Effects of knowledge management on firm competitiveness: The mediation of operational efficiency

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Introduction

Small, medium and micro enterprises (SMMEs) are key drivers of job creation and poverty alleviation in developing economies (SEDA 2016). As such, their increased competitiveness could be a main game-changer in an information-intensive global economy. Firm competitiveness denotes the business’s ability to deploy its resource combinations to have an edge over its competitors (Ramorena 2016). Literature suggests that firm competitiveness is central to the long-term financial sustenance (Kiptalam, Komene & Buigut 2016; Akben-Selcuk 2015), innovative capacity (Ramorena 2016) and operational performance of firms (Rao & Soumya 2015).

Recent studies recognise knowledge as a strategic resource (Ha & Lo 2018; Nenungwi & Garaba 2022; Samir 2020) and foreground effective knowledge management (KM) as critical to organisational success (Centobelli, Cerchione & Esposito 2019). Knowledge comprises human capital resources such as ability, ideas, expertise and know-how. Knowledge management pertains to ‘an integrated process that provides organisations with the capability to acquire, convert, apply and protect knowledge for the fulfilment of organisational objectives’ (Ha & Lo 2018:24).

Effective implementation of KM tools and practices contributes to enhanced operational efficiency, improved innovation orientation, improved service delivery and improved prediction...
of new developments in markets (De Souza & Awazu 2006). Implementation is the process that turns strategies and plans into actions to accomplish strategic objectives and goals (Olsen 2015). Effectiveness is about delivery of high-quality products and services through reasonable exploitation of resources therefore, effective implementation denotes the process through which organisations translate strategies, plans, programmes and projects into actionable activities through appropriate deployment of resources. The capacity of the firm to acquire, manipulate and apply knowledge enables the efficient operations of human and capital resources (Omotayo 2015) by eliminating resource wastage and directs critical resources to areas where they are most needed. This assertion identifies with Abusweilem and Abualoush’s (2019) view on the positive and significant role of KM in the operational performance of firms, which contributes to their increased productivity (Attar, Kang & Sohaib 2019).

Although some previous studies (Nowacki & Bachnik 2016; O’Connor & Kelly 2017) associate KM with business competitiveness in a way it brings innovation to organisational context, this is based predominantly on data relating to large firms and not SMMEs (Edvardsson & Durst 2013). Furthermore, studies by Zieba, Bolisani and Scarso (2016) suggest that the practice and execution of KM is not similar in small and large corporations. Therefore, size, resource endowments and capabilities differences mean that the results on KM-competitiveness relationships for large firms cannot be transferred simplistically to small firms.

Literature suggests a positive relationship between operational efficiency and firm competitiveness, because operational efficiency is associated with healthy and sustainable financial performance (Kholopane 2016; Ndolo 2015). Kholopane (2016) posited that operational efficiency impacts firm competitiveness through offering superior services, quality products and service delivery and serving foreign markets. Moreover, Zanotti, Reyes and Fernandez (2018) affirmed that through streamlined financial and operational performance, firms can improve their liquidity and competitive positioning. Similarly, Ndolo (2015) contended that an operational strategy enables firms to utilise their resources better to improve their competitiveness.

While there is sufficient literature on the effects of KM on firm competitiveness, Akben-Selcuk (2015) and Kiptalam et al. (2016) posited that KM influences financial performance and the effects of KM on operational efficiency (Abusweilem & Abualoush 2019; Omotayo 2015) because KM streamlines internal operations. There is lack of knowledge on the mechanisms through which operational efficiency affects the interactions between KM and competitiveness of firms. As KM directly affects firm competitiveness (Jyoti, Rani & Kotwal 2013; Kiptalam et al. 2016) and operational efficiency (Abusweilem & Abualoush 2019), the same way operational efficiency has an influence on company’s bottom line (Sharma, Vashishth & Sharma 2014), it can be inferred that operational efficiency facilitates the relationship between KM and firm competitiveness. However, what remains unclear is the extent to which operational efficiency mediates the KM and firm competitiveness relationship mediates the KM-firm competitiveness relationship; hence, this study explores this gap.

