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A PSYCHOMETRIC APPROACH TO SUPERVISORY COMPETENCY ASSESSMENT

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ABSTRACT

The primary purpose of this study was to evaluate the possibility of using a psychometric approach for assessing supervisory competencies relevant to the mining and refining environment. The competency questionnaire was developed using supervisory roles and registered supervisory unit standards from the United Kingdom (UK), as no registered unit standards exist in South Africa. Twenty-four supervisors from three departments (Production, Engineering and Laboratory) were evaluated by 125 raters; besides by themselves, also by their managers, peers, customers and their sub-ordinates. Based on difference scores derived from the Importance and Performance scales, a single factor was extracted with an internal reliability of 0,965. No statistical significant differences were obtained (ANOVA's, t-test and F-statistics) between groups based on biographical variables or between rater groups. The findings and their implications are further discussed.

OPSOMMING

Die primêre doel van die studie was om die moontlikheid vir die gebruik van 'n psigometriese benadering tot toesighouerbevoegdheidsbeoordeling, te evalueer. Die bevoegdheidsvraelys is ontwikkel deur gebruik te maak van toesighouersrolle en geregistreerde toesighouerseenheidstandaarde van die Verenigde Koningkryk, as gevolg van 'n gebrek aan bestaande eenheidstandaarde in Suid-Afrika. Vier-en-twintig toesighouers van drie departemente (Produksie, Ingenieurswese en Laboratorium) is deur 125 beoordelaars geëvalueer; buiten deur hulself, ook deur hul bestuurders, kollegas, kliënte en hul ondergeskiktes. 'n Enkele faktor, met 'n betroubaarheid van 0,965, gebaseer op die verskiltellings van die Prestasie- en Belangrikheidskaal, is onttrek. Geen beduidende verskille (ANOVA's, t-toetse en F-statistiek) kon tussen groepe gebaseer op biografiese veranderlikes en die onderskeie beoordelaarsgroepe gevind word nie. Hierdie bevindinge en die implikasies daarvan word verder bespreek.

On competencies

Competencies have wide application and serve as a foundation for various human resource processes, such as recruitment and selection, training and development, performance management, and career and succession planning (Weightman, 1994). Competencies according to McLagan and Nel (1995, p.49) "*... are the personal resources that help make a system of governance work*". It is therefore important that the competency approach be optimised.

To be competitive in the global market, South Africa has to distribute its available and required skills through the whole population. This need was reflected in South Africa's position in the World Competitiveness Report of 2001 (World Economic Forum, 2001). In this report, South Africa was placed 34th out of 75 countries, compared to 33rd out of 59 in 2000 (World Economic Forum, 2000) and 47th out of 59 in 1999 (World Economic Forum, 1999) in relation to growth and development. Thus, the assessment, development and acquisition of competence become imperative to drive a country's growth and development.

The Skills Development Act, (No 97 of 1998), and the South African Qualifications Authority Act, (No 58 of 1995), are legislative initiatives focused on addressing the aforementioned challenge. Table 1 summarises the objectives of the Skills Development Act and the South African Qualifications Authority Act.

From the summary of objectives in Table 1, it is clear that developing people, as well as giving credit for development, is to be promoted. This brings to mind a question about the relevancy and meaning of competency-based processes in managing human resources. According to Weightman (1994, p. 11) "*using competencies as the basis for National qualification, and then equivalences across borders, alleviates the difficulties of differences between job titles and cultures, as competencies concentrate on the ability to do the job*". It is therefore necessary that any competency-based assessment approach for training and development purposes in particular, will have to meet the objectives as described in the said legislation.

TABLE 1
OBJECTIVES OF THE SKILLS DEVELOPMENT ACT (NUMBER 97 OF 1998) AND SOUTH AFRICAN QUALIFICATIONS AUTHORITY ACT (NUMBER 85 OF 1995)

Skills Development Act (Number 97 of 1998)	South African Qualifications Authority Act (Number 58 of 1995)
To develop the skills of the South African workforce	To create a national framework for the learning environment
To increase investment in education, training and development and return on investment	To facilitate access, mobility and progression within education, training and career paths
To encourage employers to create an environment for learning and create opportunities to develop skills, gain experience and get employment	To promote the quality of education and training
To encourage employees to learn	To redress past unfair discrimination practices
To improve employability of previously disadvantaged groups and redress past disadvantages	To contribute to the full personal development of each learner
To ensure quality of education, training and development	
To assist work seekers, retrenched workers and employers seeking competent people	
To provide and regulate employment services	

With this in mind, two basic issues arise, namely what a competency is and what the relationship between national standards and competencies are.

