Business Intelligence Enabling Competitiveness: A Multi-Theoretical Analysis of South African Metals Manufacturers

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The competitiveness of the South African metals manufacturers is under the spotlight, since new investments in the metals and engineering industry in South Africa have been poor, and growth in the Chinese trade has had a negative competitive effect on domestic metals manufacturing output and employment. The purpose of the study was to determine how supportive the business intelligence process is in enabling successful competitiveness in practice. A theoretical model was designed and empirically tested by metals manufacturers, where four theories were selected to act as mediators between the business intelligence process and successful competitiveness. This study tested four hypotheses by applying Spearman's rank-order correlations and a structural equation model. A total of 63 responses were received and analysed. The study found that the building blocks of the business intelligence process combined in a single factor do not directly lead to successful competitiveness, but only when all the theories' principles, combined into a single factor, act as mediators.

Key Words: business intelligence, knowledge-based view, metals manufacturers, resource-based view, sustainable development, theory of constraints
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Introduction

This study investigates how the business (competitive) intelligence process enables successful competitiveness (competitive advantage) in the

South African metals manufacturing industry. Four theories were included in a theoretical structural model together with the business intelligence process as the independent variable and *successful competitiveness* as the dependent variable. The approach was not *per se* to test the theories, but rather to analyse them as a possible link between the building blocks of the business intelligence process and successful competitiveness. Consequently, these theories incorporated specific questions in a questionnaire that aggregates the principles of each theory. The selected theories, which were all employed in various business intelligence studies are (i) the resource-based view that states that organisational resources are essential to create sustainable competitive advantage (Polidoro and Toh 2011), (ii) the knowledge-based view that considers knowledge in itself as a resource (Wang, He, and Mahoney 2009; Le Roux and Oosthuizen 2010), (iii) the theory of constraints that highlights the most important limiting factors or constraints in firms that prohibit the achievement of goals and are usually identified and systematically addressed until these constraints no longer limit firms (Goldratt 1990), and (iv) the theory of sustainable development that focuses on 'development that meets current requirements without compromising future requirements' (United Nations 1987).

Business intelligence is aimed at gaining a strategic competitive advantage (Porter 1980). Although there are many ways to understand the concept of business intelligence, an encompassing definition is 'the legal collection and analysis of information regarding the capabilities, vulnerabilities and intension of business competitors conducted by using "open sources" and ethical inquiry' (https://www.scip.org/). Typically, there are six building blocks found in the competitive intelligence process, namely (i) planning and focus, (ii) collection, (iii) analysis, (iv) communication, (v) process and structure, and (vi) organisational awareness and culture (Dishman and Calof 2008).

South African metals manufacturers were selected to be the main focus of the study, as their competitiveness is currently under the spotlight due to limited new investments and a drop in the production efficiency of fixed capital (Chibanguza and Noise 2017). Furthermore, there is a perception in South Africa that the growth in the Chinese trade (accounting for more than half of the global metals consumption) has had a negative competitive effect on domestic metals manufacturing output and employment, which resulted in, according to Swansy (2016), demands for increased protection from Chinese imports.

This paper is a unique part of a greater study that investigated metals manufacturers in South Africa in order to develop a business intelligence framework to enhance their sustainability. Accordingly, the purpose of this paper was to determine how supportive the business intelligence process is in enabling successful competitiveness in practice. In achieving this, a theoretical model was designed and empirically tested. Firstly, a direct relationship was tested between the business intelligence process and successful competitiveness, followed by analyses where the theories' principles were included to serve as mediators. The theoretical contribution of this study is found in the conclusion about the mediating role of the combination of selected theories to support the business intelligence process, which may enable successful competitiveness.

In the next section, the design of the theoretical model is discussed, including the conceptual frame that indicates the different paths and the hypotheses to be tested. This is followed by the design of the empirical study, results, testing the hypotheses and a concluding discussion thereof.

Theoretical Model

THE BUILDING BLOCKS OF THE BUSINESS INTELLIGENCE PROCESS

The business intelligence wheel, developed by Dishman and Calof (2008), indicates that there are a total of six building blocks (BB), classified into two categories, in business intelligence, namely:

Core building blocks:

- BB1 (Planning and focus), which entails decisions about what information is available, as well as for what purpose(s) and from which resource(s) it was collected.
- BB2 (Collection), during which required data for a competitive intelligence exercise is collected, aligning various sources and acquisition methods.
- BB3 (Analysis), during which the collected information is converted into *actionable intelligence* from which strategic and tactical decisions can be made.
- BB4 (Communication), during which the created intelligence is communicated to those with the appropriate responsibility.