**Literature review and hypothesis**

**Theoretical overview**

The dynamic capabilities framework provides a useful strategic management framework for understanding how firms harness their internal and external capabilities to enhance their performance and long-term competitiveness. Capabilities denote the ability to adapt, reconfigure and integrate skills, resources and functional competences (Mohamud & Sarpong 2016; Teece & Pisano 1994) in ways that increase the economic value of firms. The dynamic capabilities framework postulates that firms which emphasise repetitive processes and harness their internal and external competences to address the changing environment have more potential to attain competitive advantage than those that do not (Mohamud & Sarpong 2016). Inan and Bititci (2015) posited that dynamic capabilities allow firms to extend or modify their existing resources, alter their operational capabilities so that they can adapt. The present study argues that dynamic capabilities manifest in the capacity of small firms to harness their knowledge resources and their operational efficiencies prudently and competitively in ways that reduce the cost of production, augment their sales and exert dominance in markets, thereby increasing their competitive advantage.

The dynamic capabilities framework provides a useful theoretical lens for grasping the effects of KM on firm competitiveness, as it lays a foundation for comprehending how strategic resources at the disposal of the firm (e.g. capacity to manage knowledge and operational efficiency) can be harnessed as useful vehicles for unleashing the competitive edge of firms. Nielsen (2006:60) presented dynamic capabilities as ‘integrated sets of KM activities that changes, renews and exploits the knowledge-based resources of the firm’. Effective KM (acquisition, conversion, application and protection), a key dynamic capability in organisations directly impacts strategic organisational performance, which in turn influences financial outcomes (Zack, Mckeen & Singh 2009). Effective KM, for example, creates a competitive advantage (Sook-Ling, Choo-Kim & Razak 2013), enables effective service delivery (Nenungwi & Garaba 2022) and adds value to client engagement, according to empirical studies based on economic entities from various economic sectors (Govender, Mearns & Du Plessis 2022). Given the agility and versatility of small firms in terms of resources appropriation and exploitation (e.g. bootstrapping, collapsing of managerial and ownership functions as cost-recovery strategies), one would expect such capabilities to be advanced to the benefit of the firm in terms of competing with rival firms.

**Concept of firm competitiveness**

Although there is no generally accepted definition of term ‘competitiveness’, Ocloo et al. (2014) perceived
competitiveness as the extent to which a firm’s products and services exhibit an edge over its competitors for continued survival and competition for markets, resources and revenues. Firm competitiveness is therefore usually measured by a firm’s performance against other firms and depends on its ability to manage knowledge and cultivate operational efficiency (Kiptalam et al. 2016). Institutionised competitive intelligence is critical to achieving strategic business objectives such as firm competitiveness in the information and knowledge economy age (Maritz & Du Toit 2018). An effective competitive intelligence system converts information about the business environment into new business knowledge that business leaders can use to make decisions that will improve their enterprises’ competitiveness (Chevallier et al. 2016). Ghannay and Zeineb (2012) argued that the combination and alignment of competitive intelligence and KM policies and systems allows businesses to gain a long-term competitive advantage.

Conceptualisation of knowledge management

Knowledge management is an emerging set of organisational design and operational principles, processes, organisational structures, applications and technologies that help knowledge workers to dramatically leverage their creativity and ability to deliver business value to customers and assist organisations to acquire improved business competitiveness and improved operations (Jantarajaturapath, Imsuwan & Wongsim 2016). Because organisations in the global economy no longer rely on just tangible assets and production factors to remain competitive (Omotayo 2015), KM has evolved as the main source of competitive advantage. Hence, SMMEs need this strategic shift to KM to capitalise on the innovation and competence prospects associated with it (Dube & Ngulube 2012; Krajnovic, Covo & Jasic 2012).

Knowledge management can be broadly categorised into two dimensions, namely knowledge recognition and knowledge implementation (Mokoena 2019; Ndolo 2015). These dimensions are relevant because they are concerned with the identification of knowledge gaps and the constitution of KM practices (Robertson 2016; Zieba et al. 2016). The fundamental importance of the dimensions under study is underpinned by their recursive processes that permit SMMEs to compete globally.