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The world of vocational education and training uses two distinct categories of competency models, namely 1) Competency models that are inputs based, and 2) Competency models that are outcomes based (Buckley & Caple, 1995; Mansfield, 1989). The first category constitutes descriptions of individual knowledge and skills. It is based on the assumption that competencies are individual attributes. The second category is based on descriptions of work role outcomes.

For the purpose of this study, competencies are defined as "*skills or clusters of skills performed in a particular context or environment to specific standards*" (Bellis, 1999, p. 19). This definition supports the notion of competencies being outcomes based, thus establishing a strong relationship with national standards, which are also outcomes based (Hallendorff, Richardson & Wood, 2000). It is therefore proposed that competencies as standards, and national unit standards should be seen as being the same. The underlying principle of this competency approach offers the organisation access to a framework (i.e. National Qualifications Framework) of assessing and developing staff, which is formal, structured, reliable and recognised at national and industry level. The individual benefits from this competency approach through its transferable accreditation of competencies acquired.

To be useful in any applied assessment context, competency standards have to be defined, described and assessed in terms of the behaviour they consist of. This will constitute the content validity of the assessment. It should thus be done in such a way that it accommodates most or all of the uses of competency standards, as mentioned before. Buckley and Caple (1995) and Mitchell (1989) identified the components of a competency standard *as performance criteria*, *range statements*, *related knowledge and assessment requirements*, which are similar to the key components thereof as described by Hallendorff et al (2000). These key components are: *competency standard title* (an outcome large enough to be recognised and credited), *specific outcomes* (which are smaller outcomes of the unit standard title), *assessment criteria* (which explains how well the specific outcomes should be performed) and *range statements* (used to describe the context or environment). These components underpin an approach of providing evidence as proof of competency during the standard-based assessment process.

In the vocational training process, specified learning outcomes that cover the aims of the curriculum, could be taught and assessed in unambiguous ways, which would overcome the problems of reliability, content validity and fairness in assessments. The objective therefore, is to base learning on outcomes-based competency standards (Gonczi, 1999).

It would therefore be beneficial for organisations to apply the outcomes-based assessment and development of, specifically, key employees such as supervisors, cost-effectively. The roles of supervisors will therefore be discussed in more detail below.

On the role of supervision

Managers, as supervisors do, have many roles to play in the organisation. These roles are:

- *Figurehead* (performs ceremonial and symbolic duties such as greeting visitors or signing legal documents);
- *Leader* (direct and motivate subordinates, communicating with subordinates, training and counseling them);
- *Liaison* (maintains information links both inside and outside organisation);
- *Monitor* (seeks and receives information, scans reports and maintains personal contacts);
- *Disseminator* (forward information to other organisation members, e.g. by sending memos and reports);
- *Spokesperson* (transmits information to outsiders through speeches, reports and memos);
- *Entrepreneur* (initiates improvement projects and identifies new ideas);
- *Disturbance Handler* (takes corrective action during disputes or crises and resolves conflicts among subordinates);
- *Resource Allocator* (decides who gets resources through scheduling, budgeting and setting priorities);
- *Negotiator* (represents department's interests in meetings and negotiations).

The functions that managers fulfil, are contained in their roles. This theory brings a different dimension to analysing management through focusing on the role instead of the function. The first line supervisor performs all the managerial roles of top management, but it is done within the context of his or her own section (Mintzberg, 1973).

Organisational co-ordinating mechanisms in this supervisory context are: "*the glue holding organisational structure together*" (Mintzberg, 1979, pp. 3-7). These mechanisms involve:

i) mutual adjustment,
ii) direct supervision, (own emphasis),
iii) standardisation of work processes,
iv) standardisation of skills, and
v) standardisation of outputs/results.

As organisational work becomes more complex, co-ordination seems to shift from mutual adjustment to direct supervision, to standardisation and can finally revert back to mutual adjustment. He postulated that: "*direct supervision achieves co-ordination by having one individual taking responsibility for the work of others*" (Mintzberg, 1979, pp. 3-4). This is evident with large groups that are less able to co-ordinate informally, thus with further complexity, supervision becomes necessary. Of these five elements, direct supervision and standardisation of skills support the main focus of the current study.

