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DETERMINANTS OF QUALITY MANAGEMENT PRACTICES IN STIMULATING PRODUCT AND PROCESS INNOVATIONS

Abstract: *Research highlights Quality Management System (QMS) has now become a recognizable guarantee of trust in certified business systems. A critical review of the literature reveals that empirical studies conducted to date have yielded conflicting findings on the relationship between quality management practices and innovation. This study empirically investigates how quality management principles may act as determinants of product and process innovations. The results show that customer focus and leadership explain a significant amount of product innovation, but not process innovation. Empirical support also finds that people management explains a significant amount of variance in both product innovation and process innovation. The findings highlight the importance of developing formal organisational mechanisms to measure levels of such quality determinants as they are easily overlooked or taken for granted. Moreover, firms need to recognise that innovation is a multi-faceted concept that can be controlled from a process or a product perspective, a distinction which is sometimes blurred.*

Keywords: *Innovation, product innovation, process innovation, quality management, ISO certification*

1. Introduction

The globalisation of economies has altered the business landscape which is now characterised by rapid changes and uncertainty that have compelled firms to look beyond traditional models of management (Crossan and Apaydin, 2010; Wales, 2015). This changing landscape has resulted in firms recognising the need for integrating quality and innovative strategies to satisfy customers demanding higher-quality products at competitive costs (Damanpour and Aravind, 2012; Kajalo et al., 2016). Researchers note that firms in the 21st century need to constantly innovate and become robust and dynamic to keep abreast with technological changes and hyper-competition (Crossan and Apaydin, 2010; Damanpour and Aravind, 2012; Urban and Greyling, 2015).

A critical review of the literature reveals that research findings emphasize that the twin concepts of quality and innovation constitute the core of strategic management practices which have become the guiding principles for what is known as 'management excellence' (Bon and Mustafa, 2013;

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Fernandes and Lourenço, 2011; Baronien and Neverauskas, 2005). Various formulations and models are prevalent in the literature which organisations can follow to obtain management excellence, these include amongst others, the Malcolm Baldrige Criteria for Performance Excellence, the European Foundation for Quality Management, and the International Organisation for Standards (ISO) quality management standards (Fonseca, 2015; Hoyle, 2012; Manders et al., 2016). ISO 9000 certification provides the building blocks for successful and effective quality management practices and implementation (Gotzamani and Tsiotras, 2001; Trivellas and Santouridis, 2009). By adopting these standards, firms and their customers can be assured that their quality programmes are built on solid foundations where accredited national public or private bodies (Pekovic and Galia, 2009) ascertain the implementation process through a voluntary certification process administered. ISO 9001 has been implemented by over one million organisations in 187 countries worldwide (Manders et al., 2016).

It is widely acknowledged that the modern-day approach to quality improvements has its roots in Japan, from which their firms have drawn strong competitive advantage, especially in the automotive industry (Cole and Matsumiya, 2007). Quality Management System (QMS) has now become a recognizable guarantee of trust in certified business system. Standard ISO 9004 directs a business system to sustainable success which is based on endeavours for constant improvements, learning and innovations. The prerequisite for this is that the quality management system implemented on the basis of measure, and that the mechanisms for continuous testing and review are constantly promoted. A positive correlation between quality management system, Total Quality Management (TQM) approaches and innovation, is considered by many literature sources and research. The analyses indicate that the quality management system achieves an environment in which employees are given priority over the equipment.

1.1. Study purpose and problem

However, in the modern global landscape, QMS is no longer regarded as a source of competitive advantage, but merely represents qualifying criteria, while flexibility, responsiveness and particularly innovation has taken over as winning order criteria for achieving a competitive advantage (Prajogo and Sohal, 2006). Recognising these emerging criteria, several researchers have called for research on the quality-innovation nexus. Organisations today need to be innovative to seize new opportunities and need to compete on several interrelated but different fronts, namely, efficiency, quality, flexibility and innovation (Baronien and Neverauskas, 2005; Hoang et al., 2010; Kaynak, 2003; Kim et al., 2012; Prajogo and Hong, 2008; Wales, 2015).

Extensive research highlights that innovation is a multi-dimensional phenomenon which at the firm level incorporates the behaviors and interactions of individuals and organisational factors (Kim et al., 2012; Santos-Vijande and Álvarez-González, 2007; Yusr, 2016). Innovation can take many forms (product, service and process, or marketing), and the creation of innovation is a complex process that is affected by a number of determinants (Fritsch and Meschede, 2001; Kajalo et al., 2016; Prokop and Stejskal, 2017). The theory of the innovating firm assumes that the investments that the firm makes must be developed and utilized over time, as the firm transforms technologies and accesses markets, before returns from those investments can be generated, or indeed before the rate of return can even be known (Lazonick, 2008; Yusr, 2016). With product innovation, a firm can strategically differentiate its products offering in the marketplace, thereby satisfying market demands, building customer loyalty, and improving its overall performance (Damanpour and Aravind, 2012; Damanpour

and Gopalakrishnan, 2001). Similarly, process innovation is concerned with the renewal of means of production within an organisation and it drives a firm's performance by improving productivity and/or lowering production costs (Kajalo et al., 2016; Manders et al., 2016; Pekovic and Galia, 2009).