Knowledge management recognition and firm competitiveness

Knowledge management recognition deals with the awareness of having knowledge or perceptive knowledge of a situation or fact (Wiboho 2014). Small, medium and micro enterprises’ knowledge recognition implies that SMMEs are acutely aware of the innovative potential of knowledge they search for and identify as most germane for the firm, are conscious of immediate customer trends and can establish the firm’s customers and client relations beyond immediate borders (Lofgren 2014). This confirms Baporikar’s (2014) assertion that knowledge recognition revolves around locating knowledge that increases a firm’s productive capacity, the awareness of and ability to take advantage of business opportunities, thereby strengthening the firm’s competitiveness.

Knowledge recognition deals with the awareness and realisation of the importance of well-managed knowledge and how it fits into the firm’s workflow (Wiboho 2014). The fact that knowledge recognition is a critical tool in organisational operations is suggestive of its potential contribution to increasing firm competitiveness. Hence, Kuppusamy and Ramanigopal (2017) posited that the provision of awareness sessions to employees regarding the importance of knowledge recognition needs further improvement and focus, especially among small firms, because of their dependence on knowledge resources. Masic et al. (2017) asserted that in organisations, knowledge recognition could improve the decision-making process, reduce operational costs and time, improve efficiency and enhance competitiveness of firms. This study therefore posits that:

Hypothesis 1: Knowledge management (recognition) directly influences firm competitiveness.

Knowledge management (implementation) and firm competitiveness

Naicker et al. (2017) asserted that the implementation of KM deals with the structured coordination of a firm’s people and culture, processes and technology. Hamad et al. (2018) posited that KM implementation involves the effective utilisation, sharing and transferring of knowledge once it is created with colleagues, teammates and coworkers to improve organisational effectiveness. Effectiveness involves selecting the best action among a range of alternatives or the identification of appropriate strategic goals, that is, ‘doing the right thing’ (Lee & Johnson 2012). Therefore, KM implementation can be regarded as a practice of leveraging knowledge and thus adding value to organisation advantage (Bennet, Bennet & Avedisian 2015).

Literature on KM implementation highlights that in the new knowledge-based economy, the achievement of competitive advantage depends on the firm’s capacity to develop and implement its knowledge-based resources. This assertion leads to the postulation that KM implementation is positively associated with the company’s competitiveness (Andreeva & Kianto 2012). Knowledge management implementation is a critical ingredient for organisations seeking to ensure sustainable strategic competitive advantage (Omotayo 2015). As such, it is therefore cogent to hypothesise that KM implementation is an organisation’s strategic process, which is directed at developing strategic capabilities, enabling firms to deal with turbulence in the business environment, which ultimately improves the competitive advantage of firms. It can be postulated that:

Hypothesis 2: Knowledge management (implementation) directly influences firm competitiveness.

Operational efficiency

There is a clear lack of consensus on the definition of operational efficiency. On the one hand, operational efficiency
is expressed as an operational excellence management system (OEMS) consisting of a set of rules that will guide a company in its operations to achieve operational competence (Al-Qubaisi & Ajmal 2018). On the other hand, the concept is conceived as a ratio of actual input measured against maximum output and behaves like financial leverage (Sharma et al. 2014). The authors contend that operational efficiency identifies and eliminates wasteful processes and resources that threaten organisational profits and facilitates remedial design of new work processes that improve the quality and productivity of the firm. In Njoroge’s (2012) view, a firm is operating efficiently when it is generating sales revenue and minimising costs, as evidenced by increasing its sales volumes at minimal cost.

Operational efficiency is extensively linked with firm competitiveness. Kiptalam et al. (2016) validated this observation by contending that operational efficiency and capabilities available to the firm determine whether the firm will be competitive over its rivals or not. Thus, Okwang’a, Mungania and Karanja (2015) maintained that operating efficiently ensures that firms produce at lower costs, increase customer satisfaction and stay ahead of the competition in the market.

