preparations for product and process innovations was based on a stand-alone question in the survey:

> *"I am involved in creating procedures or technical preparations, including design, to implement new or significantly improved products and processes that are not covered in the items above"*

As there were a fixed number of questions relating to the innovation activities, this question allowed for employees that felt that they were involved in innovation, even to a small extent, to be able to indicate how often they were involved in such activities. The author believes that this question is significant as the other activities are largely aimed at personnel in administrative positions. Since 35% of the sample population consisted of product assembly workers, this was most likely the activity that they could relate to. In particular, the production assembly workers, and possibly others, may have interpreted the question to relate to any type of incremental innovation. In order to validate the assumption, select respondents were asked about what they interpreted the question to mean. The response from the select sample confirmed that the majority of employees felt that they are not necessarily involved in the other innovative activities mentioned, but felt that they are certainly involved in innovative activities. They argued that the question posed above covered the remainder of activities undertaken by them that they considered to lead to innovation even if these innovations were only regarded as incremental innovations.

3) Acquisition of other external knowledge

Specific job requirements also have an influence on the likelihood that individuals' would have the opportunity to interact with individuals from outside of the organisation i.e. be involved in the activity of acquisition of external knowledge. In order to improve innovative behaviour, managers need to involve the employees in the activity of acquisition of external knowledge. They should create opportunities for employees to attend conferences, encourage employees to visit suppliers as well as encourage employees to interact with customers, therefore creating the opportunity for the employee to bring new knowledge into the organisation.

B. Focus on Antecedents

Additionally, the manager also needs to consider the effect that they can have on the way individuals perform when it comes to innovation. Some of the actions of employees can be influenced by the corporate culture or the personality traits of the individual themselves. What is important is for the manager to create a working environment where these traits can be expressed and improved upon.

1) Self-efficacy

Self-efficacy has been linked with individual innovative behaviour in a variety of studies and it is therefore not surprising that the relationship between self-efficacy and individual innovative behaviour is significant in this case study. Having determined that self-efficacy is significant, it is worth considering the managerial implications on how to increase the self-efficacy of employees. Dörner [9] suggests that leaders can increase the self-efficacy of employees through persuasion. She suggests that this can be achieved by communicating high performance expectations to the employees while at the same time expressing confidence in the employees' ability to do the task. Managers can also provide continuous positive feedback to employees on innovative acts which helps strengthen the employees own belief in their abilities.

2) Challenge the Status Quo

When considering the antecedent of challenging the status quo, it has been mentioned that this is most likely an inherent personality trait and can be difficult to change. Morrison and Phelps [17] looked at the factors that enable or motivate an employee to take charge (challenge the status quo) and in their study they determined that one of the significant factors affecting taking charge was that of the openness of management to employee suggestions as well as employee initiated change. Therefore, the manager must create a team environment where the employees are encouraged to openly express opinions as well as question how and why things are done in certain ways. Morrison and Phelps [17] suggest that felt responsibility has been shown as a predictor to taking charge. This implies that individuals that are encouraged to take ownership of their work are also more likely to challenge the status quo as they may feel that there are better ways of achieving a result than the way it has always been done.

3) External work contacts

The final antecedent that was significantly related to individual innovative behaviour related to the external work contacts of an employee. This may be regarded as very similar to the activity of acquisition of other external knowledge, but is more aligned with the personal characteristics of the individual in the sense that they actively seek out interaction with external sources. These interactions expose the employee to diverse views and provide them with opportunities to learn from others by observing how other individuals approach and solve problems. Similar to the suggestions for the activity of acquisition of other external knowledge, management needs to create opportunities for employees to interact with individuals from outside of the organisation. This helps the employee to become more exposed to what is happening within the industry and encourages them to stay abreast with opportunities and threats within the industry.

C. Managerial implications at the various stages

When considering the activity involvement of the individual at the idea generation stage, the activities of intramural (in-house) R&D, acquisition of other external knowledge as well as other preparations for product and process innovations tie up with the overall model. This indicates that the idea generation stage ties up very closely with the overall model, so if one was to concentrate on the overall model, one could expect to get a lot of ideas from employees within the organisation.

In the idea promotion stage, it can be seen that the antecedents that are the most significant in relation to individual innovative behaviour are; self-efficacy, challenging the status quo and external work contacts. This aligns with the overall model as well as the idea generation stage. It is important to note that the significance of the external work contacts is lower than that in the idea generation stage. Self-efficacy is very significant in this stage and makes sense as the individual trying to promote his or her idea would need to have a strong belief in their abilities and hence the confidence to gather support for their ideas. When considering the significant activities that are related to the idea promotion stage, it can be seen that training becomes significant. Individuals that are well versed at transferring knowledge to others, i.e. trainers, are better equipped to communicate ideas and are able explain ideas to others in such a way that it is easily understood. This enables these individuals to better campaign for support of the innovation and is therefore an important activity in the idea promotion stage. Managers need to encourage employees' to be involved in the training of staff as this exposes them to the skills that are necessary to effectively get ideas across to others, which ultimately will influence their ability to gain support for their innovations.

