THE STRATEGIC RELEVANCE OF TECHNOLOGY-RELATED VARIABLES TO THE COMPETITIVENESS OF SMALL - TO MEDIUM-SIZED FURNITURE MANUFACTURERS

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ABSTRACT

SMMEs can make a critical and positive economic contribution to South Africa, and small- to medium-sized furniture manufacturers (SM/FMs) have the potential to contribute to economic growth, job creation, and GDP. However, the furniture industry has not stayed abreast of technological advances. To survive in an environment of increasing competition and imports, competitive strategies must be devised. One such strategy is for technology adoption and implementation that can provide solutions for the furniture industry to improve speed, quality, variety, flexibility, and productivity, resulting in improved competitiveness. However, the adoption of technology means that its acquisition and application must be managed strategically, as the use of technology involves far more than simply taking it into account during the business-planning process.

This paper investigates the impact of business strategy and selected technology-related variables on the competitiveness of SM/FM.

OPSOMMING

SMMEs het die potensiaal om ’n kritiese en positiewe bydrae te maak tot Suid-Afrika se ekonomiese groei en SM/FMs, tot die skepping van werksgeleenthede, en tot die BNP. SM/FMs het egter nie op die hoogte gebly met tegnologiese ontwikkelings en die aanwending daarvan nie. Om in ’n omgewing van toenemende mededingendheid en invoere te wedywer moet effektiewe strategieë ontwikkel word. Een strategie wat moontlik sal lei tot verhoogde mededingendheid is die aanwending van tegnologie wat oplossings kan bied in terme van spoed, kwaliteit, verskeidenheid, aanpasbaarheid, en produktiwiteit. Die aanwending van tegnologie moet egter op ’n strategiese manier bestuur word, want dit behels veel meer as bloot om tegnologie in ag te neem gedurende die strategiese beplanningsproses.

Hierdie artikel ondersoek die invloed van besigheidstrategieë en sekere tegnologie-verwante veranderlikes op die mededingendheid van SM/FMs.

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1. INTRODUCTION

Pieris [1] states that it is important for developing countries such as South Africa (SA) to strengthen their technological capabilities, as these countries have been losing their traditional comparative advantages based on cheap labour, natural resources, and production by small- to medium-sized businesses (SMMEs). The critical challenge facing SA business has been to connect and direct small-business activity, technology, and effort among the various groups of entrepreneurs and small-business owners.

Thaver [2] also identifies small business as being critical to the economic development of a nation. SMMEs have assisted, as job creators, in raising incomes and improving the distribution of wealth. SMMEs have also broadened participation in the national economy, opened up the ownership of assets, and often emerged from linkages and spin-offs related to the growth of larger business. Berry et al. [3] state that SMMEs have an economic role to fulfil: they contribute to a country's national product by providing goods or services, and to the country's overall export performance. As a result, SMMEs have the potential to generate employment, upgrade human capital, create purchasing power, and stimulate productive activity.

1.1 Domestic furniture industry

According to the 2004/2005 business plan compiled by the Furniture Joint Action Group [4], the furniture industry is one of the largest potential employers of skilled, semi-skilled, and non-skilled employees in the South African economy, and is a vehicle for black economic empowerment. Moodley [5] postulates that small furniture businesses are important from a development perspective, owing to their potential for economic growth, job creation, and black economic empowerment.

Furniture accounted for 3.5% of the total manufacturing employment and 2.7% of the total manufacturing exports for SA between 1995 and 1999 [5]. Exports in furniture sales grew from less than 5% in 1992 to over 40% in 1999, which exceeded the export/sales ratio in the South African manufacturing sector as a whole. So the wood furniture-producing sector has been an important contributor in terms of employment, exports, and economic growth. However, in 2008 the Department of Trade and Industry (DTI) reported that the industry had not kept up with global trends relating to skills development and technological advancement, and that SA's ranking as a furniture exporter had dropped from the 2005 ranking of 34 to 43 in 2006 [6].

The main problem investigated by this research study was how business strategy and selected technology-related variables impact on the competitiveness of SM/FMs in selected areas of SA. The theoretical foundation for the study is discussed in the next section, followed by the research questions, research design, results, findings, conclusions, and recommendations.

2. THEORETICAL FOUNDATION: DEVELOPMENT OF A TECHNOLOGY STRATEGY FRAMEWORK

Business strategy and selected technology variables formed the basis of the development of a technology strategy framework for SM/FM in aiming to improve their competiveness [7].

The technology strategy framework was developed from a comprehensive literature study. Table 1 illustrates the three phases and various components of the framework, as well as the relevant authors whose research contributed to its development.