**Operational efficiency mediates the relationship between knowledge management (recognition) and firm competitiveness**

To attain better competitive advantage, it is imperative that firms recognise their KM strengths and shortfalls. The general view is that KM (recognition), which is the firm’s ability to locate and recognise knowledge that increase the productive capacity (Baporikar 2014), has the potential to affect operational efficiency. For instance, Al-Qubaisi and Ajmal (2018) underscore that KM recognition can be implemented to maximise the organisations’ efficiency, which according to Kiptalam et al. (2016) is higher productivity against lower inputs. This corroborates Hegazy and Ghorab’s (2015) assertion that KM recognition enables an organisation to achieve its goals of improving effectiveness and efficiency – in other words, operational efficiency. Omotayo (2015) affirmed that KM recognition increases the capacity of firms to effectively utilise their resources in ways that assert their dominance in the market in relation to their competitors. Moreover, Omotayo (2015) emphasised that KM (recognition) is a key driver of organisational performance, as it is a vital tool for organisational survival, competitiveness and profitability.

Although the impact of operational efficiency on firm competitiveness has been equivocal, operational efficiency and KM recognition have also shown complementary or substitutive effect on firm competitiveness. For instance, KM (recognition) directly impacts firm competitiveness (Abusweilem & Abualoush 2019; Obeidat et al. 2016) and operational efficiency (Madonsela, Sobiyi & Twala 2017), then operational efficiency also directly impacts firm competitiveness (Ponelis 2011). It is plausible that KM (recognition) interacts with firm competitiveness via operational efficiency. Put differently, operational efficiency mediates the relationship between KM and firm competitiveness. One needs to test this postulation empirically to establish the extent of this mediation. It is against this background that this study hypothesises that:

**Hypothesis 3:** Operational efficiency mediates the influence of knowledge management (recognition) on firm competitiveness.

**Operational efficiency mediates the relationship between knowledge management (implementation) and firm competitiveness**

Even though studies (Ho, Hsieh & Hung 2014; Lyu, Zhou & Zhang 2016) report the lack of empirical evidence validating the relationship between KM practices (implementation) and operational efficiency, Al-Qubaisi and Ajmal (2018) argued that there is credible evidence within KM literature suggesting strong links between KM implementation and operational efficiency. Moreover, Omotayo (2015) proclaimed that for any organisation, the goal of managing knowledge is to increase profit by improving the efficiency of operations, thus enhancing competitiveness or competitiveness differentiation. Therefore, it can be inferred that the superior profits and improved efficiency are positive benefits accruing to operational efficiency, a view that supports operational efficiency’s mediation of KM implementation–firm competitiveness relationship. This inference corroborates Okwang’a et al.’s (2015) study that suggested a positive relationship between KM implementation and operational efficiency and Kuppusamy and Ramanigopal’s (2017) claim that KM implementation is a critical and vital organisational resource that aids efficiency and effectiveness, which invariably affect the competitive advantage of firms in the global business environment.

The current study identifies with Simaškienė and Stanciukienė’s (2014) argument that the implementation of KM helps the company to create, collect, organise, share, analyse, update and use knowledge as a rationally managed resource (Simaškienė & Stanciukienė 2014), which helps the company to appropriately adapt to the changes and compete successfully in the market. As such, it is plausible to have an indirect relationship between KM implementation and firm competitiveness, when KM interacts with competitiveness via operational efficiency, which is an intermediary between these two variables. This study, therefore postulates that if knowledge management (implementation) directly impacts firm performance firm performance (Jyoti et al. 2013; Kiptalam et al. 2016) and operational efficiency (Meiami & Meilami 2013), then operational efficiency directly impacts firm competitiveness (Simaškienė & Stanciukienė 2014). Furthermore, it is plausible that KM (implementation) interacts with firm competitiveness via operational efficiency. Therefore, operational efficiency mediates the relationship between KM and firm competitiveness. Cognisant of the preceding discussion, this study hypothesises that:

**Hypothesis 4:** Operational efficiency mediates the influence of knowledge management (implementation) on firm competitiveness.

The conceptual model depicted in Figure 1 demonstrates a direct relationship between KM and firm competitiveness,
KM can also interact with firm competitiveness through operational efficiency (mediation effect).

**Methodology**

**Research design and target population**

This study employed an explorative, cross-sectional design to explore the influence of KM and firm competitiveness, with operational efficiency as an intermediary. A positivistic and quantitative approach was adopted to test the associative relationships between variables under study. A survey instrument was developed based on extensive literature covering KM, operational efficiency and competitiveness. A cross-section survey was administered on retail SMMEs in Manguang Metropolitan Area (MMA), Free State province, a large administrative area with a fairly large concentration of small business in the central region of South Africa. As one of the traditional methods of research, a survey instrument was considered most appropriate for the study because of its ease of use and ability to yield large amounts of analysable data (Young 2016) in a short time.