Supporting building blocks:

- BB5 (Process and structure), which requires appropriate policies, procedures and infrastructure to enable effective contribution to the intelligence system.
- BB6 (Organisational awareness and culture), i.e. enabling/empowering companies to utilise their intelligence efforts successfully.

Companies should know how to remain competitive and how to anticipate and react to changes inside and outside the industry. In order to manage such a challenge, companies should have a process in place to turn data into information, and information into actionable intelligence, from which strategic and tactical decisions can be made. These processes of gathering data and turning raw data into intelligence are fundamental aspects of conducting business (Laudon and Laudon 2012).

For hypothesis building and testing, the researchers developed a number of statements to measure the practical application of each of the six building blocks included in the business intelligence process. According to the researchers' judgement, four statements were developed for each building block, which can be viewed in table 1.

SELECTED THEORIES

The theoretical model of this paper entails a combination of four selected theories, primarily centred on key factors impacting continued sustainability, namely the resources of human capital, knowledge, and natural capital, as well as cognisance of possible constraints in which the organisation may operate.

The first theory is T1 (Resource-based view), which states that organisational resources and capabilities are essential to ensure the creation of a competitive advantage (Kessler 2013; Wang, He, and Mahoney 2009). A common measure that reflects the status of resource utilisation is indexes to measure production efficiency. With reference to this study, the average index rating for 2015 and 2016 for the iron and steel products subsector was well below the full capacity norm, which is indicative of lower efficiency and lower productivity (Chibanguza and Noise 2017). To measure and test the importance of the resource-based view for companies in the metals manufacturing industry (with special reference to human resources), the following was posited:

- The effective application of human resources will lead to a competitive advantage; and

- Companies apply human resources effectively to attain a competitive advantage.

Secondly, T2 (Knowledge-based view) refers to the deployment of knowledge as a resource (Wang, He, and Mahoney 2009; Peters et al. 2016). As such, business intelligence provides a framework of knowledge to organise coordinated activities in a group, to analyse and share information, and to incorporate active collection techniques (Streamcrest 2003). Therefore, companies should actively involve their employees as a key part in organisational knowledge, as intellectual capital becomes more accepted as being a valuable resource for a sustainable, successful economic future (Auer 2004). To measure and test the knowledge-based view for companies in the metals manufacturing industry, two statements were posited:

- Companies know certain competitive aspects *better* than their competitors do; and
- Companies know certain competitive aspects *sooner* than their competitors do.

Thirdly, T3 (Theory of constraints) refers to a managerial framework for continuous improvement where the *weakest link* is regarded as the largest constraint, which should be addressed first (Kessler 2013). It highlights the most important limiting factors in companies that prohibit them from being competitive (Goldratt 1990). To measure and test aspects of the theory of constraints in the metals manufacturing industry, the following were posited:

- Companies regularly identify their most debilitating constraints; and
- When companies identify their most debilitating constraints, such constraints are addressed until they are no longer inhibiting factors.

Finally, the declaration of the World Commission on Environment and Development (United Nations 1987) makes it clear that T4 (Sustainable development) emphasises that (economic) development should be pursued with a sense of shared responsibility towards future generations. According to Seliger (2007), sustainability is directed at enhancing the living standard of humans while ensuring the continued availability of natural resources for future generations. To measure and test aspects of sustainable development (with specific reference to natural resources) for companies in the metals manufacturing industry, the following were posited:

- Companies are sensitive to matters pertaining to sustainable development; and
- Companies incorporate the principles of sustainable development in their operations.

COMPETITIVENESS IN THE SOUTH AFRICAN METALS AND ENGINEERING INDUSTRY

The South African metals manufacturers form part of the manufacturing industry and are a combination of the metals industry and the engineering industry (Lundall, Maree, and Godfrey 2008). According to the current economic sector census, the metals and engineering industry covers 29 percent of the manufacturing industry footprint (Statistics South Africa 2017). The fortunes of the metals and engineering industry correlate with the South African economy (Chibanguza and Noise 2017), and as such, growth in the South African economy is an important prerequisite for the metals and engineering industry. Unfortunately, the human resource utilisation in the metals and engineering industry can be considered a drawback, as is illustrated by the labour cost increase of 81 percent (2005 to 2015), while labour productivity increased by only 12 percent (Statistics South Africa 2017), thereby creating a competitively unsustainable situation.