Table 1: Phases of a technology strategy framework for SM/FM

	Phase 1 *Identify strategy*	*Phase 2* *Technology*	*Phase 3* *Evaluation*
Literature theme	Strategic management process, technology strategies	Technology choices for future strategies Technology fit and selection	Evaluation
Focus	Components of a technology strategy framework Business strategy options Critical success factors for SM/FM	**External technology analysis** Technology scanning, monitoring, forecasting Factors influencing technology management in SA **Analyzing current internal technologies** Technology audit **Selecting appropriate technology** **Linking technology and SM/FMs** **Integrating technology choices and business strategy**	Benefits, improved competiveness
Main authors	[8], [9], [10], [11], [12], [13], [14], [15], [16], [17]	[18], [19], [20], [21], [22], [23], [24], [25], [26], [27], [28]	[29], [30], [31], [32], [33], [34], [35], [36]

3. THE RESEARCH QUESTION, SUB-PROBLEMS, AND HYPOTHESES

The following quantitative and qualitative approaches to solving the main research problem were applied. The sub-foci for the qualitative analyses were centred on the hypotheses to triangulate the quantitative results.

***Hypothesis 1*:** Business strategy (measured by low-cost and differentiation) exerts an influence on competitiveness (measured by business performance and technology-competitive advantage).
Qualitative question: What is the influence of business strategy on competitiveness?

Hypothesis 2: Technology type (measured by software and hardware) exerts an influence on competitiveness (measured by business performance and technology-competitive advantage).
***Qualitative question*:** What is the influence of technology type on competitiveness?

Hypothesis 3: Technology purchasing strategy exerts an influence on competitiveness (measured by business performance and technology-competitive advantage).
***Qualitative question*:** What is the influence of technology purchasing strategy on competitiveness?

Hypothesis 4: Technology proficiency (measured by outsourcing and insourcing) exerts an influence on competitiveness (measured by business performance and technology-competitive advantage).
***Qualitative question*:** What is the influence of technology proficiency on competitiveness?

Hypothesis 5: Technology information sourcing exerts an influence on competitiveness (measured by business performance and technology-competitive advantage).
***Qualitative question*:** What is the influence of technology information sourcing on competitiveness?

4. RESEARCH DESIGN

This study employed a mixed method research design where quantitative findings were triangulated by qualitative means. Triangulation is a method used extensively in quantitative studies for the confirmation and generalisation of research findings, adding value to research results by combining research methods.

4.1 Questionnaire

A structured questionnaire, developed from the findings of a comprehensive literature review (refer to Table 1), was used to test the latent factors that influence competitiveness within the context of a technology strategy. Methods of measuring each variable were identified, developed, and standardised with considerable attention to validity and reliability. The intent of the questionnaire was to establish, confirm, or validate associations, and to develop generalisations that contribute to existing theories.

The most important innovation of this questionnaire was that it concentrated on the business strategy and technology-related items influencing competitiveness specifically for SM/FMs. This allowed the researcher to determine technology-related causes of poor competitiveness.

4.2 Testing for effects

The measurement instrument used to evaluate the constructs was developed in three phases. Firstly, items were formulated to measure each latent variable identified from a comprehensive literature review (refer Table 1). Secondly, as suggested by Bryman [37], the draft measuring instrument was tested. Twenty-five questionnaires were either sent via electronic mail or hand-delivered within the Eastern, Western, and South Western Cape. Academics and SM/FM managers or owners participated in the pilot study, and 15 completed questionnaires were returned. Results of the pilot study identified questions that should be altered, and a Cronbach test revealed an acceptable reliability level. The third phase, to refine the measuring instrument, was carried out based on the feedback received.

4.3 Quantitative data collection

To determine the population of furniture manufacturers in the Cape regions of SA, databases representing the Western, South Western, and Eastern Cape were obtained from the Furniture Bargaining Councils of the Western Cape [38], the South Western Cape Districts [39], and the Eastern Cape [40].

Owing to the classification of SMMEs, businesses with more than five employees and fewer than 200 were identified to be surveyed. Businesses employing fewer than five employees were viewed as micro-businesses, and those with more than two hundred employees as large businesses. Micro- and large businesses, therefore, as well as upholsterers and mattress manufacturers, fell outside the scope of this study, and only businesses manufacturing wooden furniture were included. The identified businesses were contacted telephonically to confirm their existence, size, and willingness to participate in the study. Respondents were asked if they wanted the questionnaire to be faxed, e-mailed, posted, or, where possible, hand-delivered. Questionnaires that were e-mailed contained a link where respondents could complete the questionnaire electronically. Alternatively, respondents could return questionnaires via fax or post.

Table 2 illustrates the stratified sample of 196 businesses identified as SM/FMs.