The current study responds directly to these calls for further research by empirically investigating the how the quality management principles of leadership, customer focus and people management may act as determinants of product and process innovations. Empirical studies conducted to date have yielded conflicting findings on the relationship between TQM and innovation (Fotopoulos and Psomas, 2009; Hoang et al., 2010; Prajogo and Hong, 2008; Prajogo and Sohal, 2006). Such divergent findings imply that a knowledge gap exists which warrants further study (Manders et al., 2016). Moreover, studies examining the TQM and innovation relationship consider it important to establish whether TQM hinders or supports innovation (Abrunhosa and Sa, 2008; Castillo et al., 2008). For instance, if TQM hinders innovation, an organisation can take actions to limit its impact and achieve both high quality and innovation performance. On the other hand, if TQM acts as an antecedent to innovation, then it is important to establish under what conditions it does so, so that the organisation can ensure that those conditions persist at all times (Bon and Mustafa, 2013; Manders et al., 2016).

1.2. Study contribution and structure

The study provides the following contributions to both theory and practice. First, it adds to the existing body of knowledge by testing causal links between organisational quality management antecedents and product vs. process innovations. Rather than merely testing the TQM-innovation link, a more nuanced approach is adopted to show how various antecedents operate through different types of innovation or vary in the strength of these paths to increase overall firm innovation. Second, the study builds on existing research where although alternative conceptualizations of quality management antecedents are to be found (Abrunhosa and Sa, 2008; Samson and Terziovski, 1999), and have demonstrated some usefulness, the existing ISO 9001 measures has the advantage of theoretical backing and showing meaningful relationships in terms of different types of innovations (Baronien and Neverauskas, 2005; Hoyle, 2012). Thirdly, the study focuses on a single industry in an emerging market context. South Africa has a well-developed steel manufacturing industry, comparable to those of many developed countries but is under pressure due to the slowing down in the global economy that has reduced demand, coupled with increased production – mainly by China (Stewart et al., 2014). By focusing on a single industry sector, a greater homogeneity of context is achieved which addresses the concerns of broad applicability versus perfect suitability for narrower groups (Davidsson, 2004). Moreover, researchers note that the innovativeness of a country is largely derived not from the entire economy, but mainly from the specific status of a narrow group of industries that can be largely considered the determinants of innovation (Zdrazil et al., 2016). Lastly, the study has several academic and managerial implications, since the findings are able to support scholars and practitioners in understanding how much emphasis should be placed on each of the organisational quality management antecedents to improve overall levels of product and process innovations.

The paper begins with a literature review to position the hypotheses in theory and prior empirical findings. The methodological section follows where data collection and instruments are discussed. The findings are then presented and discussed in detail.

2. Quality management practices and innovation

2.1. Introduction

The current state of the art defining the field of quality management shows that TQM is a multidimensional construct where reference is made to the dichotomous character of TQM (Fotopoulos and Psomas, 2009; Hoang et al., 2010; Prajogo and Hong, 2008; Prajogo and Sohal, 2006; Manders et al., 2016). Different researchers have expressed this dichotomy using different terms, and have divided the TQM dimensions/constructs into various groupings, such as soft' elements which include leadership, teamwork and empowerment, recognition and rewards systems, and communication (Baronien and Neverauskas, 2005; Trivellas and Santouridis, 2009). On the other hand, the 'mechanistic or 'hard' elements refer to the documented dimensions of quality management, the primary function of which is to foster quality conformance in the organisation (Trivellas and Santouridis, 2009).

This study is positioned in the TQM literature where although there has been no consensus on a comprehensive list of TQM dimensions (Samson and Terziovski, 1999; Rogers, 1998), several researchers report a positive relationship between leadership, people management, strategic management and innovation. It seems that flexible or soft elements of TQM are associated with innovation performance, while the mechanistic elements (hard elements) are only associated with quality management. Consequently, the configuration of TQM elements can be manipulated to make it suitable to promote the quality and/or innovation objectives of a firm. Research notes that attention should be paid to the fact that different TQM factors have a strong impact on firms' innovative activity (Baronien and Neverauskas, 2005; Hoang et al. 2006; Perdomo-Ortiz et al., 2009.

Embodied in total quality management literature are concepts such as quality control, quality assurance, quality improvement, and quality planning (Ahire et al., 1996). These terms are primarily defined according to ISO 9000 principles where TQM is a management approach that tries to achieve and sustain long-term organisational success by encouraging employee feedback and participation, satisfying customer needs and expectations, respecting societal values and beliefs, and obeying governmental statutes and regulations (Fotopoulos and Psomas, 2009; Hoang et al., 2010). The aim of any quality management system is to create an environment in which 'doing it right the first time' is achieved while designing and building quality into each activity rather than inspecting it in the final product (Lee et al., 2010; Kim et al., 2012). The benefits of TQM implementation are the production of higher-quality products at reduced costs, having more satisfied employees and customers as a result of meeting their needs and expectations, and improved financial performance of the organisation (Arumugam et al., 2008; Baronien and Neverauskas, 2005; Hoyle, 2012). The ISO 9000 standards are founded on fundamental principles of leadership, customer focus, systems approach to management, continuous improvement, involvement of people, process management, factual approach to decision-making, and mutually beneficial supplier relationships (Arumugam et al., 2008; Fonseca, 2015; Manders et al., 2016).