The target population for this study was retail SMMEs, business entities that have a strong presence in the central region of South Africa (SEDA 2016). Moreover, the choice of SMMEs was driven by their overall strategic importance in boosting the country’s economy through employment creation and poverty alleviation (Mbuyisa 2017), despite their apparent weak competitiveness (Rambe & Khaola 2020), a concern which necessitates due attention. The Wholesale and Retail Sector Training Authority (W&RSTA) of South Africa estimated that there are approximately 3165 registered SMMEs in the Free State province. The W&RSTA was deemed the most credible source because it is made up of predominantly SMMEs, which account for approximately 90% of the retail sector.

**Sampling and data collection**

Drawing on the identified population, the researchers extracted a sample comprising a manageable number of SMMEs. Using an online sample size calculator1 set at 95% confidence level and a margin of error of 5%, a population of 3165 SMMEs will generate a sample of 343 SMMEs. Even though the sample was drawn from SMMEs, the authors drew their information from SMME owners and managers because of their close proximity to the relevant variables under study and their knowledge of routine business operations. A structured questionnaire comprising closed-ended, five-point Likert scale questions was developed to establish the extent of respondents’ agreement with the provided statements (Maree & Pietersen 2016). The questionnaire was deemed most appropriate as it provided convenience of completion in view of the SMME owners and managers’ competing roles and responsibilities. The instrument covered demographic data and business profiles, SMME’s KM dimensions, operational efficiency and competitiveness.

A total of 343 survey questionnaires were distributed by hand by the main author and two research assistants to SMME owners and managers in the MMA. Some SMME owners and managers completed and handed over their copies instantly to the researchers, while others asked them to collect it later. Over a period of 2 months, 300 out of the 343 questionnaires (representing acceptable 87.5% response rate) were correctly completed and collected from SMME owner and managers. Small, medium and micro enterprise owners and managers were accessible directly from their respective workplaces, while those who were not physically available were reached through their e-mails. Those who completed the form electronically submitted it via e-mail to the researcher or research assistants.

**Demographics and business profile of respondents**

The results indicate male dominance (60%) in SMME ownership, while the female counterparts accounted for 40%. This finding corroborates Bhorat et al.’s (2018) assertion that men typically own the majority of SMMEs. About 46.7% of the respondents were between the ages of 36 and 55 years, 42.3% were between 18 and 35 years, while only 11.0% were individuals over 56 years. This demonstrates the presence of mature adult population as either owners or managers of SMMEs. Black people were the most represented (49%) racial group, followed by mixed race people, who comprised 27.7% of the sample. A significant percentage (35.3%) of owners and managers possessed the highest qualification of matric or lower high school grade and 27.7% professed to having tertiary qualification, while 30% were postgraduates. The important statistics to note are that almost half the number of respondents (47.3%) were owners and managers of the business and 42% of businesses were in existence for 6–10 years.

**Measures**

The scales used to measure the variables were adapted from the existing literature.

**Knowledge management**: Two dimensions (recognition and implementation) were used to assess SMME KM (Cardoni et al. 2020). On a five-point Likert scale, respondents were asked to indicate their extent or agreement with an available set of statements. Items included in the measurement scale were knowledge resources available in operations and sales, training and personnel, including knowledge sharing and transfer (Baporikar 2014; Robertson 2016). Sample questions around KM recognition (items) were how critical the recognition of KM was in business operations and sales and

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whether the business supported employees with training and role specification. Sample question items on KM implementation were the extent to which the business deployed other resources and personnel to support the implementation of KM and how the business encouraged knowledge sharing and transfer. Overall, KM was measured by 11 items covering two dimensions.