South Africa is typically considered a mineral-rich country, and China, as one of the fastest developing countries in this era, requires South African minerals as part of its growth strategy. There is, however, a perception that the growth in Chinese trade has had a negative competitive effect on domestic manufacturing (Swansy 2016). It is widely accepted that competitiveness brings improved performance (Du Plessis et al. 2015), and a healthy state of competitiveness is of critical importance to the good health of South African metals manufacturers. To measure the successful competitiveness of the metals manufacturers, seven statements were developed and divided into four themes, namely (i) resource utilisation, (ii) the so-called China effect, (iii) performance, and (iv) globalisation. The inclusion of the seven statements was further motivated during the pilot study phase when industry experts voiced important viewpoints.

In order to test the *resource utilisation,* the following was posited:

- The effective application of human resources will lead to a competitive advantage in the South African metals manufacturing industry.

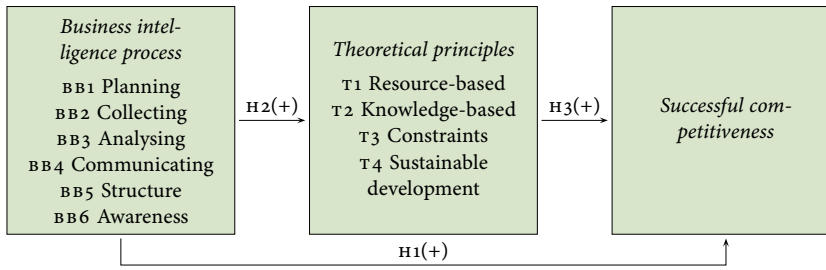

FIGURE 1 Conceptual Scope

Regarding the *China effect,* the study posited:

- South African companies in the metal manufacturing industry will have a better competitive position in relation to China if the level of competitive intelligence in the company increases; and
- South Africa's trading with China is benefitting South African companies in the metal manufacturing industry.

To test *performance,* the study posited:

- The efficiency of South African companies in the metal manufacturing industry can be significantly improved; and
- The competitiveness of South African companies in the metal manufacturing industry can be significantly improved.

In terms of *globalisation,* the study posited:

- The global trading market is benefitting South African companies in the metal manufacturing industry; and
- South African companies in the metal manufacturing industry are cognisant of the competition laws of the countries of their clients.

CONCEPTUAL FRAME AND HYPOTHESES

Figure 1 provides a frame for the broad conceptual scope in which the study was concluded. Each of the six building blocks in the business intelligence process is to be tested to enable successful competitiveness, while the theoretical principles are employed as mediators. Note that the theoretical model is not the destination, but rather the vehicle to clarify the theories' relationships.

As exhibited in figure 1, the study firstly argues that when the building blocks of the competitive intelligence process are adequately accomplished, it will be directly related to (H1) enabling successful competitiveness, and (H2) enhance the principles of the four selected theories. With

such theories as the mediators, it can also be argued that (H3) the adequate accomplishment of the theoretical principles will be related to the successful enabling of competitiveness. A correlation analysis of the relationship between the above hypotheses (H1, H2 and H3) should allow the study only to conclude upon the size and the direction of the relationship. Therefore, the study's second argument is that more insight can be gained by analysing (H4) how the building blocks enable successful competitiveness via the four theories' principles. Therefore, a structural equation model analysis may further support the refinement of the selected theories and to improve the practical value of the study.

Design

The target population was the metals manufacturers in South Africa. The metals manufacturing fraternities employed 38,860 workers in quarter 4 of 2016 (Statistics South Africa 2017), of which approximately 15 percent are employed in management, engineering and other supervisory roles (C. Dednam, e-mail to author, 14 July 2017), the latter of which were targeted. The questionnaire was distributed via two employer representative organisations, namely SEIFSA (Steel and Engineering Industries Federation of Southern Africa) and SAISI (South African Iron and Steel Institute). The request to the employer representative organisations was twofold, namely (i) to send the questionnaire to its member employers, and (ii) to request that the questionnaire be distributed by the employers in their organisations.

In developing the questionnaire, the researchers were guided by a questionnaire that tests business intelligence practices as developed by Saayman et al. (2008) as well as suggestions obtained during the literature review and the pilot study phase. This article reports on (i) the demographic information, (ii) the business intelligence process, (iii) testing the application of the selected theories, and (iv) competitiveness in practice. In all cases, statements were posed that requested responses on a five-point Likert scale ranging from strongly disagree (option 1) to strongly agree (option 5). In terms of structuring the questionnaire, the following should be noted:

- Firstly, in total, 24 statements were ordered to support the six building blocks (table 1). The first four statements from each of the six building blocks were followed progressively by the other statements in order to ensure continued reliability of the factor analysis to be followed.