The justification for this study is built on previous research where several key variables are operationalised for the purpose of this study that have been identified in the literature as important antecedents of product and process innovations at the firm level (Baronien and Neverauskas, 2005; Prajogo and Ahmed, 2006; Trivellas and Santouridis, 2009).

Comparing the present study variables with prior work shows that the literature is replete with definitions of innovation. According to

Crossan and Apaydin (2010), innovation is "the production or adoption, assimilation and exploitation of a value-added novelty in economic and social spheres; renewal and enlargement of products, services, and markets; development of new methods of production; and establishment of new management systems" (p. 1155). Innovation is a multi-faceted concept that can be viewed from a process or an outcome perspective, a distinction which is sometimes blurred. The process perspective explores how new ideas are discovered, created, developed, commercialised or implemented, while the outcome perspective considers innovation as a product of the innovation process (Damanpour and Aravind, 2012; Yusr, 2016). Similarly, according to Fritsch and Meschede (2001), product and process innovations are interrelated, as product innovations demand new process innovations to enable a firm to produce completely different products or to improve their quality. Thus, new products stimulate and result from new processes, and product innovation cannot take place without parallel process innovation. Firms should pursue both process and product innovations if full benefits are to be derived, as these types of innovations are complementary.

For the present study it is recognised that the selection of variables is by no means exhaustive. It is acknowledged that the actual process of how product and process innovations are formed is far more complex and that no single factor can determine the outcome of this process. A number of variables are necessary, but no one is sufficient. Notwithstanding the complexity of the phenomenon and the reciprocal nature of relationships between the quality antecedents of innovation, hypotheses are formulated but are restricted to a number of variables and links. These variables which inform the hypotheses are briefly delineated.

2.2. Customer focus and innovation

Prajogo and Sohal (2006) point out that customer focus constitutes a stimulus to innovation because it pushes firms to consistently scan the needs of the customer in order to make products that match those needs. By doing so, it provides a clear alignment of innovation by linking it with customer needs. Manders et al. (2016) qualified this further by arguing that such a customer focus promotes incremental innovation, as well as adaptive learning. Some researchers propose that TQM is more of a 'market pull', exercise while innovation is more 'product push' (Bon and Mustafa, 2013). By adopting a market orientation, firms detect opportunities and resources are immediately made available to exploit those opportunities and capture the advantages associated with being the first to market. Therefore, the organisation can develop new products faster and develop new markets quicker (Santos-Vijande and Alvarez-Gonzalez, 2007). According to Perdomo-Ortiz et al. (2006), customer focus also helps organisations to align their strategy with their technological capabilities and mobilise resources and innovative ideas to meet customer needs. On the other hand, customer focus may narrow the attention of the firms'employyees to current products and services only, and therefore is limited to incremental improvements rather than novel ones (Martínez-Costa and Martínez-Lorente, 2008). Similarly, it has been proposed that customer focus hinders innovation as it forces firms to focus on the current customer needs, and so they often ignore latent needs because the customers are often unable to express their needs beyond their current consumption experiences (Abrunhosa and Sa, 2008). Considering the unresolved issues surrounding the customer focus and innovation relationship, and in line with prior empirical findings, the first hypotheses predicts that:

Hypothesis 1: Customer focus as an element of a firm's quality management system has a positive relationship with (a) product innovation and (b) process innovation

2.3. Leadership and innovation

The role of leadership is to create an environment of trust, encouraging employees to contribute their ideas freely, and support both quality improvement and innovation by providing the required resources (De Jong and Den Hartog, 2007; Prajogo and Sohal, 2006; Perdomo-Ortiz et al., 2009). Leadership possess power and control resources which are needed to overcome organisational inertia to stimulate innovation. Transformational leader's shape the fertile environment (i.e. organisation culture) needed to nurture innovation through defining clear strategic goals, providing autonomy and challenging work, and also shape organisational characteristics that support innovative behaviour (Amabile et al., 1996). Leadership and top management play a critical role in the execution of successful innovation process, especially with regard to radical innovation that requires a level of learning, and change that is often disruptive, risky and costly (Prajogo and Hong, 2008). Researchers report that leadership is positively related to product innovation, where a relationship is found in terms of the level of newness (Hoang et al. 2006; Lee et al., 2010). Building on in this research direction, the second hypotheses states that:

Hypothesis 2: Leadership as an element of a firm's quality management system has a positive relationship with (a) product innovation and (b) process innovation