Operational efficiency: The construct was subdivided into two dimensions: proactiveness and intelligence generation (Bindl & Parker 2010; Ndolo 2015). On a five-point Likert scale, respondents were asked to indicate their extent or agreement with a provided set of statements. Sample items used to measure proactiveness covered the firm’s ability to leverage technology, enhance employee skills and promote efficient delivery of goods and services to customers (Kalluru & Bhat 2009). Intelligence generation was measured using sample questions (items) such as the gathering and assessing of competitor information, gathering of customer information, business discussions with suppliers and maintaining corporate relations with other firms. Overall, operational efficiency was measured by 11 items covering two dimensions.

Firm competitiveness: On a five-point Likert scale, respondents were asked to indicate their extent or agreement with a provided set of statements. Sample items used to measure firm competitiveness were whether the firm forecasted better return on investment (Arslan & Tathil 2012; Ricardo 2015), the company enjoyed better market share, the firm had increased gross sales (SME Competitiveness Outlook 2015). Measuring SME competitiveness the firm had retained existing customers and attracted new customers and the business could attract talented employees.

Ethical considerations
Ethical clearance to conduct this study was obtained from the Faculty of Management Sciences Research and Innovation Committee of the Central University of Technology (ref. no. FMSEC05/18).

Results
The researchers used partial least squares structural equation modelling (PLS-SEM) to test whether the collected data adequately described the proposed model. ADANCO 7 computer software was used to conduct the tests. The PLS-SEM is a nonparametric structural equation model estimator which, unlike covariance-based SEM, does not require specific thresholds concerning data distribution and sample size to be satisfied. The PLS-SEM is conducted at two levels, that is, (1) assessment of the measurement (outer) and (2) assessment of the structural (inner) model assessment.

Measurement (outer) model assessment
Assessment of the measurement model involves ascertaining whether proposed indicator variables adequately represent the latent constructs, which they are purposed to measure. In this regard, the following issues are tested: internal consistency (reliability), convergent and discriminant validity. Firstly, the researchers used the Cronbach’s alpha (α) coefficient to access reliability. A Cronbach’s alpha coefficient of at least 0.7 confirms acceptable internal consistency of measuring items. Secondly, average variance extracted (AVE) was used to measure convergent validity. Convergent validity of a latent construct is confirmed when its indicator values demonstrate high levels of positive correlation – AVE greater than 0.5. The results of the two tests are presented in Table 1. Based on the data presented in the table, all the constructs in the proposed conceptual model satisfied the minimum conditions of reliability and convergent validity.

While testing the suitability of the measurement model, the extent to which the constructs in the model differed from each other was also evaluated. This is known as discriminant validity. Discriminant validity exists when indicators exhibit high factor loadings on the specific constructs, which they represent and there are no cross-loading of items across constructs. Table 2 shows no evidence of cross-loadings, and this confirms discriminant validity.

Structural (inner) model assessment
The structural model was assessed using the following indicators: (1) the coefficient of determination (R-squared), a measure of predictive power, and (2) path coefficients, measures of strength of relationships between variables. R-squared measures the variance of an endogenous variable explained by a set of predictor variables. Its value ranges from 0 to 1. As presented in Figure 2 and Table 3, KM (recognition) and KM (implementation) accounted for 75.4% of the variance in operational efficiency (proactiveness) and 53.1% of the variance in operational efficiency (intelligence gathering). Moreover, KM (recognition), KM (implementation), operational efficiency (proactiveness) and operational efficiency (intelligence gathering) collectively explained 64.6% of the variance in firm competitiveness. Hair et al. (2014) suggested that R² values ranging from 0.5 to 0.75 represent moderate predictive power of a proposed model. Therefore, the model that was proposed in this study has moderate predictive power.

Path coefficients were used to test the strength of the direct and indirect relationships between the independent and dependent variables. The statistics in Table 4 shows that data supported the following hypothesised direct relationships: H1: KM