- Secondly, the four theories each led to two statements that summarise the principles of the theory as posited with regard to the South African metals manufacturers (table 2). A similar practice as above was followed, where the eight statements for the final questionnaire were ordered by selecting the first statement from each of the four theories followed by the second statement, again to ensure continued reliability of the factor analysis.
- Finally, seven statements, representing what was posited with regard to the metals manufacturers, were developed from themes identified during the literature reviews and from views of experts, to evaluate the competitiveness in practice (table 3). Therefore, a variety of divergent statements were used to determine the degree of practising the broad themes identified, utilisation of resources, the China effect, performance and the global environment. Note that the statements are differently specified, i.e. for Statements E4, E6 and E7, a higher selection on the five-point Likert scale implies a higher degree of positivity and *vice versa*. Statements E1, E2, E3 and E5 show the opposite, where a higher score represents a higher degree of negativity and *vice versa*. Therefore, the respondents' answers to the latter four statements were reversed before they were used in the analyses.

The reliability and validity of the questionnaire were tested during multiple practical sessions, including a structured pilot study.

The results were analysed by means of a factor analysis, the purpose being to determine which items belong together. Confirmative factor analysis was used in sections where the four statements per building block and the two statements per theory, respectively, already form predetermined groups. Exploratory factor analysis was used where the seven divergent statements were posed to the respondents. The following guides were employed to interpret the factor analysis: Cronbach's alpha coefficients were used to gauge reliability and internal consistency (accepted values > 0.7); eigenvalues of factors and scree plots assisted with factor extraction (acceptable values > 0.5); communalities indicate the common variance present in a variable (a variable with no specific variance shows a communality of 1 and a variable that shares none of its variance with any other variable shows a communality of 0); and Kaiser-Meyer-Olkin (KMO) values were used to determine sample adequacy (acceptable values > 0.5) (Field 2009).

To test the relationship between all variables, the non-parametric approach of Spearman's rank-order correlation analysis was used. Correlation analysis was applied to test the first three hypotheses.

To test the fourth hypothesis, a structured equation model (SEM) was applied to explore the paths (i) directly from the building blocks to successful competitiveness, and (ii) from the building blocks to the theories and from the latter to successful competitiveness. SEM is based on the principles of chi-square analysis and interpreted accordingly. This model was tested through the collected data and the following pointers were used as a guide to the model fit: CMIN/DF (minimum sample discrepancy divided by the degrees of freedom) should be interpreted subjectively by the researcher; however, ratios as high as 3, 4 or even 5 are considered as still representing a good fit (Meuller 1996); CFI (comparative fit index) > 0.9 indicates an overall good fit (Meuller 1996); and RMSEA (root mean square error of approximation) should be less than 0.1 (Blunch 2008).

Results

RESPONSE

In total, 63 usable questionnaires were completed by respondents. The overall analysis of the completed questionnaires showed good KMOS and Cronbach's alpha coefficients, and it was recommended by the North-West University's Statistical Consultation Services that additional data collection was not necessary.

The respondents represent firms with fewer than 200 employees (48%), between 200 and 1,000 (27%), between 1,000 and 3,000 (14%) and more than 3,000 (11%). The respondents were mainly from management (76%) and specialists (13%), and 57 percent of the respondents are more than 50 years old. The respondents are highly experienced, with 76 percent who have been employed for more than 10 years in the metals and engineering industry.

BUSINESS INTELLIGENCE PROCESS

The six building blocks of business intelligence in section B of the questionnaire delivered one factor for each of the building blocks. The factor pattern matrixes for the aforementioned six building blocks/factors are shown in table 1. Building block, or factor, 6 obtained the lowest but acceptable KMO coefficient (0.604), the lowest first component eigenvalue of 47.87 percent, marginally below the 0.5 norm, and lowest Cronbach's