Table 2: Furniture manufacturers by geographic area (sample)

Area	*SM/FMs with more than five but fewer than 200 employees*
Eastern Cape	21
Western Cape	157
South Western Cape District	18
Total	196

5. RESPONSES TO QUESTIONNAIRE

The research instrument was administered to a total of 196 SM/FMs within the Western, South Western, and Eastern Cape regions. Sixty-seven questionnaires were completed and returned, representing a response rate of 34%.

5.1 Construct responses

This section relates to the constructs of the hypotheses.

a. Strategy identification: Low-cost (COST) and Differentiation (DIFFN)

Hypothesis 1: Business strategy (as measured by low-cost and differentiation) exerts an influence on competitiveness (as measured by business performance and technology-competitive advantage).

Respondents selected a response appropriate to their business strategy, thus indicating the extent to which they followed a differentiation or low-cost strategy.

b. Hardware and software technology (TECH)

Hypothesis 2: Technology type (as measured by software and hardware) exerts an influence on competitiveness (as measured by business performance and technology-competitive advantage).

Respondents were asked to select the software and hardware used in their businesses. The technology types were categorised according to their relevant application: office systems, design, control, engineering, planning, and manufacturing.

Technology-application rating

A technology rating system was developed to gain a realistic perspective of technology-application and use. This rating system is based on the literature findings (refer to Table 1), and in consultation with a systems engineer and a statistician.

The rating system allocated one point for the use of a basic technology tool, three points for sub-system use, and five points for an integrated system.

E-mail and the Internet are regarded as a basic tool (one point), and both EDI and CAD as sub-systems (three points each). Computerised control systems are more than a basic tool, but not a complete sub-system, whereas CAE is regarded as an integrated system scoring five points.

Technology in the planning category scored three points each (MRP, JIT, MRPII, ERP), and computerised decision support systems scored two points. CNC machinery scored four points, and both CAM and FMS scored five points each as fully-integrated systems. AMH-handling scored three points as a sub-system. Each respondent's technology use was scored, and the results indicated that 10 (14.92%) respondents scored two points from a total of 46. The highest score was 42, and was achieved by only one respondent, representing the highest level of technology integration. The mean score among the 67 respondents for technology application was 13.59. The data from this set of questions was used for the TECH construct of the hypotheses.

c. Purchasing (PURCH)

Hypothesis 3: Technology purchasing strategy exerts an influence on competitiveness (measured by business performance and technology-competitive advantage).

Respondents were presented with 19 questions relating to the conditions under which they would purchase or upgrade technology, and what the considerations were for making the decision.

d. Technology proficiency (SOUT, SOIN)

Hypothesis 4: Technology proficiency (measured by outsourcing and insourcing) exerts an influence on competitiveness (measured by business performance and technology-competitive advantage).

Outsourcing

Respondents were presented with six questions relating to when they would outsource jobs or tasks because they lacked the technology.

Insourcing

Respondents were presented with five questions relating to when other businesses would outsource work owing to a lack of technology.

e. Needs identification (NEED)

Hypothesis 5: Technology information sourcing exerts an influence on competitiveness (measured by business performance and technology-competitive advantage).

Respondents were presented with 12 questions relating to how they source information related to new technology and industry developments.

f. Competitiveness (COMP)

Respondents were presented with 12 questions relating to the overall successfulness of their business.

g. Benefits (BENE)

Respondents were presented with nine questions relating to selected benefits. The benefits related to the critical success factors of value, speed, flexibility, and innovation.

5.1.1 Summary of construct responses

Maree [41] explains that when a number of items are formulated to measure a certain construct, there must be a high degree of similarity among them, given that they are expected to measure one common construct. A measure of this degree of internal reliability is called Cronbach's alpha coefficient, and is based on inter-item correlations. If the items correlate strongly with each other, then the internal consistency is high and the alpha coefficient will be close to one. If the items are poorly formulated and do not correlate strongly, then the alpha coefficient will be close to zero.

The following guidelines for the interpretation of Cronbach's alpha coefficient have been suggested, and seem generally accepted by researchers:

- 0.90 - high reliability;
- 0.80 - moderate reliability; and
- 0.70 - low reliability.

Values lower than 0.60 are regarded as unacceptable.

Table 3 provides a summary of the construct responses.

Table 3: Summary of construct responses

	*N**	*M*	*SD*	*Average inter-item correlation*	*Internal reliability: Cronbach alpha*
COST	**65**	**3.56**	**0.59**	**.27**	**.80**
DIFFN	**67**	**3.73**	**0.54**	**.28**	**.83**
PURCH	**66**	**3.41**	**0.56**	**.26**	**.86**
SOUT	**66**	**1.99**	**0.66**	**.25**	**.63**
SOIN	**67**	**2.41**	**0.98**	**.51**	**.83**
COMP	**66**	**3.69**	**0.57**	**.32**	**.82**
BENE	**67**	**3.86**	**0.45**	**.22**	**.70**
NEED	**67**	**3.07**	**0.67**	**.23**	**.78**

(* values less than 67 indicate missing data on some variables)

Table 3 shows that 67 completed questionnaires were received, and 67 responses were recorded for DIFFN, SOIN, BENE, and NEED. Sixty-six responses were recorded for PURCH, SOUT, and COMP, and 65 for COST.