The idea realisation stage requires the ability of an individual to be able to produce some form of model or prototype to test the viability of the innovation. Since this final stage can require a lot of skill and effort, it is not surprising that self-efficacy and challenging the status quo are significant. Managers need to utilise individuals that believe in their abilities to develop conceptual models or prototypes that prove that the innovation could work. This stage also requires individuals that are willing to challenge the status quo by looking at better ways of achieving a result. Therefore, managers need to encourage employees to look for alternative ways of solving problems when faced with challenges i.e. not give up when the first attempt to solve the problem does not work. Managers need to create an environment where there is an acceptance to the possibility of failure, but the manager must encourage the employee to learn from the failure and think of alternative solutions to the problem. When considering the activities that are significant in this stage, it is not unexpected that the activity of intramural (in-house) R&D becomes significant. Individuals that are most likely to have the skills necessary to develop prototypes and conceptual models are likely to be involved in activities relating to research and development. It must be noted that not all innovations are product related; therefore one would expect the activity of other preparations for product and process innovations to also be significant in this stage of the process.

D. Limitations and recommendations for future study

Although this case study does not close the link between individual innovative behaviours and the innovative performance of a company, it looks at the foundation that is the individual. It is understood that the results of this study cannot be generalised for other companies, but the methods employed in this research provide a framework that can be utilised by other organisations to get a better understanding of the antecedents and activities that lead to individual innovative behaviour within their particular context. The information from research based on the framework presented, provides a guideline for managers looking to improve on the innovative behaviour of individuals working for a company

as well as highlight the necessary traits required of potential hires that are likely to generate innovative ideas for the company.

Furthermore, the study does not close the link between individual innovative behaviour and the actual innovative performance of an individual. In the framework presented, it has been suggested that there is possibly a link between individual innovative behaviour and individual innovative performance. As such, as far as this study tries to determine the antecedents and activities that are necessary to improve on individual innovative behaviour, one needs to find a link between the innovative behaviours of individuals and their measurable innovative performance. This is necessary as it is further suggested that there is a link between the individual innovative performance of individuals working within a company and the innovative performance of a company.

The antecedents found in the literature reflect what the other researchers in other developed countries have found, however, it is shown in this study where a case is used in an developing country, the following antecedents are not supported: openness, intrinsic motivation, problem solving and autonomy. These may reflect to the unique South African culture which can be investigated further. Moreover, other factors that may influence a person's innovative behaviour (such as the innovation influencers in the company) are not included in the research framework. Future studies should provide a more comprehensive list of antecedents or factors from the literature.

Finally, the results obtained in this study represent a snapshot of the significant antecedents and activities that lead to individual innovative behaviour for a particular South African company. In order to gain more insight into the activities and antecedents to individual innovative behaviour, similar studies need to be performed in other companies. This will provide researchers with information relating to a number of companies and this data can be used to determine if there are any similarities between companies working in a similar industry.

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APPENDICES

TABLE 7: SUMMARY OF STUDY RESULTS

*: p<0.1   **: p<0.05   ***: p<0.01

TABLE 8: SUMMARY OF CHOSEN VARIABLES WITH MEASUREMENT CRITERIA

Independent Variables	Item(s)	Source and Cronbach's α
Self-efficacy	• I feel that I am good at generating original ideas. • I have confidence in my ability to solve problems creatively. • I have a knack for further developing the ideas of others. • I have a knack for making others enthusiastic for new ideas. • I have confidence in my ability to convince others of the benefit of new ideas. • I have the social contacts needed to find backers for realizing new ideas. I have confidence in my ability to implement new methods at work. • I have confidence in my ability to implement new products at work. • I feel that I am good at adopting new methods at work. • I feel that I am good at adopting new products at work.	Dörner [9] α = 0.85
Openness to experience	• I am always open to new experiences. • I am a very complex person. • I am very creative. • I am very imaginative.	Gosling et al. [18] α = 0.68
Challenge the status quo	• I often try to adopt improved procedures for doing my job • I often try to change how my job is executed in order to be more effective. • I often try to bring about improved procedures for the work unit or department. • I often try to institute new work methods that are more effective for the company. • I often try to change organizational rules or policies that are non-productive or counterproductive. • I often make constructive suggestions for improving how things operate within the organization. • I often try to correct a faulty procedure or practice. • I often try to eliminate redundant or unnecessary procedures. • I often try to implement solutions to pressing organizational problems. • I often try to introduce new structures, technologies, or approaches to improve efficiency.	Morrison and Phelps [17] α = 0.92
Intrinsic motivation	• Doing this job gives me pleasure • If I started over, I would still choose to do the kind of work I am doing now • My job is one of the parts of my life that gives me more satisfaction	Coelho et al. [19] α = 0.85

Note: All items in the table use 5 point Likert scale: 1 = strongly disagree to 5 = strongly agree.