TABLE 1 Confirmatory Factor Analysis of Six Building Blocks

CI Building block	Factor statistics					(6)	(7)	(8)
	(1)	(2)	(3)	(4)	(5)			
BB1: Planning & focus	0.714	63.66	0.809	3.492	0.798	1	0.753	0.567
						7	0.875	0.766
						13	0.893	0.797
						19	0.645	0.417
BB2: Collection	0.718	58.38	0.710	3.387	0.725	2	0.269	0.072
						8	0.889	0.791
						14	0.857	0.734
						20	0.859	0.738
BB3: Analysis	0.823	73.45	0.876	3.426	0.909	3	0.884	0.781
						9	0.854	0.729
						15	0.782	0.612
						21	0.903	0.816
BB4: Communication	0.787	63.95	0.811	3.379	0.786	4	0.740	0.547
						10	0.805	0.649
						16	0.822	0.675
						22	0.829	0.687
BB5: Process & structure	0.727	58.01	0.766	3.302	0.802	5	0.824	0.679
						11	0.718	0.515
						17	0.736	0.541
						23	0.764	0.584
BB6: Awareness & culture	0.604	47.87	0.625	3.277	0.676	6	0.524	0.275
						12	0.698	0.487
						18	0.698	0.487
						24	0.816	0.666

NOTES Column headings are as follows: (1) KMO, (2) eigenvalue (%), (3) Cronbach's Alpha, (4) factor mean, (5) factor standard deviation, (6) question number, (7) loading, (8) communality.

Continued on the next page

alpha of 0.625, below the 0.7 norm, and also the lowest factor mean coefficient (3.277) of all six of the building blocks. The rest of the building blocks obtained good factor scores, i.e. KMOS between 71.4 percent and 82.3 percent, first component eigenvalues of between 58.01 percent and 73.45 percent, Cronbach's alphas between 71 percent and 87.6 percent, and

TABLE 1 *Continued from the previous page*

No.	Question
1	Our company plans what CI information we need
2	In our company CI information is analysed in order to achieve CI results
3	In our company CI information is analysed in order to achieve CI results
4	In our company reported CI information is passed on to decision-makers
5	Our company has structures whereby CI information can be reported
6	Our company has CI training available for our employees
7	The results of our CI efforts are such that it influences our company's strategic direction and decision-making
8	Collected information in our company is checked for accuracy and validity before being forwarded in our system
9	Collected information in our company is checked for accuracy and validity before being forwarded in our system
10	In our company we generally receive feedback of CI information
11	Our company maintains CI information in formal ICT systems
12	In our company we are encouraged to report information that can contribute towards our company's competitive position
13	In our company we focus on CI information gathering that will benefit us
14	In our company analysed information can be obtained from a variety of information management systems
15	In our company analysed information can be obtained from a variety of information management systems
16	In our company helpful information is frequently communicated upwards and downwards
17	We know how to collect information that could be of competitive value to our company
18	Our company encourages the sharing of information that could be to the advantage of our company
19	In our company we only gather specific information on which we base our CI
20	Our company continually analyses information to provide competitive advantages
21	Our company continually analyses information to provide competitive advantages
22	Non-sensitive CI findings are available to employees
23	We maintain profiles of our customers and competitors
24	Our office-bound employees understand what CI is

the factor means between 3.302 and 3.492. Except for Questions 2 and 6, all the communality values are mostly above or close to 0.5.

TABLE 2 Confirmatory Factor Analysis of the Selected Theories

No.	Statement	(1)	(2)	(3)	(4)
D1	The effective application of human resources will lead to a competitive advantage for my company	•			
D2	My company knows certain competitive aspects better than our competitors		•		
D3	My company regularly identifies our most inhibiting constraints			•	
D4	My company is sensitive to the matters around sustainable development				•
D5	My company applies human resources effectively such that it leads to a competitive advantage for my company	•			
D6	My company knows certain competitive aspects sooner than our competitors		•		
D7	Once my company identifies our most inhibiting factors we address it until it is not inhibiting any longer			•	
D8	My company incorporates the principle of sustainable development in our operations				•
Cronbach's Alpha		0.379	0.689	0.758	0.819
Component mean		3.540	3.532	3.640	
Component standard deviation		0.748	0.834	0.836	

NOTES Column headings are as follows: (1) theory 1: D1, D5, (2) theory 2: D2, D6, (3) theory 3: D3, D7, (4) theory 4: D4, D8.

MULTIPLE THEORIES

Table 2 shows the eight statements supporting the four theories (Section D of the questionnaire). An analysis of the spread of the responses and descriptive statistics of the eight statements supporting the four theories has shown that the means of the responses provided by the participants were higher than 3. This implies that the participants generally agreed with the statements.