The mean presents the central location of the data. The higher the score, the closer the answer is linked to *agree* or *strongly agree* responses for a question or set of questions. BENE responses show the highest mean (3.86), followed by DIFFN (3.73) and COMP (3.69). This is followed by COST (3.56), PURCH (3.41), and NEED (3.07). The lowest means are recorded for SOIN (2.41) and SOUT (1.99).

The standard deviation indicates that if the scores are evenly distributed, they cluster closely around the mean [42]. If the standard deviation is high, the responses vary from both sides of the mean, and the spread in the responses is big. This implies that not all respondents felt the same or perceived things in the same way, but rather that the feeling or perception among the respondents relating to those specific questions varied. It is thus more difficult to make deductions that are applicable to the whole sample. The highest standard deviation is recorded for SOIN (0.98), followed by NEED (0.67), SOUT (0.66), PURCH (0.56), and DIFFN and COST (0.54 and 0.59 respectively). The lowest standard deviation is for BENE (0.45).

Correlation data shows the degree of association, or the association between variables. SOIN shows the highest average inter-item correlation of 0.51, followed by COMP (0.32) and DIFFN (0.28). COST shows 0.27, whilst PURCH and SOUT show 0.26 and 0.25 respectively. The smallest average inter-item correlation is recorded for NEED (0.23) and BENE (0.22).

A reliability coefficient (measuring the internal consistency) of 0.70 or higher is considered acceptable. The highest internal reliability or consistency is found in PURCH (0.86), followed by DIFFN and SOIN (both 0.83) and COMP (0.82). This is followed by NEED (0.78) and BENE (0.70). The lowest internal reliability is found in SOUT (0.63).

5.2 Correlations

Correlations estimate the extent to which the changes in one variable are associated with changes in another variable. For example, the lower the correlation, the lower the association between the two variables. A positive correlation reflects a direct association, in which an increase in one variable corresponds to an increase in the other variable. Inversely-related variables (a negative number) produce a negative correlation, indicating that an increase in one variable is associated with a decrease in the other. A coefficient of -1.00 represents a perfect inverse association, and +1.00 presents a perfect direct association; a coefficient close to zero indicates no association [42].

5.2.1 Correlations with technology

The correlations depicted in Table 4 show the associations with technology (TECH).

Table 4: Correlations with technology

Correlations with technology	Statistically significant at the 5% LEVEL (p<0.0500) highlight means statistically significant at the 5% level	*Significance*
COST	0.35	Significant
DIFFN	0.30	Significant
PURCH	0.47	Significant
SOUT	-0.07	Not significant
SOIN	0.17	Not significant
COMP	0.44	Significant
BENE	0.29	Significant
NEED	0.55	Significant

There is a significant correlation between technology and COST (0.35), DIFFN (0.30), PURCH (0.47), COMP (0.44), BENE (0.29), and NEED (0.55). The correlation between technology and SOUT and SOIN is very small and is not significant.

5.2.2 *Hypotheses*

Table 5 presents the correlations of the constructs, and illustrates, as per the hypotheses, the association between the dependent variables (COMP and BENE) and the independent variables (COST, DIFFN, PURCH, SOUT, SOIN, NEED, TECH).

Table 5: Correlations for hypotheses

Corre-lations (data. sta) N=67	***Means***	***SD***	***COST Total***	***DIFFN Total***	***PURCH Total***	***SOUT Total***	***SOIN Total***	***COMP Total***	***BENE Total***	***NEED Total***	***TECH Total***
COST	3.56	0.59	1.00	0.29	0.50	-0.02	-0.02	0.54	0.47	0.39	0.35
DIFFN	3.73	0.54	0.29	1.00	0.61	-0.11	0.19	0.62	0.69	0.45	0.30
PURCH	3.41	0.56	0.50	0.61	1.00	0.12	0.28	0.55	0.45	0.73	0.47
SOUT	1.99	0.66	-0.02	-0.11	0.12	1.00	0.41	-0.06	-0.18	0.26	-0.07
SOIN	2.41	0.98	-0.02	0.19	0.28	0.41	1.00	0.28	0.12	0.35	0.17
COMP	3.69	0.57	0.54	0.62	0.55	-0.06	0.28	1.00	0.69	0.50	0.44
BENE	3.89	0.45	0.47	0.69	0.45	-0.18	0.12	0.69	1.00	0.42	0.29
NEED	3.07	0.67	0.39	0.45	0.73	0.26	0.35	0.50	0.42	1.00	0.55
TECH	-	-	0.35	0.30	0.47	-0.07	0.17	0.44	0.29	0.55	1.00

Outcomes of hypotheses testing:

Hypothesis 1:

A significant association exists between business strategy and competitiveness.