The necessity of supervision in the modern organisation can be attributed to new technology and a change in worker values (Hodgetts, 1987). Direct supervision, according to Mintzberg (1979), included planning, scheduling, allocating, instructing and monitoring actions, and closely resembles what Hilgert and Leonard (1998,) (planning, organizing, staffing, leading and controlling), as well as Hodgetts (1987) (planning, organising, directing and controlling) described as supervisory functions. These supervisory functions could be grouped in the same groupings as Mintzberg (1973) has done with managerial activities and roles as illustrated in Table 2. The supervisory competencies, according to UK standards, are also listed in the last column to indicate the overlap with supervisory functions and roles.

TABLE 2
COMPARISON OF MINTZBERG'S MANAGERIAL ROLES, SUPERVISORY FUNCTIONS AND THE COMPETENCIES EXTRACTED FROM UK UNIT STANDARDS

Managerial Activities	Associated roles	Supervisory Functions	Supervisory competencies
Interpersonal Relationships	• Figurehead • Liaison • Leader	• Instructing	• Building teams • Communicating • Acting assertively • Influencing others
Information processing	• Monitor • Disseminator • Spokesman	• Monitoring	• Focussing on results • Searching for information
Making significant decisions	• Improver/ changer • Disturbance handler • Resource allocator • Negotiator	• Allocating • Planning • Scheduling	• Thinking and taking decisions • Behaving ethically • Managing self

Companies are often encountering difficulties in the area of supervision. These difficulties refer to problems with communications, controlling internal mobility, managing change, managing subordinates, performance management and measurement, and managing discipline and grievances (Calhoon, 1971). These difficulties can be related to the roles of supervisors as was described above. It is argued that the problems as mentioned, can be addressed through ensuring the competence (standardisation of skills) of supervisors in the roles that they have to play. Multi-rater performance evaluations play a valuable role in this regard.

On 360° competency assessments

As mentioned before, there are different approaches towards assessing competencies. Standards-based competency assessment can be a long and tedious process due to its nature of seeking proof or evidence of competence. It is highly likely that this process will be biased when performed by a single individual. Different sources of bias in performance ratings were identified by Theron and Roodt (1999, 2000) who listed different working relationships; ego-centric bias; differences in organisational level; rater-leniency; the halo effect; purpose of ratings; and differences in rating criteria as examples. Theron and Roodt (2000) also added different mental models of raters to this list, based on their own research. Mental models in this instance refer to "*unitary, spatial models where distance has functional consequence, and which are used to give meaning and understanding to complex systems or phenomena*" (Theron & Roodt, 2000, p. 15). Quantitative evidence of the validity and reliability of such single-sourced, standards-based competency assessments are therefore difficult to determine. Following a multi-rater approach on the other hand, such as 360° competency assessments, may address most of these concerns by generating quantitative, psychometric information on reliability and validity coefficients. In 360° competency assessments, according to Jones and Bearly (1996), an individual receives feedback from a multi-rater assessment process, providing a more objective, holistic view of the individual. Overall, 360° assessments are more accurate, credible, fair and motivational than single-source assessments (Edwards, 1998) when applied effectively.

The success of 360° assessments (multi-rater assessment) is largely dependent on effective integration with human resource systems and business strategy, valid content, accurate responses, clear and specific results, integration with career development and planning support, and measurable performance improvement (Morical, 1999). In order to achieve this, specific attention should be given to design, implementation and evaluation factors (Theron & Roodt, 2001). More specifically, users of the system should be allowed to participate in the development of the system, to ensure that the system will be perceived as fair. Users of the system should also be trained in the proper use of the system (Edwards & Ewen, 1996), and the requirements of the Employment Equity Act (No 55 of 1998) that requires all psychological tests and other similar assessments to be valid and reliable, fair as well as not biased against any employee or any group of employees, should be adhered to. This necessitates that any 360° assessment rating system should be evaluated and validated.

In this study, the 360° competency assessment approach is seen as supplementary to the formal standards-based competency approach, as it is based on registered UK standards. The statistical reliability and validity of the 360° competency assessment process can be defended and could possibly be included in the standards-based assessment process.

In view of the discussion in the section above, the research objectives are stated as follows:

Research Objectives

The primary objective of the study was to determine whether a 360° degree competency assessment questionnaire could reliably and validly assess supervisory competencies.

The secondary objectives of the study were:

- To determine if there are any statistically significant differences in the mean difference scores between the Importance and Performance scales, with regard to different work departments, educational qualification levels and language groups. This comparison would assess whether different comparison groups have different mental models regarding supervisory competencies.
- To determine if there are any statistically significant differences in the mean difference scores between the Importance and Performance scales, with regard to different rater groups (manager, self, customer, sub-ordinate and peer/colleague). This comparison would assess possible differences in mental models on supervisory competencies between different rater groups.