The highest difference between two means per theory occurred in Theory 1 (0.6 = 4.2 – 3.6). In retrospect, it can be argued that it is only in the case of Statement 1 where the phrasing of the sentence is more general, whereas the rest of the statements in this section are phrased specifically to test the views of the participants with regard to 'my company.' It was, therefore, easier for the participants to agree with a more general statement than to evaluate a response based on the realities of their own company. Consequently, Statement 1 was eliminated from the study, espe-

TABLE 3 Exploratory Factor Analysis for Seven Divergent Statements

No.	Statement	(1)	(2)	(3)
E3	The efficiency of my company can be significantly improved	0.909		0.825
E1	The human resources (HR) capacity utilization of my company can be significantly improved	0.807		0.654
E5	The competitiveness of my company can be significantly improved	0.793		0.627
E2	My company will have a better competitive position in relation to China should my company's level of competitive intelligence (CI) increase	0.757		0.593
E6	The global trading market has benefits for our company		0.773	0.631
E7	Our company is cognizant of the competition laws of our clients' countries		0.748	0.559
E4	South Africa's trading with China has benefits for our company		0.714	0.509
Factor Cronbach's Alpha		0.835	0.605	
Factor mean		3.791	3.213	
Factor standard deviation		0.731	0.830	

NOTES Column headings are as follows: (1) factor 1, (2) factor 2, (3) communalities. Kaiser-Meyer-Olkin measure of sampling adequacy = 0.687, eigenvalue of component 1 = 38.93%, eigenvalue of component 1 and 2 (cumulative) = 62.83%.

cially when anomalies were also identified in further analyses. Therefore, its paired statement, Statement 5, was, treated as a stand-alone statement (T1.5). This is supported by the attempt to define a factor from Statement 1 and Statement 5 that resulted in a Cronbach's alpha of 0.379, resulting in the rejection of the factor. The remaining six questions are paired in three sets of two questions in the questionnaire to test for three theories (T2, T3 and T4).

COMPETITIVENESS

The seven arbitrary statements designed to test views on successful competitiveness in practice are shown in table 3. The exploratory factor analysis identified two factors.

Each factor component in section E loaded a minimum of 0.714 and communalities ranged from 0.509 to 0.909. The means of both factors calculated at more than 3, the mid-point of the Likert scale. The first factor focuses on 'my company' and can be considered a more inwardly focused perspective, which is renamed as Practical Competitiveness-

TABLE 4 Spearman's Correlation Coefficient (rho) Matrix

	BB1	BB2	BB3	BB4	BB5	BB6	T1.5	T2	T3	T4	PC-I	PC-E
BB1	1,00											
BB2	0.70**	1,00										
BB3	0.83**	0.77**	1,00									
BB4	0.70**	0.79**	0.73**	1,00								
BB5	0.73**	0.66**	0.80**	0.76**	1,00							
BB6	0.69**	0.80**	0.78**	0.82**	0.75**	1,00						
T1.5	0.46**	0.23	0.36**	0.26*	0.31*	0.33**	1,00					
T2	0.57**	0.54**	0.60**	0.46**	0.47**	0.52**	0.43**	1,00				
T3	0.59**	0.43**	0.62**	0.62**	0.63**	0.60**	0.53**	0.61**	1,00			
T4	0.56**	0.49**	0.55**	0.59**	0.49**	0.53**	0.50**	0.60**	0.80**	1,00		
PC-I	0.39**	0.23	0.19	0.24	0.22	0.27*	0.23	0.20	0.37**	0.28*	1,00	
PC-E	0.17	0.30*	0.26*	0.30*	0.13	0.23	0.14	0.09	0.22	0.25*	0.09	1,00

NOTES * Correlation is significant at the 0.01 level (two-tailed). ** Correlation is significant at the 0.05 level (two-tailed).

Internally focused (PC-I). The second factor looks at the bigger picture and can be considered a more outwardly-focused perspective, which is renamed as Practical Competitiveness-Externally focused (PC-E). The PC-I factor obtained a Cronbach's alpha of 0.835 and can be considered good, while the PC-E factor obtained a Cronbach's alpha below 0.7 and can be considered acceptable but not good.

TESTING HYPOTHESES

To test the first three hypotheses, the monotone relationship between variables was determined. Table 4 displays the non-parametric Spearman correlation (rho) between the variables.

The first hypothesis is partly supported, where the building blocks BB1 and BB6 are significantly positively related to PC-I. Furthermore, it is also supported where building blocks BB2, BB3 and BB4 are significantly positively related to PC-E.