Hypothesis 2:

A significant association exists between technology and competitiveness.

Hypothesis 3:
A significant association exists between purchasing strategy and competitiveness.

Hypothesis 4:
No significant association exists between technology proficiency and competitiveness.

Hypothesis 5:
A significant association exists between information sourcing and competitiveness.

5.3 Analysis of variance (ANOVA)

A technology-application score was recorded for each respondent. The data was divided into three groups of more or less the same size. With that data, analysis of variance (ANOVA) was performed to determine how the three groups (low, medium, or high in terms of their technology application) differed with reference to COMP and BENE. Table 6 illustrates a breakdown of the descriptive statistics.

Table 6: Descriptive statistics for COMP and BENE

N67	*TECH Rating cat*	*COMP Total*	*COMP Total*	*COMP Total*	*BENE Total*	*BENE Total*	*BENE Total*
		Means	**N**	**SD**	**Means**	**N**	**SD**
	Low	3.45	22	0.48	3.81	22	0.36
	Medium	3.61	23	0.51	3.73	23	0.4
	High	4.01	22	0.59	4.04	22	0.53
	All groups	**3.69**	**67**	**0.57**	**3.86**	**67**	**0.45**

5.4 Effect size analysis

The eta-squared was calculated to indicate the results of the effect size (which is the measure of the strength of association, based on the proportion of variance accounted for by the effect of the independent variable on the dependent variable). The effect size is a scale-free measure of the practical significance (importance) of an item that is not affected by the size of the sample [41]. The effect size (d) is calculated to analyse the difference between means, and Cohen's guidelines are used to interpret the effect size:

- small effect = 0.2;
- medium effect = 0.5; and
- large effect = 0.8 or larger than 0.8.

The effect size is illustrated in Table 7.

Table 7: Effect size

	SS Effect	*DF Effect*	*MS Effect*	*SS Error*	*DF Error*	*MS Error*	*F*	*P*	*Eta-squared*	*Result*
COMP Total	3.6	**2**	**1.8**	**17.92**	**64**	**0.28**	**6.42**	**0.002**	**0.167**	**Large effect**
BENE Total	1.13	2	0.56	12.14	64	0.19	2.97	0.058	0.085	**Medium effect**

The association between COMP and TECH based on Cohen's values constitutes a large effect, whilst the association between BENE and TECH constitutes a medium effect. And to determine significant results, the TUKEY HSD post hoc test was used to determine where the differences lay between the three groups. The results are reflected in Table 8.

Table 8: TUKEY HSD

Tukey HSD test; Variable: COMP Total (data.sta)				*Tukey HSD test; Variable: BENE Total (data.sta)*			
Marked differences are significant at p < .050				**Marked differences are significant at p < .050**			
	{1}	{2}	{3}		{1}	{2}	{3}
	M=3.45	M=3.62	M=4.01		M=3.81	M=3.73	M=4.04
Low {1}				**Low {1}**			
Medium {2}	0.5597			**Medium {2}**	0.817		
High {3}	0.0026	0.0404		**High {3}**	0.202	0.0553	

In Table 8 the COMP results indicate that groups 1 (low) and 3 (medium and high technology) and groups 2 and 3 differ from each other. The difference between groups 2 and 3 is the largest, and therefore the difference is the most significant (significant at 5%). The results also indicate that groups 1 and 2 do not differ significantly. Figure 1 illustrates the spread of the differences.