METHOD

The research participants

The study was conducted in the mining and refining industry during 2002. A group of twenty-four first line supervisors from three departments (Production, Laboratory and Engineering) was assessed using the 360° Supervisory Competency Inventory (360° SCI). The total population of participants (N = 125) in this study were from 5 different rater groups: managers, self, customers, peers/colleagues, and subordinates. Participating employees were briefed about how to complete the rating form, the aim of the assessment and the purpose of 360° assessment.

Table 3 provides a brief overview of the biographical background of the rater sample in this study.

TABLE 3
DISTRIBUTION OF PARTICIPANTS ACCORDING TO BIOGRAPHICAL VARIABLES

Demographic variable		
1. Department	**N**	**%**
Production	65	52
Laboratory	38	30,4
Engineering	22	17,6
Total	**125**	**100**
2. Relationship	**N**	**%**
Self	24	19,2
Manager	40	32
Customer	11	8
Subordinate	38	30,4
Peer/colleague	12	9,6
Total	**125**	**100**
3. Qualification	**N**	**%**
Std 8 – 10	77	61,6
Tertiary	44	35,2
Missing	4	3,2
Total	**125**	**100**
4. Language	**N**	**%**
Afrikaans	43	33,3
English	22	17,1
Zulu	34	26,4
Other	30	23,3
Total	**129**	**100**
5. Gender	**N**	**%**
Male	119	95,2
Female	6	4,8
Total	**125**	**100**

The level of education of the participants ranges from standard 8 to tertiary qualifications. Four language groupings were included, namely Afrikaans, English, Zulu and Other. It should be noted that 129 respondents (more than 125) are listed under language groups, which can be attributed to multi-lingual individuals who listed more than one home language.

The measuring instrument

Accepted United Kingdom standards for management and supervision were analysed and compared with in-house supervisory roles. The obtained results were further validated by subject matter experts, such as line management and individuals drafting standards for the Standards Generating Body for management and supervision. The nine supervisory competency dimensions (refer to Table 2) extracted from the unit standards were: Team building; Communicating; Focusing on results; Thinking and taking decisions; Acting assertively; Managing self; Influencing others; Searching for information; and Behaving ethically. Statements were developed around these nine competency dimensions for the 360° SCI. The 360° SCI included a total of 34 behaviourally based statements. Examples of items used were as follows:

"The person I am assessing:
– Motivates team members to do a good job.
– Seeks to clarify conflicting information."

Participants responded to the items of the 360° SCI on two scales, namely a six-point scale in respect of actual Performance and a six-point scale in respect of Importance (in terms of overall performance), where a 1 on the response scale was 'strongly disagree' (meaning poor performance), and a 6 'strongly agree' (meaning good performance) or 'low importance' and 'high importance' respectively.

The research procedure

The Business Manager of the Business Unit provided a letter of support to the project to explain the objective of the project and to urge participants to be honest and co-operative. This letter was attached to each form (the assessment was paper-based) and distributed to the participating employees with instructions on how to complete the 360° SCI and whom they were to assess. A deadline date for submitting the completed questionnaire was also communicated.

Senior staff members from each section or department were identified as contact people for the study, overseeing the distribution, completion, collection and control of the 360° SCI forms. This ensured the integrity of the assessment tool and the data collected for the study.

RESULTS

First level factor analysis on the item inter-correlation matrix

The initial 34 items were inter-correlated. Owing to a lack of space, the inter-correlation matrix cannot be reproduced here. A Kaiser-Meyer-Olkin measure of sampling adequacy (MSA) of 0,906 was obtained which indicated that the unreduced matrix was suitable for a first level factor analysis. Item 23 was omitted from the inter-correlation at this point. Eigenvalues were calculated on the inter-correlation of the remaining 33 items and six factors were postulated according to Kaiser's (1961) criterion (eigenvalues larger than unity). These six factors explained 71,738% of the variance in the factor space, as reflected in Table 4.

Six factors were extracted using principal axis factoring. Meaningful item loadings were obtained on all six postulated factors. Subsequently, the sub-scores were calculated for these six factors.