Except for the non-significant correlation between BB2 and T1.5, the second hypothesis is supported, since there is a positive significant relationship between each of the building blocks of the business intelligence process and each theory's principles.

The third hypothesis is only supported where there is a positive relationship between T3 and T4 and PC-I, as well as T4 and PC-E.

TABLE 5 Regression Default Model: PC-I = Dependent Variable

			Estimate	SE	CR	*p*	Estimate*
Theories	←	BB	0.619	0.130	4.748	***	0.787
BB1	←	BB	1.000				0.893
BB2	←	BB	0.871	0.091	9.602	***	0.855
BB3	←	BB	1.190	0.101	11.795	***	0.933
BB4	←	BB	0.968	0.095	10.158	***	0.877
BB5	←	BB	0.988	0.097	10.164	***	0.877
BB6	←	BB	0.845	0.080	10.537	***	0.891
T1.5	←	T	1.000				0.624
T2	←	T	0.913	0.201	4.549	***	0.684
T3	←	T	1.393	0.248	5.618	***	0.936
T4	←	T	1.262	0.237	5.324	***	0.847
PC-I	←	T	0.575	0.299	1.923	0.054	0.441
PC-I	←	BB	0.001	0.220	0.004	0.997	0.001

NOTES * Standardised regression weights: default model. Model: CMIN/DF = 1.982; CFI = 0.929; RMSEA = 0.127.

To further shed light on the relationship where all variables are included, a structural equation model was built to test the collected data. Two models were tested, where the first unravels how the building blocks of the competitive intelligence process support PC-I directly and how they support PC-I through the mediation of the principles of the theories. The second model was similar, with the only difference being that PC-E replaced PC-I.

The researchers decided to test the six building blocks together against (i) PC-I (or PC-E) and (ii) against the four theories together, and (iii) test the four theories together against PC-I (or PC-E). The reason for this is that an analysis shows that Cronbach's alphas for the six building blocks and the four theories are 0.955 and 0.855, respectively. These high scores confirm that it is sensible to put the six building blocks and the four theories together in groups. A similar analysis to regroup PC-I and PC-E together was not realised, as a result of a very low Cronbach's alpha of –0.165, which confirms the original exploratory factor analysis to treat them as separate factors.

Table 5 exhibits the results as per AMOS, a part of the SPSS software where PC-I is the dependent variable, the grouped building blocks the

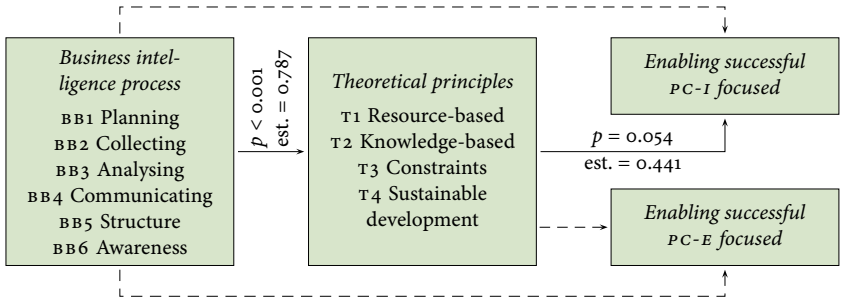

FIGURE 2 Structured Equation Model (dashed – insignificant path)

independent variable and the grouped theories the mediator. Table 5 can be interpreted as a regression analysis, where *** indicates a significance level of less than 1 percent. Note that the emphasis is on the relationship and that this model does not necessarily test for causality. There is a coefficient of 0.787 between the building blocks and theories, which is significant at 0.001. The coefficient between the theories and PC-I is 0.441 with a *p*-value of 0.054, slightly above the significance level norm of 0.05. However, it can be argued that for a small sample size such as this study, a 0.1 significance level may also be an appropriate norm. The direct link between PC-I and the building blocks indicates a coefficient of 0.001 and a *p*-value of 0.997, far above the 0.05 level, implying that a variation in PC-I is not attributable to a variation in the building blocks. This model fit to the data is good, where the CMIN/DF of the default model of 1.981 is good; the CFI level of 0.929 is also good, since it is above 0.9. The RMSEA of 0.127 is slightly higher than the norm of approximately 0.1. Finally, we concluded with this model, since further attempts to enhance it were not successful.

A similar model was built to fit the data, where PC-E is the dependent variable instead of PC-I. Unfortunately, the only good fit in that model was the link between the building blocks and the theories (with the same coefficient of 0.787 and a *p*-value < 0.001 as in the above PC-I dependent model). The relationships between the theories and the direct relationship between the building blocks and PC-E were not significant.