2.4. People management and innovation

Research has shown that central to the innovation process in an organisation, is the innovative behaviour exhibited by employees in response to signals they receive concerning organisational expectations for behaviour and potential outcomes of innovative behaviour (Fotopoulos and Psomas, 2009; Perdomo-Ortiz et al., 2008). People management is concerned with employee empowerment and involvement. Employees are empowered to inspect their own work and take corrective action, or even stop the process, if production and quality are out of control (Ahire et al., 1996, Prajogo and Sohal, 2006). Martinez-Costa and Martinez-Lorente (2008) argue that TQM promotes empowerment, which has been known to play a major role in fostering creativity in an organisation. Similarly, Manders et al. (2016) propose an organisation provides employees with greater autonomy and responsibility which are essential for them to be innovative. People will generate more ideas if they know that they are valued by management (Santos-Vijande and Álvarez-González, 2007), and where cross-functional communication is crucial in fostering organisational innovation (Prajogo and Sohal, 2006). On the other hand, some researchers have found that people involvement and teamwork have a negative effect on innovation as employees have no time to participate in non-productive activities and this reduces their chances to innovate. Recognising the mixed issues surrounding people management and innovation, and in line with prior empirical findings, the last hypotheses predicts that:

Hypothesis 3: People management as an element of a firm's quality management system has a positive relationship with (a) product innovation and (b) process innovation

3. Research design

The study context was the South African steel industry. As mentioned, by focusing on a single industry, a greater homogeneity of context is achieved which addresses the concerns of broad applicability versus

perfect suitability for narrower groups (Davidsson, 2004). This singular focus is important as researchers note that the innovativeness of a country is largely derived not from the entire economy, but mainly from the specific status of a narrow group of industries that can be largely considered the determinants of innovation (Zdrazil et al., 2016). The sampling frame for the study, the South African Institute of Foundrymen Management (SAIFM, 2016) shows there are approximately fifty ISO 9001 certified foundries in South Africa, employing approximately 7000 individuals. This sampling frame served as the target population of the study where a cross-section of firm employees and management were surveyed which included senior and middle management, supervisors, quality department personnel, and shop-floor employees. Sample members were drawn randomly from the sampling frame, where a single contact person within each organization was identified, with this person furnishing the email details of employees, who were selected to be the study participants. The first e-mailing request sent out 2500 questionnaires and was followed by a second and third email request, one week and three weeks later respectively. These efforts resulted in 183 full questionnaires, which was deemed acceptable for electronic surveys of this nature (Davidsson, 2004). No patterns among undelivered surveys were noticed as undelivered surveys were distributed approximately evenly among different regions and organizations, Sample characteristics reveal that in terms of firm size (by employee numbers), the majority (56%) of firms had between 50–200 employees, and more than half (52%) had had been quality management certified for a period of more than 10 years.

3.1. Instruments

Items in the questionnaire were formulated based on prior studies documented in the literature review. The research instrument consisted of three sections and all were measured on a 1 to 7 Likert scale, where '1' = strongly agree and '7' = strongly disagree.

The first section (Section A) of the instrument measured the quality management antecedents of customer focus (7 items), leadership (6 items), and for people management (7 items). Customer focus was operationalised as the extent to which an organisation unceasingly uncovers customer needs and expectations. It includes meeting unmet needs of customers before aligning its quality processes to produce products and services that fulfil those needs, thereby ensuring customer satisfaction (Bon and Mustafa, 2013; Prajogo and Sohal, 2006; Kim et al., 2012; Samson and Terziovski, 1999). Leadership was operationalised as creating an environment of trust, encouraging employees to contribute their ideas freely, and support both quality improvement and innovation by providing the needed resources (De Jong and Den Hartog, 2007; Prajogo and Sohal, 2006; Perdomo-Ortiz et al., 2009). People management was operationalised as the involvement of individuals at all levels of the organisation by devolving responsibilities and a sense of ownership so that teams and individuals understand their contribution and their roles in the organisation (Manders et al. 2016; Santos-Vijande and Álvarez-González, 2007).

Section B measured innovation as the dependent variable (DV). Literature reveals variations in the methods used to measure innovation performance in organisations. This is attributed to the broad scope of innovative activities (Rogers, 1998). Types of innovation are categorised as either product (service) innovation, represented by the new or improved products or service, or process innovation, which entails new or better ways of producing products or delivering services (Damanpour and Aravind, 2012; Fritsch and Meschede, 2001). By linking innovation measures to the input and output of innovative activity in a firm, variables that measure innovative

activities in terms of the number of new product or services, processes, markets and new materials seem to be more appropriate (Arumugam et al., 2008; Bon et al., 2012). Consequently, in the current study eight items consisting of four items for product innovation and four items for process innovation measured innovation.

Section C measured firm-level variables. Consistent with previous studies control variables included firm size and firm age, as well date of ISO certification, all of which have a prior theoretical basis for expecting the variable to have a systematic relationship with either the DV or IVs, or both (Arumugam et al., 2008; Bon et al., 2012; Fonseca, 2015).

In order to ensure that the instrument demonstrated sufficient face and content validity, a preliminary analysis via a pilot test, to easily accessible respondents was undertaken (n = 15). This procedure ensured that the respondents had no difficulties in answering the questions and there was no problem in recording the data. As a precaution, common method response bias was methodologically controlled for by counterbalancing the question order, as well as safeguarding respondent anonymity which ensured that social desirability and item ambiguity were avoided to some extent (Podsakoff et al., 2012). Ethical considerations were taken into consideration by ensuring that the instrument used posed no risk or danger to respondents and their privacy and confidentiality was respected at all times.