TABLE 4
EIGENVALUES OF THE UNREDUCED INTERCORRELATION MATRIX OF THE 360° SCI

	Initial Eigenvalues		
Root	Eigenvalues	% of Variance	Cumulative %
1	**15,937**	48,293	48,293
2	**2,386**	7,230	55,523
3	**1,671**	5,064	60,587
4	**1,476**	4,474	65,061
5	**1,153**	3,495	68,556
6	**1,050**	3,182	71,738
7	0,927	2,809	74,546
8	0,838	2,538	77,084
9	0,754	2,286	79,370
10	0,726	2,201	81,572
11	0,668	2,025	83,597
12	0,576	1,746	85,343
13	0,524	1,589	86,932
14	0,512	1,551	88,482
15	0,469	1,422	89,904
16	0,392	1,189	91,093
17	0,333	1,010	92,103
18	0,318	0,962	93,066
19	0,304	0,921	93,986
20	0,251	0,761	94,748
21	0,233	0,707	95,455
22	0,204	0,619	96,074
23	0,194	0,589	96,663
24	0,178	0,540	97,203
25	0,147	0,445	97,649
26	0,140	0,424	98,072
27	0,124	0,377	98,449
28	0,121	0,365	98,815
29	0,108	0,327	99,142
30	0,087	0,265	99,407
31	0,075	0,228	99,635
32	0,070	0,212	99,847
33	0,051	0,153	100,000
Trace	33,000		

Item 23 was omitted before the intercorrelation was performed

Second level factor analysis on the sub-score inter-correlation matrix

The six sub-scores (obtained from the first level factor analysis) were inter-correlated and the results of the inter-correlation of the sub-scores are displayed in Table 5. A Kaiser-Meyer-Olkin measure of sampling adequacy of 0,904 was obtained on this inter-correlation matrix, which indicated that this matrix was also suitable for the second level factor analysis.

TABLE 5
INTERCORRELATION MATRIX OF THE SUBSCORES OF THE 360° SCI

Factor	1	2	3	4	5	6
1	1	0,785	0,478	0,737	0,800	0,728
2	0,785	1	0,594	0,730	0,739	0,741
3	0,478	0,594	1	0,487	0,430	0,560
4	0,737	0,730	0,487	1	0,702	0,626
5	0,800	0,739	0,430	0,702	1	0,658
6	0,728	0,741	0,560	0,626	0,658	1

All correlations are significant at the 0,01 level (2-tailed)

Table 6 provides the eigenvalues of the unreduced inter-correlation matrix of sub-scores. A single factor was postulated based on Kaiser's (1961) criterion. This factor explained 71,606% of the variance of the factor space.

Table 6
Eigenvalues of unreduced intercorrelation matrix (6×6)

	Initial Eigenvalues		
Root	Eigenvalues	% of Variance	Cumulative %
1	4,296	71,606	71,606
2	0,660	10,998	82,604
3	0,364	6,061	88,664
4	0,283	4,722	93,386
5	0,214	3,563	96,949
6	0,183	3,051	100,000
Trace	6,000		

The factor solution converged after six iterations. As only one factor was extracted, no further rotation took place. Table 7 provides the factor matrix of the 360° SCI.

Table 7
Factor loadings of the 360° SCI

Subscores	Items	N	Factor 1	h_j^2
1	3,4,18,1,2,28,7,19	8	0,894	0,799
2	14,21,12,24,17,10,26,11,13	9	0,904	0,817
3	25,34,22,30,20	5	0,599	0,358
4	8,6,29,33,27	5	0,812	0,659
5	9,15,5	3	0,833	0,694
6	32,31,16	3	0,815	0,665

variance explained of factor space = 71,606%
Cronbach alpha = 0,965

Iterative item analyses were performed in respect of the single factor for both the Performance and the Importance measures of the 360° SCI and high Cronbach alpha coefficients of 0,968 and 0,964 respectively were obtained. The results will not be presented separately for each scale, owing to limited space. Difference scores were used to present the scale properties. A high Cronbach alpha coefficient of 0,965 was obtained in respect of the difference scores of these two scales. Table 8 provides the item statistics of the difference scores of the two scales in respect of the 360° SCI.

It is clear from Table 8 that the corrected item-total reliabilities vary between 0,330 and 0,815 with only five items having values below 0,50 that contributed to the high internal consistency of the scale. The above results suggest that supervisory competencies could be reliably (high Cronbach alpha coefficient of 0,965) and validly [based on factorial validity – a component of construct validity (Allen & Yen, 1979)] measured which support the primary objective of this study.

The first secondary objective of the study was to determine whether there were any statistically significant differences in the mean difference of competency scores of groups created in terms of the different biographical variables. ANOVA'S (more than two groups), t-tests (two groups only) and F-statistics were used for these analyses. As a large majority of the respondents were male and very few females participated in the study, gender was not included in this analysis.