Figure 2 summarises the adjusted conceptual frame used in this study, where both the PC-I and PC-E are incorporated. From the figure, it is clear that the building blocks in the business intelligence process do not directly lead to PC-I. The competitive intelligence process only led to PC-I via the mediation of the theories. Furthermore, similar to the findings

in the multi-regression model, the competitive intelligence process does not lead directly or indirectly via the theories to enable PC-E.

Concluding Discussion

The purpose of the study was to determine how supportive the business intelligence process is in terms of creating sustainable competitiveness. This was done by testing its relationship directly with successful competitiveness in practice, and secondly, a similar relationship testing the involvement of the theories.

Many related studies confirmed that the business intelligence process is valuable in many regards (Olszak 2016), especially to improve competitiveness or competitive advantage (Peters et al. 2016). The study's first hypothesis (H1) was designed to conclude upon the direct relationship, without interventions of the theories, between the building blocks of the business intelligence process and successful competitiveness. Although the results from this study support some of the findings of related studies, the results also provide a refinement of such relationships to identify only specific areas of the business intelligence process that are related to successful competitiveness. Consequently, it is concluded that on a stand-alone basis, only BB1 (Planning and focus), and BB6 (Establishing an awareness culture), are positively related to enable successful competitiveness – internally focused, and BB2 (Collecting), BB3 (Analysing) and BB4 (Communicating) are positively related to enable successful competitiveness – externally focused.

The selection of four theories for the scope of this study was inspired by related works where they are associated with business intelligence and/or competitiveness (Polidoro and Toh 2011; Wang, He, and Mahoney 2009; Le Roux and Oosthuizen 2010; Goldratt 1990; United Nations 1987). The second hypothesis (H2) concluded that each of the building blocks is positively related to each of the theories, with the exception of BB2 (Analysis), which does not significantly correlate with T1.5 (Resource-based theory). Therefore, with this overwhelming evidence, this study concludes that these selected theories are appropriate in studying competitive intelligence/competitiveness.

The results from the third hypothesis (H3) support the view of Kessler (2013) and Goldratt (1990) that T3, the theory of constraints, which is a holistic approach, improves firms' performance and that it will lead to improved competitiveness. This study provides a refined view and concludes that, on a stand-alone basis, the theory of constraints is positively

related to successful practical competitiveness – internally focused. This study also supports views such as those of Porter (1980) that sustainable development relates to improved competitiveness, since this study concludes that, on a stand-alone basis, the principles of sustainable development relate positively to successful practical competitiveness, both internally and externally focused. Our study does not support findings that the resource-based view (Capron and Chatain 2008) and knowledge-based view lead to an increased competitive advantage (Meihami and Meihami 2014; Wang, He, and Mahoney 2009).

The structural equation model provided further insight, namely that the building blocks in the business intelligence process may be grouped together and the four theories may also be grouped together. Furthermore, the study provides further refinement that all the building blocks collected in the business intelligence process enable successful competitiveness – internally focused, only via the mediation of the combined theoretical principles.

To summarise, the study concluded that, without interventions of the theories, five of the six building blocks correlate with successful inwardly- and outwardly-focused competitiveness, and by including the theories, the building blocks correlate well with all the theories, and that two theories correlate with successful inwardly- and outwardly-focused competitiveness. From here, the conclusion can be made that the business intelligence process, with or without the mediation of the theories, *relates* to successful competitiveness. However, within the context of the structural equation model, the building blocks *enable* successful inwardly-focused competitiveness; however, they are somewhat incapable without the mediation of the theories.

This study's contribution to theory is emphasised in the conclusions above, where the roles of the theories are refined within the context of this study and all the variables included in the models. The practical implication of the study is that metal manufacturers are aware now of the significance or insignificance of paths between the boxes, including individual elements in and/or groupings of the boxes. To enable successful inwardly-focused competitiveness, companies in the metals manufacturing industry are encouraged to apply all six building blocks of the competitive intelligence process and to ensure that special attention is given to the first, i.e. planning and focus. Furthermore, the principles of all four theories investigated should be applied, with special attention to the theory of constraints and sustainable development.

The structural equation model could not identify factors that can enable successful competitiveness from an outward-looking perspective. Future studies may investigate which factors and theories may be an aid, for the industry in general and for South African metals manufacturers in particular, to enable successful practical outwardly-focused competitiveness.

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