3.2. Data analysis

Data collected was captured and coded on Excel software and analysed statistically using IBM Social Package for Social Scientist (SPSS) version 21 software. First the psychometric properties of the measures being tested were checked for reliability and validity. Descriptive statistics were then calculated and regression analyses was used to test the hypotheses. Since the hypotheses were formulated to reflect construct level relationships, the constructs were presented as consolidated scores at the first level of analysis.

4. Results

4.1. Validity and reliability testing results

A Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy of 0.799 was obtained, indicating sampling adequacy as this figure is above the recommended minimum value of 0.6 (Hair et al., 2010). This was supported by the Bartlett's test of sphericity with the following values: approx. chi-square = 139.197, df = 21, sig. = 0.000.

Principal component analysis (PCA) was used and Table 1 provides the factor loadings of the items on the factors extracted as well as the variance explained by each factor. The loading values for each item on a particular construct were evaluated and deleted if cross-loading and/or poor loading of less than 0.5 were detected (Zikmund et al., 2013). Scree plots were also used to determine the factors extracted. As per Table 1 results, the items loaded as expected on the factors in line with prior research.

To test for scale reliability the Cronbach alphas for each factor were calculated and are also shown in Table 1, with all values above the minimum requirement of 0.7 (Hair et al., 2010). Items CF3 and CF7 were deleted as they were below this threshold and subsequently the overall Cronbach's alpha of this construct increased to 0.782.

4.2. Descriptives and correlations

Descriptive statistics and correlations are presented in Table 2. Mean scores are evenly distributed on the high end of the scale (1-7), with standard deviations being fairly moderate. Pearson correlations coefficients for customer focus ($r = 0.219$, $p < 0.05$), leadership ($r = 0.290$, $p < 0.01$), and people management ($r = 0.262$, $p < 0.05$), were

significantly and positively associated with product innovation, while only people management ($r = 0.288$, $p < 0.01$) was significantly and positively associated with process innovation. Individual one-way ANOVA tests did not find any statistical differences in the IVs and the DVs between any of the control variables expect for one category of firm size group (between 201-500), where $F(4, 658) = 2.07$, $p = 0.01$), and consequently were not included in further analyses.

Table 1. Factor analysis and reliability results

Construct	Item	Cronbach's alpha	Factor Loadings	% Variance
Customer Focus	CF1	0.782	0.652	54.5
	CF2		0.799	
	CF4		0.716	
	CF5		0.772	
	CF6		0.741	
Leadership	LD1	0.863	0.797	60.3
	LD2		0.687	
	LD3		0.748	
	LD4		0.782	
	LD5		0.857	
	LD6		0.766	
People Management	PM1	0.883	0.789	59.1
	PM2		0.772	
	PM3		0.614	
	PM4		0.734	
	PM5		0.846	
	PM6		0.812	
	PM7		0.791	
Product Innovation	Prod1	0.802	0.789	62.8
	Prod2		0.789	
	Prod3		0.807	
	Prod4		0.784	
Process Innovation	Proc1	0.826	0.701	66.1
	Proc2		0.875	
	Proc3		0.808	
	Proc4		0.858	

Table 2. Descriptives and Pearson's correlations coefficients

		Product innovation	**Process innovation**	**Customer focus**	**Leadership**	**People management**
Product innovation	Pearson Correlation	1	.283**	.219*	.290**	.262*
	Sig. (2-tailed)		.010	.046	.008	.017
Process innovation	Pearson Correlation	.283**	1	.147	.154	.288**
	Sig. (2-tailed)	.010		.184	.164	.008
Customer focus	Pearson Correlation	.219*	.147	1	.671**	.617**
	Sig. (2-tailed)	.046	.184		.000	.000
Leadership	Pearson Correlation	.290**	.154	.671**	1	.757**
	Sig. (2-tailed)	.008	.164	.000		.000
People management	Pearson Correlation	.262*	.288**	.617**	.757**	1
	Sig. (2-tailed)	.017	.008	.000	.000	
Mean		5.055	4.721	6.012	5.706	5.178
Std. Dev.		0.999	1.227	0.672	0.830	1.076

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

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

4.3. Hypothesis testing

Multiple regression analysis (MRA) was used to test the hypotheses. Table 3a provides a summary of the regression analysis results of each of the quality management determinants in terms of customer focus (H1a), leadership (H2a), and people management (H3a) on product innovation, while Table 3b provides the summary results for H1b, H2b and H3b on process innovation.

In terms of regression results for customer focus (DV = product innovation) an R^2 of 0.049 was obtained with the coefficient of regression of 0.327 ($p < 0.05$). This implies that customer focus explained 4.9 % of variance in product innovation, and therefore hypothesis H1a is accepted. The low explanatory power of customer focus on product innovation should not be viewed in an adverse manner, as the primary purpose of any quality management system is to achieve higher quality performance, rather than innovation performance. Nonetheless, this significant and positive finding resonates with past research where customer focus has been reported to stimulate organisations to search for new customer needs and expectations, and to develop and introduce new products in the endeavour to always create value for their customers (Bon and Mustafa, 2013; Prajogo and Sohal, 2006).