Table 8
Item statistics in respect of the difference scores of the two scales of the 360° SCI (N = 125)

Item	Scale Mean if item deleted	Scale variance if item deleted	Item SD	Corrected Item-total correlation	Alpha if item deleted
V1	26,542	1032,704	32,136	0,773	0,964
V2	26,592	1034,260	32,160	0,761	0,964
V3	26,708	1040,797	32,261	0,692	0,964
V4	26,692	1049,929	32,403	0,675	0,964
V5	26,358	1034,534	32,164	0,714	0,964
V6	26,483	1031,849	32,122	0,712	0,964
V7	26,667	1042,006	32,280	0,667	0,964
V8	26,883	1066,507	32,657	0,487	0,965
V9	26,458	1035,259	32,175	0,767	0,964
V10	26,350	1034,532	32,164	0,753	0,964
V11	26,650	1038,145	32,220	0,738	0,964
V12	26,542	1037,292	32,207	0,760	0,964
V13	26,633	1025,512	32,024	0,795	0,964
V14	26,675	1054,020	32,466	0,551	0,965
V15	26,183	1024,538	32,008	0,799	0,964
V16	26,458	1040,351	32,254	0,739	0,964
V17	26,508	1020,336	31,943	0,815	0,963
V18	26,600	1037,133	32,205	0,772	0,964
V19	26,842	1072,050	32,742	0,484	0,965
V20	27,317	1079,865	32,861	0,364	0,966
V21	26,733	1051,912	32,433	0,621	0,965
V22	27,142	1080,576	32,872	0,330	0,966
V24	27,067	1054,197	32,468	0,587	0,965
V25	26,983	1063,580	32,613	0,522	0,965
V26	26,283	1035,264	32,176	0,702	0,964
V27	26,525	1030,806	32,106	0,697	0,964
V28	26,667	1044,325	32,316	0,704	0,964
V29	26,758	1053,748	32,461	0,596	0,965
V30	26,858	1074,190	32,775	0,481	0,965
V31	26,675	1043,868	32,309	0,705	0,964
V32	26,733	1046,433	32,349	0,708	0,964
V33	26,475	1029,747	32,090	0,729	0,964
V34	26,958	1065,116	32,636	0,624	0,965

No statistically significant differences were found in respect of the mean scores of different departments, qualification levels or home languages. Tables 9, 10 and 11 reflect the results in respect of the mentioned biographical variables.

Table 9
ANOVA: Comparison of the mean difference scores of the various work departments

	N	Mean	SD	Std. Error	
Production	65	0,90	0,968	0,120	
Engineering	38	0,84	1,213	0,197	
Laboratory	22	0,66	0,774	0,165	
Total	125	0,84	1,016	0,091	
	Sum of Squares	DF Square	Mean	F-ratio	P(F)
Between Groups	0,890	2	0,445	0,427	0,653
Within Groups	127,066	122	1,042		
Total	127,956	124			

As the obtained value of F = 0,427 does not exceed $F_{(p=0,05;\ df=2,\ 122)}$ = 3,07 it is concluded that there are no statistically significant differences in respect of the mean difference scores of the departments.

Table 10
T-Test: Independent comparison of the mean difference scores of the educational groups

Group Statistics				
QUALIFICATION	N	Mean	SD	Std. Error Mean
Std 8-10	77	0,86	0,981	0,112
Tertiary	44	0,85	1,129	0,170

	Levene's Test for Equality of Variances		t-test for Equality of Means			
	F-ratio	P(F)	t-value	DF	P(t)	Mean Difference
Equal variances assumed	0,047	0,829	0,061	119	0,952	0,01
Equal variances not assumed			0,059	79,674	0,953	0,01

As the obtained value of t = 0,061 does not exceed $t_{(p=0,05;\ df=119)}$ = 1,960 and the obtained value of F = 0,047 does not exceed $F_{(p=0,05;\ df=2,\ 119)}$ = 3,07 it is concluded that there are no statistically significant differences in respect of the mean difference scores of the educational qualification levels of the sample.

Table 11
ANOVA: Comparison of the mean difference scores of the various language groups

	N	Mean	SD	Std. Error
English	22	0,93	1,526	0,325
Zulu	34	0,68	0,752	0,129
Afrikaans	42	0,72	0,747	0,115
Other African Languages	29	1,23	1,128	0,210
Total	127	0,86	1,024	0,091

	Sum of Squares	DF	Mean Square	F-ratio	P(F)
Between Groups	6,115	3	2,038	1,988	0,119
Within Groups	126,119	123	1,025		
Total	132,234	126			

As the obtained value of F = 1,988 does not exceed $F_{(p=0,05;\ df=3,\ 123)}$ = 2,68 it is concluded that there are no statistically significant differences in respect of the mean difference scores of the different language groups.