<table>
<thead>
<tr>
<th>Construct</th>
<th>Number of items</th>
<th>Cronbach’s alpha (α)</th>
<th>Average variance extracted (AVE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operational efficiency (intelligence gathering)</td>
<td>5</td>
<td>0.8514</td>
<td>0.6279</td>
</tr>
<tr>
<td>Knowledge management (recognition)</td>
<td>5</td>
<td>0.7540</td>
<td>0.5110</td>
</tr>
<tr>
<td>Operational efficiency (proactiveness)</td>
<td>6</td>
<td>0.8356</td>
<td>0.5532</td>
</tr>
<tr>
<td>Firm competitiveness</td>
<td>6</td>
<td>0.8744</td>
<td>0.6148</td>
</tr>
<tr>
<td>Knowledge management (implementation)</td>
<td>6</td>
<td>0.8490</td>
<td>0.5942</td>
</tr>
</tbody>
</table>
(recognition) -> firm competitiveness ($B = 0.662, p = 0.000$) and H2: KM (implementation) -> firm performance ($B = -0.1402, p = 0.0335$). This means KM (recognition) had a strong, positive and significant explanatory influence on firm competitiveness, while KM (implementation) had a weak but negative, significant explanatory effect on the same outcome variable.

### TABLE 2: Indicator factor-loadings

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Operational efficiency (intelligence gathering)</th>
<th>Knowledge management (recognition)</th>
<th>Operational efficiency (proactiveness)</th>
<th>Firm competitiveness</th>
<th>Knowledge management (implementation)</th>
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<tbody>
<tr>
<td>C23</td>
<td></td>
<td>0.5234</td>
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<tr>
<td>C24</td>
<td></td>
<td>0.6526</td>
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<td>C25</td>
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<tr>
<td>C26</td>
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<td>0.8477</td>
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<td></td>
<td>0.8338</td>
</tr>
<tr>
<td>F53</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.8129</td>
</tr>
<tr>
<td>F54</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.7323</td>
</tr>
<tr>
<td>F55</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.6967</td>
</tr>
</tbody>
</table>

* means relationship is statistically significant at the 0.05 level.
*** means relationship is statistically significant at the 0.01 level.

**FIGURE 2:** Path relationships and coefficients.
TABLE 3: Coefficient of determination.

<table>
<thead>
<tr>
<th>Construct</th>
<th>Coefficient of determination ($R^2$)</th>
<th>Adjusted $R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operational efficiency (intelligence gathering)</td>
<td>0.5311</td>
<td>0.5280</td>
</tr>
<tr>
<td>Operational efficiency (proactiveness)</td>
<td>0.7544</td>
<td>0.7527</td>
</tr>
<tr>
<td>Firm competitiveness</td>
<td>0.6459</td>
<td>0.6411</td>
</tr>
</tbody>
</table>


TABLE 4: Variable effect overview.

<table>
<thead>
<tr>
<th>Effect</th>
<th>Direct effects</th>
<th>$p$</th>
<th>Indirect effects</th>
<th>$p$</th>
<th>Total effect</th>
<th>$p$</th>
<th>Cohen's $f^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge management (recognition) -&gt; firm competitiveness</td>
<td>0.6620</td>
<td>0.0000</td>
<td>0.1545</td>
<td>0.019</td>
<td>0.8164</td>
<td>0.0000</td>
<td>0.2836 – medium effect size</td>
</tr>
<tr>
<td>Knowledge management (implementation) -&gt; firm competitiveness</td>
<td>-0.1402</td>
<td>0.0335</td>
<td>0.0697</td>
<td>0.050</td>
<td>-0.0705</td>
<td>0.2533</td>
<td>0.0171 – small effect size</td>
</tr>
</tbody>
</table>


A bootstrapping procedure based on 500 samples was carried out to ascertain the mediation effects of operational efficiency on the influence of KM (recognition) and KM (implementation) on firm competitiveness. The mediation effects describe a situation where a third variable is added and intervenes in the relationship between two variables (MacKinnon, Fairchild & Fritz 2007). The result of the tests are presented in Table 4. The indirect relationship proposed in H3: KM (recognition) -> operational efficiency -> firm performance ($B = 0.1545$, $p = 0.019$) was significant. This proves complementary partial mediation because both the direct and indirect relationships between KM (recognition) and firm competitiveness were statistically significant. The indirect relationship in H4: KM (implementation) -> operational efficiency -> firm performance was also supported ($B = 0.0697$, $p = 0.050$), confirming mediation. As the direct and total effects and/or relationships were negative while the indirect effect and/or relationship was positive, the nature of the mediation relationship was partial and positive.