In terms of regression results for leadership (DV = product innovation) an R^2 of 0.084 was obtained with the coefficient of regression of 0.349 ($p < 0.05$). This implies that customer focus explained 8.4 % of

variance in product innovation, and therefore hypothesis H2a is accepted. The results confirm prior study's findings where leadership and has been positively related to product innovation (Hoang et al. 2006). Similarly, De Jong and Den Hartog (2007) argue that leaders who create a positive and safe environment, where openness and risk-taking are encouraged, tend to promote product and service innovation.

In terms of regression results for people management (DV = product innovation) an R^2 of 0.070 was obtained with the coefficient of regression of 0.245 ($p < 0.05$). This implies that customer focus explained 7.0 % of variance in product innovation, and therefore hypothesis H2a is accepted. This finding is in line with Abrunhosa and Sa's (2008) study who report that the implementation of people management practices, such as continuous education and training and the use of appropriate appraisal systems, is significantly associated with the adoption of product innovation. It could be argued that people management practices provide employees with space and responsibility to make decisions, and flexibility in performing their daily activities, allowing them to be innovative.

In terms of Table 3b, where the DV is process innovation, customer focus and leadership did not have statistically significant values and therefore H1b and H2b were rejected. A plausible explanation for these results may be that with customer focus, firms produce products to specifications in order to meet customer's requirements, and therefore fail to search for customers' latent needs in terms of adjusting processes. By doing so, they fail to drive generative learning, which is nurtured by searching for the unserved, untapped ways of serving customer needs. Similarly, Prajogo and Sohal (2006) argued that managers see the world only through their current customers' eyes, and fail to make process related improvements.

Table 3a. Summary regression analysis on product innovation

Construct	B	SE	β	R^2	*p*	Verdict
Customer focus (H1a)	0.327	0.163	0.220	0.049	0.049	accepted
Leadership (H2b)	0.349	0.130	0.290	0.084	0.041	accepted
People management (H3c)	0.245	0.101	0.264	0.070	0.018	accepted

Table 3b. Summary regression analysis on process innovation

Construct	B	SE	β	R^2	*p*	Verdict
Customer focus (H1b)	0.248	0.197	0.136	0.018	0.213	rejected
Leadership (H2b)	0.203	0.160	0.137	0.019	0.209	rejected
People management (H3b)	0.314	0.120	0.275	0.075	0.010	accepted

In terms of regression results for people management (DV = product innovation) an R^2 of 0.075 was obtained with the coefficient of regression of 0.314 ($p < 0.05$). This implies that customer focus explained 7.5 % of variance in product innovation, and therefore hypothesis H3b is accepted. These findings are in line with research which suggests that training elevates the morale and confidence of employees, creating a work environment that is conducive to work in, and hence innovation processes can be enhanced (Manders et al. 2016). Moreover, it must be noted that Prajogo and Sohal (2006) found that there is a strong association between product quality and process

innovation, and they concluded that as firms push for increased product quality, they adopt and implement rigorous process innovations to enhance process capability.

In order to validate the regression analysis, multicollinearity and normality of the data was checked. Hair et al. (2010) suggested that if the correlation value does not exceed 0.90, then multicollinearity does not exist. Results indicated no correlation value above 0.90, therefore multicollinearity was not considered a problem. Furthermore, the tolerance and the variance inflation factors (VIFs) were also checked to assess multicollinearity problems. Multicollinearity exist when tolerance values of less than 0.1 and VIF values of greater than 10 are obtained. This was not the case and hence no collinearity issues were detected.

5. Conclusions

Building on a stable theory of quality management determinants (Ahire et al., 1996; Fonseca, 2015), the current study set out to extend theory by empirically investigating their influence in product and process innovations. The study makes an important contribution by examining quality management determinants in terms of different types of innovation, and is one of the first studies in an emerging market context to examine the inter-relatedness of these constructs.

The study hypotheses can be supported based on the evidence emanating from the results. Statistically significant results were found to support H1a where customer focus as an element of a firm's quality management system has a positive relationship with (a) product innovation. However, no significant support was found for H1b where customer focus as an element of a firm's quality management system has a positive relationship with process innovation. Empirical support was also found for H2a where leadership as an element of a firm's quality management system has a positive relationship with (a) product innovation. However, no significant support was found for H2b where leadership as an element of a firm's quality management system has a positive relationship with process innovation. Lastly, significant results were found for H3 where people management as an element of a firm's quality management system has a positive relationship with (a) product innovation and (b) process innovation.

Integrating the positive findings with theory and prior findings highlights the relevance of focusing on both product and process innovations as they are interrelated, where typically product innovations demand new process innovations to enable a firm to produce completely different products or to improve their quality (Fritsch and Meschede, 2001). Thus, new products stimulate and result from new processes, and product innovation cannot take place without parallel process innovation. Consequently, firms should pursue both process and product innovations if full benefits are to be derived, as these types of innovations are complementary (Fritsch and Meschede 2001; Yusr, 2016). Additionally by accounting for customer focus it helps the firm attain a superior understanding of the factors that influence a customer's buying behaviour and enables the firm to achieve a higher level of product innovation through differentiation (Fernandes and Lourenço; 2011; Prajogo and Sohal, 2006).