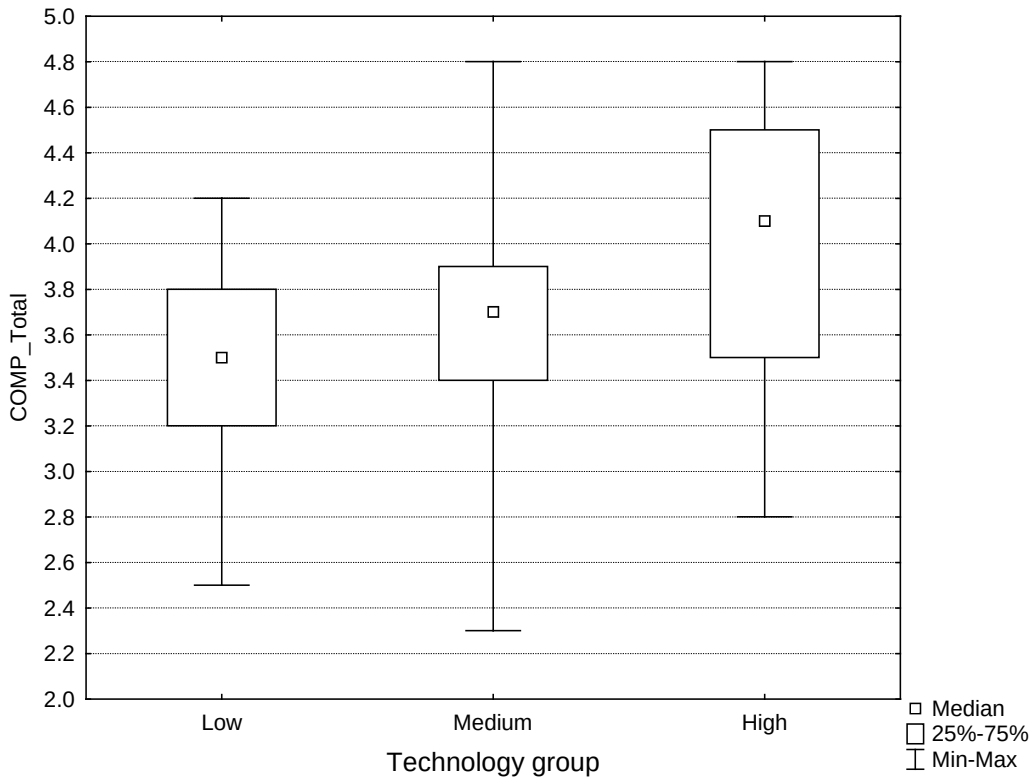

Figure 1: TUKEY HSD results for COMP

The BENE results (at the 10% level) indicate that groups 1 and 3 do not differ significantly, and neither does group 1 and 2. However, the differences between groups 2 and 3 are significant (significant at 5%). Figure 2 illustrates the spread of the differences.

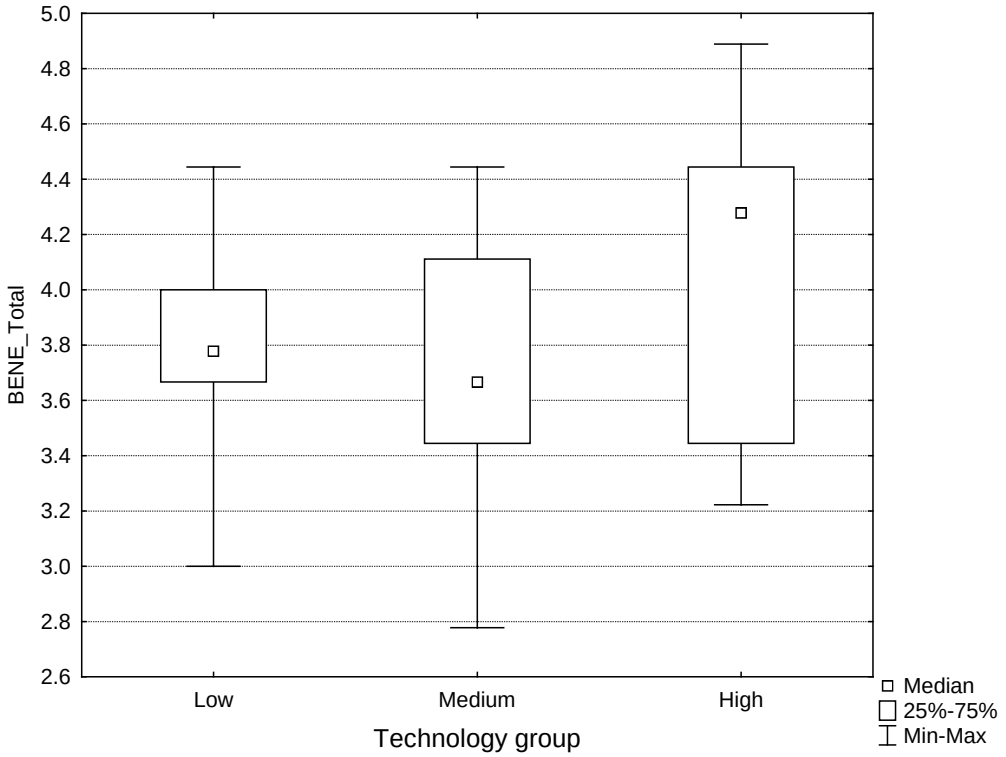

Figure 2: TUKEY HSD results for BENE

Table 9 shows a summary of the above results.