The last secondary objective of the study was to determine if there were any significant differences between the mean difference scores of the different rater groups. ANOVA's and F-statistics yielded the following results in Table 12:

As the obtained value of F = 1,311 does not exceed $F_{(p=0,05;\ df=4,\ 120)}$ = 2,45 it is concluded that there are no statistically significant differences in respect of the mean difference scores of the rater groups. This finding supports the last of the secondary objectives.

Table 12
ANOVA: Comparison of the mean difference scores of the various rater groups

	N	Mean	SD	Std. Error
Manager	24	0,84	1,045	0,213
Self	40	0,97	1,204	0,190
Subordinate	38	0,70	0,889	0,144
Customer/Supplier	11	0,45	0,308	0,093
Peer/Colleague	12	1,29	1,042	0,301
Total	125	0,85	1,021	0,091

	Sum of Squares	DF	Mean Square	F-ratio	P(F)
Between Groups	5,412	4	1,353	1,311	0,270
Within Groups	123,792	120	1,032		
Total	129,204	124			

DISCUSSION

The primary purpose of this study was to evaluate the possibility of using a psychometric approach for assessing supervisory competencies relevant to the mining and refining environment. The results obtained from the factor analyses and the item analyses indicate that the construction of the 360° SCI was based on sound psychometric principles. The factor analysis resulted in a single factor that indicates a solid theoretical base and sound procedure in the construction of the 360° SCI. A high level of reliability and a limited amount of error variance in the measurement of the construct of "supervisory competency" was obtained, indicated by the high internal consistency of 0,968 and 0,964 for the Performance and Importance scales respectively. The difference scores between these two scales yielded an Alpha coefficient of 0,965.

These results indicate that supervisory competencies can be assessed in a reliable and consistent manner with the 360° SCI. The content validity (based on the content of unit standards) supports the face validity of the instrument that was based on the comparison of supervisory competencies and Mintzberg's managerial roles (1973) as indicated in Table 2.

It is clear that the 360° SCI can be used for supervisors in different functional contexts within in the mining and refining industry, as no significant differences were found between the mean difference scores for the three departments that participated in this study. The 360° SCI also seems to be fair and equitable, as no significant differences were found in the mean difference scores with regard to the qualification level or language groups. As only six females participated in the study, gender groups were not included in the analysis. It appears that the 360° SCI is not biased in terms of the biographical differences analysed, which supports the first of the secondary objectives of this study.

No significant differences were obtained on the ratings of the different rater groups (self, manager, peer, customer/supplier and sub-ordinate). This is often not the case for first time (or even second time) ratings as pointed out by Theron and Roodt (1999) and Theron and Roodt (2000). This implies that the different rater groups often apply different mental models for interpreting the questionnaire, resulting in significantly different ratings.

The implications of these findings are far-reaching for organisations, as well as at a national level. The 360° SCI provides a cost-efficient and time-efficient way of assessing the supervisory competencies of individuals in organisations. The time consuming process of declaring a person competent to supervise people through evidence-seeking, standards-based assessments, can be made more effective and efficient. The 360° assessment approach has added advantage in that it seems to be a valid and reliable way of measuring supervisory competencies.

One of the shortcomings of the study was that there were very few female participants in the study. Another shortcoming was that the rater sample was relatively small, even though sufficient sampling adequacy was achieved.

In future studies it might be useful to consider the following:

- Including more female participants in all the rater groups. The results may be very different when this level of diversity is introduced.
- Considering the mental models that the different rater groups use as frames of reference, even though no significant differences were found between the rater groups in this study.
- Researching the possibilities of using the instrument for developmental and promotional purposes or remuneration increases.
- Investigating the possibility of measuring other competencies with a multi-rater assessment approach.
- Testing the research against current legislation and practical or operational requirements.
- Using a larger sample of raters and ratees.
- Including other units within the organisation in the study to test its applicability, reliability and validity for the larger organisation and not just one unit.
- Correlating the ratings on the 360° SCI with ratings obtained from supervisory unit standards assessment.

The study was aimed at evaluating the possibility of using a psychometric approach for assessing supervisory competencies. The results reported in this article support the use of psychometric assessment (in the form of a 360° supervisory competency questionnaire) in this regard and could be considered as a sound alternative to single-sourced, standards-based competency assessment.