A plausible reason for no significant associations between leadership and process innovation could be attributed to strict adherence to procedures for all production processes, as imposed by certification (Gotzamani and Tsiotras, 2001). This means that processes have to be followed as described by the set procedures, and this constrains the workers from experimenting and therefore discovering new methods of doing the work. Procedures will only be reviewed where problems are encountered in terms of the quality of products, otherwise they would not be changed, and therefore the

opportunity to experiment and improve on them is lost (Hoang et al., 2010; Urban and Greyling, 2015).

The study results lead to several recommendations and practical implications. Leaders and managers who want to derive evidence-based product and process innovations should understand the benefits from quality management in terms of customer focus, leadership and people management. Additionally, the findings highlight the importance of developing formal organisational mechanisms to measure levels of these quality determinants as they are easily overlooked or taken for granted.

5.1. Limitations and future research

Although the study has several limitations it presents future research avenues. The cross-sectional nature of the study prevents any causal relationship between the variables to be made; a longitudinal study is required to understand how quality determinants may evolve over time to shape innovations. The study also focused on a single industry, which limits any generalisations, but this presents an opportunity for scholars to study the same variables used in this study across industries. Moreover, the current study used predetermined scales to measure a limited amount of quality determinants and as such it is recommended that scales be improved upon in future studies with more constructs added that capture the dynamic nature of the quality management and innovation relationship. Finally, future studies could examine the moderation effects of organisational culture on the relationship between quality management and innovation, as well as account for specific environmental factors, which may influence this relationship.

In conclusion the importance of the study is clear in that investigation into this under-researched, yet crucial aspect of unpacking the relationship between quality management determinants and innovation can assist firms in leveraging significant factors which positively influencing product and process innovations.

References:

Abrunhosa, A., & Sa, P. M. E. (2008). Are TQM principles supporting innovation in the Portuguese footwear industry? *Technovation*, *28*(4), 208-221.

Ahire, S. L., Golhar, D. Y., & Waller, M. A. (1996). Development and validation of TQM implementation constructs. *Decision Sciences*, *27*(1), 23-56.

Amabile, T. M., Conti, R., Coon, H., Lazenby, J., & Herron, M. (1996). Assessing the work environment for creativity. *Academy of Management Journal*, *39*(9), 1154-1184.

Arumugam, V., Ooi, K.-B., & Fong, T. C. (2008). TQM practices and quality management performance: An investigation of their relationship using data from ISO 9001: 2000 firms in Malaysia. *The TQM Journal*, *20*(6), 636-650.

Bon, A. T., & Mustafa, E. M. (2013). Impact of total quality management on innovation in service organisations: Literature review and new conceptual framework. *Procedia Engineering*, *53*(6), 516-529.

Baronien, L., & Neverauskas, B. (2005). The role of quality management in the process of innovation development. *Inzinerine Ekonomika-Engineering Economics*, *3*(43), 15-21.

Castillo, S. M., Casadesús, M., Karapetrovic, S., Heras, I., & Martín, I. (2008). Do standardized management systems hinder innovation processes? *International Journal for Quality Research*, *2*(2), 121-127.

Cole, R. E., & Matsumiya, T. (2007). Too much of a good thing? Quality as an impediment to innovation. *California Management Review*, *50*(1), 77-93.

Crossan, M. M., & Apaydin, M. (2010). A multi-dimensional framework of organisational innovation: A systematic review of the literature. *Journal of Management Studies*, *47*(6), 1154-1191.

Damanpour, F., & Aravind, D. (2012). Managerial innovation: Conceptions, processes, and antecedents. *Management and Organisation Review*, *8*(2), 423-454.

Damanpour, F., & Gopalakrishnan, S. (2001). The dynamics of the adoption of product and process innovations in organisations. *Journal of Management studies*, *38*(1), 45-65.

Davidsson, P. (2004). *Researching entrepreneurship*. New York: Springer.

De Jong, J. P., & Den Hartog, D. N. (2007). How leaders influence employees' innovative behaviour. *European Journal of Innovation Management*, *10*(1), 41-64.

Fernandes, A., & Lourenço, L. (2011, April). *Quality, innovation and performance: an exploratory study.* Paper presented at the European Concurrent Engineering Conference, Londres, France.

Fonseca, L. M. (2015). From quality gurus and TQM to ISO 9001: 2015: A review of several quality paths. *International Journal for Quality Research*, *9*(1), 167-180.

Fotopoulos, C. B., & Psomas, E. L. (2009). The impact of "soft" and "hard" TQM elements on quality management results. *International Journal of Quality and Reliability Management*, *26*(2), 150-163.

Fritsch, M., & Meschede, M. (2001). Product innovation, process innovation, and size. *Review of Industrial Organisation*, *19*(3), 335-350.

Gotzamani, K. D., & Tsiotras, G. D. (2001). An empirical study of the ISO 9000 standards' contribution towards total quality management. *International Journal of Operations and Production Management*, *21*(10), 1326-1342.