Table 9: Summary of results

	LOW		*MED*		*HIGH*		*F*	*P*	*Eta-squared*
	Mean	**Stand Dev**	**Mean**	**Stand Dev**	**Mean**	**Stand Dev**			
COMP	3.45	0.48	3.61	0.51	4.01	0.59	6.42	0.0028 *	0.167 (large)
BENE	3.81	0.36	3.73	0.4	4.04	0.53	2.97	0.058 **	0.09 (medium)

***SIGNIFICANT AT 5%**
****SIGNIFICANT AT 10%**

The results indicate a strong association between the three groups and COMP (at 5% level), indicating that the higher the level of technology application, the more competitive the business.

The results indicate a strong association between the three groups and BENE. Owing to the small sample size, BENE is determined at a 10% significance level. The results imply that the higher the technology level, the more significant the benefits to the business.

6. QUALITATIVE RESULTS

6.1 Qualitative data collection

The main probes presented to interviewees required them to discuss the influence of business strategy, technology type, technology purchasing strategy, technology proficiency, technology information sourcing, technology benefits, and competitiveness. Additional

probes were prepared as encouragement to elicit the required data when an interviewee's response did not provide adequate data.

6.2 Sampling and interview process

The sample was identified from the respondents' quantitative questionnaire. Selection criteria - including the region, level of technology used, years in operation, number of employees, age, job title, and years of work experience of the interviewee - were established to identify at least four interviewees. The interviews conducted with four SM/FMs were recorded and typed verbatim.

6.3 Coding

To make sense of the data, a coding process that led to the development of a codebook was developed. Interview data was grouped and coded according to five categories: business strategy, technology type, technology purchasing, technology proficiency, and information sourcing.

To make inferences about the business strategy, questions regarding the type of strategy, planning, external influences, and the internal situation, as well as competitiveness, were asked. To confirm the types of technology used, respondents were asked about the software and hardware used in their businesses, and whether they had any specific or unique technology-related experiences.

The respondents were questioned about their technology selection criteria, the reasons for buying or upgrading technology, and whether they experienced any specific benefits from technology application. To ascertain technology proficiency, respondents were questioned about their in- and outsourcing practices, and whether those practices and experiences had influenced their business. The final category required respondents to confirm the sources of information available to them, and whether they experienced any specific benefits relating to the sources.

The verbatim responses of each respondent were analysed and allocated to the relevant category. Responses were interpreted by employing thematic analysis by a team of three academics to minimise bias.

6.4 Quantitative results for triangulation

Reference was made to the quantitative questionnaire to triangulate or confirm the quantitative results; find meaning in the qualitative findings; and answer the qualitative questions. It was thus necessary to extract quantitative data representing the four respondents' responses to questions regarding their competitiveness, benefits, and technology-application rating from the quantitative data. In this way, the quantitative data corroborated the qualitative findings.

Table 10 illustrates the four respondents' answers in the quantitative survey regarding their competitiveness (COMP), benefits (BENE), and technology-application rating (TECH).

Table 10: Summary of selected quantitative data

Respondent	*Technology-application score (lowest to highest)*	*Competitiveness (mean)*	*Benefits (mean)*
Respondent C differentiation	4	**3.3**	**3.6**
Respondent B Best cost	21	4.0	4.3
Respondent D Low cost	36	4.5	4.2
Respondent A Low cost	42	4.8	4.8
	Max 46	Overall mean: 3.69 (n=67)	Overall mean: 3.86 (n=67)

Table 9 may be interpreted as follows:

Competitiveness

Respondent C is the least competitive, and the best-cost (B) and two low-cost (A and D) producers are the most competitive.

Benefits

Respondent A benefits more from technology than respondents D, B, and C.

Technology-application rating

Respondent A scored the highest (42), and respondent C the lowest (4).

The respondent with the highest technology-application rating also rated the highest on competitiveness and benefits. The data also revealed that only respondent C scored below the mean for competitiveness and benefits.

To triangulate the qualitative and quantitative findings, the results of the hypotheses were used with the data above relating to competitiveness, benefits, and technology-application.

7. TRIANGULATING QUALITATIVE AND QUANTITATIVE RESULTS

Five qualitative questions were identified based on the hypotheses. The qualitative questions, the quantitative hypotheses, and the qualitative findings are discussed in the sections below.

a. ***Hypothesis 1:*** A significant association exists between business strategy and competitiveness.
Qualitative question 1**:** What is the influence of business strategy on competitiveness?

The SM/FM (respondent B), who followed a best-cost strategy by supplying low-cost differentiated products to a niche market, seemed to be the least affected by external forces and, in particular, by imports that have affected the rest of the market. The two respondents (A and D) who followed low-cost strategies were confident and comfortable with their competitiveness and success within their market. Three respondents (A, B, and D) made use of technology at varying degrees of complexity and application to ensure that they met their strategy. They also had a clear strategy direction and the technology to support the strategy. Although respondent D provided solid wood and custom-made items, he had experienced a severe drop in demand, causing him to diversify his product offerings. Respondent D was also the only respondent who was not up-to-date with planning, and had no current plans to acquire any advanced technologies.