Discussion

This study sought to investigate the mechanisms through which operational efficiency interacts with KM to influence firm competitiveness in selected SMMEs in South Africa. This topic is under-researched in emerging economies, especially in the small business context.

Consistent with previous research emphasising the contribution of effective and efficient KM to organisational performance (Donate et al. 2017; Naicker et al. 2017), the findings of this study demonstrate that KM (recognition) and KM (implementation) were directly and positively linked to firm competitiveness. This outcome is not surprising, given the claim that KM is regarded as a critical dynamic resource for attaining competitive advantage (Jyoti et al. 2013; Kiptalam et al. 2016).

This study’s results also indicate that the effect of both subtypes of KM on firm competitiveness was partially mediated by the operational efficiency variable. The result thus resonates with the claim that effective KM is integral to organisational efficiency, which in turn is a precursor to firm competitiveness (Meilham & Meilham 2013). A plausible explanation could be that good management and internal communication of intelligence about the business environment enhances the integration of organisational processes, which ultimately leads to operational improvement. This in turn positions the firm to perform better against competitors.

Limitations, implications and recommendations

While the study provides insightful knowledge on the intersection of KM, operational efficiency and firm competitiveness, there were some limitations. Firstly, the study used a cross-sectional design to address the hypotheses. While Wang and Cheng (2020) conceded that a cross-sectional study is relatively inexpensive and easy to conduct, its major weaknesses are that it does not follow-up with the individual (respondent) over time and it is difficult to make causal inferences based on its data. That said, the authors accept that the rigour applied in the data analysis coupled with the use of mainstream literature in the development of the scales was useful in the generation of credible results. Secondly, while the sample may have been adequate to test the hypotheses, it may not be enough to make inferences across the whole of the Free State province. Hence, future studies could examine the research variables on a larger research setting. Thirdly, even though the use of mixed method research approach in conducting interviews in parallel with administering questionnaires could have provided some more comprehensive insights on relationships between variables (Rambe & Khaola 2020), the limitation of resources (finances, time and effort) could not permit the researchers to do so. Lastly, the choice of parameters of competitiveness adopted in this study was constant, whereas in reality, they may be different for individual firms (Celindamar & Kılıççıoglu 2013). As such, the results need to be considered in their context. While this could threaten the transferability of results, it is noted that despite any measure’s comprehensiveness, no measure can be exhaustive and be a one-size-fits-all.

Despite the limitations, there are useful owner and managerial implications revealed by the study. The results confirm that firm competitiveness is directly and positively influenced by KM recognition and implementation. As such, SMME owners and managers must identify knowledge gaps, provide personnel training, draft and follow KM implementation processes and policies that are germane to the growth and competitiveness of the business. Although the study results confirmed partially mediated relationships, the effect sizes were substantial, pointing to the significance of SMMEs’ streamlining their daily operations through better communication with customers and suppliers, improved delivery of goods and services and maintaining good corporate relations with other firms, to ensure that competitiveness is not negatively impacted.
Conclusion
This study has hypothesised and demonstrated a statistically strong influence of KM dimensions (recognition and implementation) and operational efficiency on the competitiveness of SMMEs. While the literature shows that KM and operational efficiency in small firms are widely researched, research on operational efficiency as an intermediary between KM (recognition and implementation) and firm competitiveness still requires more focus. The authors have provided evidence on the direct interaction between KM and firm competitiveness and on the mediating effects of operational efficiency in this interaction. Based on the foregoing discussion, it is logical to argue that while KM (recognition and implementation) has a direct influence on firm competitiveness, it also influences it indirectly via operational efficiency.

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Competing interests
The authors declare that they have no financial or personal relationships that may have inappropriately influenced them in writing this article.

Authors’ contributions
M.P.M. did the data collection and wrote the literature sections of this paper. P.R. wrote the theory sections and the discussion and substantially reworked the different versions of the draft. He also supervised the Master’s study on which this study was based. T.M.N. did the methodology section and also analysed the data for the article.

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Data availability
The SPSS data on which this article was based is available from the first author upon request. However, this data remains the intellectual property of the Central University of Technology.

Disclaimer
The views and opinions expressed in this article are those of the authors and do not necessarily reflect the official policy or position of any affiliated agency of the authors.

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