Hair, J. F., Anderson, R. E., Babin, B. J., & Black, W. C. (2010). *Multivariate data analysis: A global perspective* (7th ed.). Upper Saddle River, NJ: Pearson.

Hoang, D. T., Igel, B., and Laosirihongthong, T. (2010). Total quality management (TQM) strategy and organisational characteristics: Evidence from a recent WTO member. *Total Quality Management*, *21*(9), 931-951.

Hoyle, D. (Ed.). (2012). *ISO 9000: 2000: An AZ guide*. London: Routledge.

Kajalo, S., Rajala, A., & Tuominen, M. (2016). The impact of market-based assets on innovativeness and business performance. *International Journal of Business Innovation and Research*, *11*(4), 584-596.

Kaynak, H. (2003). The relationship between total quality management practices and their effects on firm performance. *Journal of Operations Management*, *21*(4), 405-435.

Kim, D.-Y., Kumar, V., & Kumar, U. (2012). Relationship between quality management practices and innovation. *Journal of Operations Management*, *30*(4), 295-315.

Lazonick, W. (2008). *Entrepreneurial ventures and the developmental state. Lessons from the advanced economies*. Helsinki: UNU World Institute for Development Economics Research.

Lee, V. H., Ooi, K. B., Tan, B. I., & Chong, A. Y. L. (2010). A structural analysis of the relationship between TQM practices and product innovation. *Asian Journal of Technology Innovation*, *18*(1), 73-96.

López-Mielgo, N., Montes-Peón, J. M., & Vázquez-Ordás, C. J. (2009). Are quality and innovation management conflicting activities? *Technovation*, *29*(8), 537-545.

Manders, B., de Vries, H. J., & Blind, K. (2016). ISO 9001 and product innovation: A literature review and research framework. *Technovation*, *48*(1), 41-55.

Martínez-Costa, M., & Martínez-Lorente, A. R. (2008). Does quality management foster or hinder innovation? An empirical study of Spanish companies. *Total Quality Management*, *19*(3), 209-221.

Pekovic, S., & Galia, F. (2009). From quality to innovation: Evidence from two French Employer Surveys. *Technovation*, *29*(12), 829-842.

Perdomo-Ortiz, J., Gonzalez-Benito, J., & Galende, J. (2009). An analysis of the relationship between total quality management-based human resource management practices and innovation. *The International Journal of Human Resource Management*, *20*(5), 1191-1218.

Podsakoff, P. M., Mackenzie, S. B., & Podsakoff, N. P. (2012). Sources of method bias in social science research and recommendations on how to control it. *Annual Review of Psychology*, *63*(5), 539-569.

Prajogo, D. I., & Hong, S. W. (2008). The effect of TQM on performance in R & D environments: A perspective from South Korean firms. *Technovation*, *28*(12), 855-863.

Prajogo, D. I., & Sohal, A. S. (2006). The relationship between organisation strategy, total quality management (TQM), and organisation performance—the mediating role of TQM. *European Journal of Operational Resea*rch, *168*(1), 35-50.

Prokop, V., & Stejskal, J. (2017). Different approaches to managing innovation activities: an analysis of strong, moderate, and modest innovators. *Inzinerine Ekonomika-Engineering Economics*, *28*(1), 47-55.

Rogers, M. (1998). *The definition and measurement of innovation*. Parkville, VIC: Melbourne Institute of Applied Economic and Social Research.

Samson, D., & Terziovski, M. (1999). The relationship between total quality management practices and operational performance. *Journal of Operations Management*, *17*(4), 393-409.

Santos-Vijande, M. L., & Álvarez-González, L. I. (2007). Innovativeness and organisational innovation in total quality oriented firms: The moderating role of market turbulence. *Technovation*, *27*(9), 514-532.

South African Institute of Foundrymen Management (SAIFM) (2016). Membership Lists. Retrieved from: http://www.foundries.org.za/info/pdf

Stewart, T. P., Drake, E. J., Bell, S. M., & Wang, J. (2014). *Surging steel imports put up to half a million us jobs at risk.* Washington, DC: Economic Policy Institute.

Trivellas, P., & Santouridis, I. (2009, October). *TQM and innovation performance in manufacturing SMEs: The mediating effect of job satisfaction.* Paper presented at the 2009 IEEE International Conference on Industrial Engineering and Engineering Management, Beijing, China.

Urban, B., & Greyling, B.C. (2015). Open source software adoption and links to performance. *International Journal of Technology Learning, Innovation and Development*, *7*(3), 261-278.

Wales, W. J. (2015). Entrepreneurial orientation: A review and synthesis of promising research directions. *International Small Business Journal*, *34*(1), 3-15.

Yusr, M. M. (2016). Innovation capability and its role in enhancing the relationship between TQM practices and innovation performance. *Journal of Open Innovation: Technology, Market, and Complexity*, *2*(1), 1-12.

Zdrazil, P., Kraftova, I., & Mateja, Z. (2016). Reflection of industrial structure in innovative capability. *Inzinerine Ekonomika-Engineering Economics*, *27*(3), 304-315.

Zikmund, W. G., Babin, B. J., Carr, J. C., & Griffin, M. (2013). *Business research methods.* Mason, OH, USA: South-Western, Cengage Learning.

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