The qualitative data therefore reinforces the quantitative data, which proved a positive correlation between strategy and competitive benefits.

b. ***Hypothesis 2:*** A significant association exists between technology and competitiveness.
Qualitative question 2*:* What is the influence of technology type on competitiveness?

The qualitative data indicated that those businesses with a technology strategy, using various degrees of software and hardware, were able to provide quick, quality service. They were competitive and appeared to be growing within their market segments. The fact that the four respondents were still profitable, and that respondents A, B, and D were growing while so many other SM/FMs had shut down, was indicative of their competitiveness. It was, however, noticeable that respondents A, B, and D – who used more technology, as is evident from their higher technology-application rating – appeared to be more competitive. There thus appears to be an association between applying technology and competitiveness in both the qualitative and the quantitative results.

c. ***Hypothesis 3:*** A significant association exists between purchasing strategy and competitiveness.
Qualitative question 3: What is the influence of technology purchasing strategy on competitiveness?

The qualitative results indicated that a purchasing strategy included planning for technology to result in competitive benefit. This was evident from the respondents who stated that they considered application, cost, and flexibility when planning for technology, to ensure the highest possible use of their technology purchases. The qualitative data, therefore, supports the positive correlation found in the quantitative data.

d. ***Hypothesis 4:*** No significant association exists between technology proficiency and competitiveness.
***Qualitative Question 4*:** What is the influence of technology proficiency on competitiveness?

The qualitative data was clear, that very little out- and insourcing happened within the industry. This corroborated the findings of the quantitative results. The industry was competitive and, therefore, secretive by nature. The qualitative and quantitative responses indicated that they did not out- or insource and, if they did, it happened very seldom, or only when they started out. It is thus possible to state that the technology in- and outsourcing practices of a business do not affect its competitiveness.

e. ***Hypothesis 5:*** A significant association exists between information sourcing and competitiveness.
Qualitative question 5: What is the influence of technology information sourcing on competitiveness?

The qualitative respondents who were informed about technology trends and developments were more competitive. The qualitative results confirmed the positive correlation found in the quantitative data between technology and technology information sourcing. The qualitative respondents mostly used trade magazines and the Internet for research purposes, which informed them so that they could plan for future upgrades and technology acquisitions.

8. FINDINGS

This study indicated that the respondents felt the least successful in increasing annual growth and in improving sales turnover and market share. This could be ascribed to the low-levels of technology-application that were evident in the empirical findings.

Respondents rated themselves the highest in producing products of consistent quality, providing efficient after-sales service, responding to customer demands (flexibility), and meeting delivery schedules. This is a positive finding for the industry, as retailers rated quality, service, and delivery as critical success factors for this sample of the South African domestic-furniture industry.

This study confirms a significant association between competitiveness (measured by business performance and technology-competitive advantage) and technology. The study found that the SM/FMs perceived that they were mostly successful in producing unique products of consistent quality, while meeting their delivery schedules and successfully decreasing inventory levels. Furthermore, the study found the sample to be successful in providing efficient after-sales service, being flexible to meet customer demands, and improving innovation of products and service. They felt the least successful in reducing cost and production times owing to the relatively low technology application level.

This study found that not all SM/FMs actively plan for technology acquisition and implementation. Therefore it is recommended that they become disciplined in conducting

long- and short-term planning and in evaluating their progress, successes, and failures with data that will substantiate their findings.

9. CONCLUSION & RECOMMENDATIONS

This study found a strong association between business strategy, technology application, technology purchasing strategy, technology information sourcing, and competitiveness (as measured by business performance and technology-competitive advantage).

Key recommendations

This study identified and assessed selected determinants of technology application and integration in this industry. More comprehensive research is needed to clarify the underlying dimensions and associations that influence technology acquisition and technology strategies in the industry.

Limited research regarding technology has been conducted in this industry. In addition, international studies might not always be relevant to the domestic industry, as it appears to differ significantly in size, market, orientation, and financial resources. It is recommended, therefore, that more research be conducted among domestic SM/FMs to produce data relevant to the industry.

It is recommended that research be conducted with a larger sample representing the complete domestic industry, not only a section of it. It is also recommended that higher levels of statistics be used to determine causality, among other things.

It is recommended that the outsourcing and insourcing findings are further explored and researched. Development of outsourcing and insourcing strategies could be an important component in the development of the industry. Finally, research should be conducted into the specific hardware and software technology most suited for SM/FMs.

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