REFERENCES

Allen, M.J. & Yen, W.M. (1979). *Introduction to Measurement Theory*. Monterey, CA.: Brooks/Cole Publishing Company.

Bellis, I. (1999). Between the rock and the hard place. *People Dynamics*, (September), 14-19.

Buckley, R. & Caple, J. (1995). *The theory and practice of training* (3rd ed.). London: Kogan Page.

Calhoon, R.P. (1971). *Cases in personnel management and supervision* (2nd ed.). Englewood Cliffs, NJ.: Prentice-Hall.

Cannon-Bowers, J.A. & Salas, E. (1997). Team work competencies: The interaction of team member knowledge, skill and attitudes. In H.F. O'Neil (Jr.) (Ed.). *Workforce readiness: Competencies and assessment*. (pp.151-175) Mahwah, JN: Lawrence Erlbaum.

Edwards, M.R. (1998). *The future of 360° technologies: Power tools to accelerate workplace learning*. Paper presented at the ASTD International Conference, 3 June, San Francisco, CA.

Edwards, M.R. & Ewen, A.J. (1996). *360° Feedback*. New York: American Management Association.

Gonczi, A. (1999). Competency-based learning: a dubious past – a assured future? In D. Boud & J. Garrick (Eds.). *Understanding learning at work*. (pp.180-195). London: Routledge.

Hallendorff, E., Richardson, B. & Wood, B. (2000). *Standards writer course*. (3rd. ed.). Learning Network SA.

Hilgert, R.L. & Leonard, E.C. (1998). *Supervision: concepts and practices of management*. Cincinnati, Ohio: South Western College.

Hodgetts, R.M. (1987). *Effective supervision: a practical approach*. New York: McGraw-Hill.

Jones, E.J. & Bearly, W.L. (1996). *360° feedback: strategies, tactics and techniques for developing leaders*. Amherts, MA.:MRD.

Kaiser, H.F. (1961). A note on Guttman's lower bound for the number of common factors. *British Journal of Statistical Psychology*, *14* (1),1.

Mansfield, B. (1989). Competence and standards. In J.W. Burke (Ed.). *Competency based education and training*. (pp.26-38). London: Falmer.

McGuigan, F.J. (1997). *Experimental psychology: Methods of research* (7th ed.). Upper Saddle River, NJ: Prentice Hall.

McLagan, P. & Nel, C. (1995). *The age of participation*. San Francisco: Berett-Koehler.

Messick, S. (1989). Validity. In R.L. Linn. (Ed.). *Educational measurement*. (3rd ed.). (pp.13-103). New York: American Council on Education & McMillan.

Mintzberg, H. (1973). *The nature of managerial work*. New York: Harper & Row.

Mintzberg, H. (1979). *The structuring of organisations*. Englewood Cliffs, NJ: Prentice-Hall.

Mitchell, L. (1989). The definition of standards and their assessment. In J.W. Burke (Ed.). *Competency based education and training*. (pp.54-64). London: Falmer.

Morical, K.E. (1999). A product review: 360° assessments. *Training and Development*, *53* (4), 43-47.

Skills Development Act (no. 97 of 1998). Republic of South Africa. (http://www/labour.gov.za/docs/legislation/skills/act98-097.html)

South African Qualifications Authority Act (no. 58 of 1995). Republic of South Africa. (http://www.saqa.org.za/docs/actd8-95.html)

Theron, D. & Roodt, G. (1999). Variability in multi-rater competency assessment. *Journal of Industrial Psychology*, *25* (2), 21-27.

Theron, D. & Roodt, G. (2000). Mental models as moderating variable in 360-degree competency assessments. *Journal of Industrial Psychology*, *26* (2), 14-19.

Theron, D. & Roodt, G. (2001). An evaluation of the 360° project management competency assessment questionnaire. *Journal of Industrial Psychology*, *27* (2), 51-56.

Weightman, J. (1994). *Competencies in action*. London: IPD House.

Woodruffe, C. (1993). What is meant by a competency? *Leadership and Organisation Development Journal*, *14* (1), 29-36.

World Economic Forum (1999). *World Competitiveness Report*. (http://www.weforum.org/site/homepublic.nsf/Content/Global+Competitiveness+Programme).

World Economic Forum (2000). *World Competitiveness Report*. (http://www.weforum.org/site/homepublic.nsf/Content/Global+Competitiveness+Programme).

World Economic Forum (2001). *World Competitiveness Report*. (http://www.weforum.org/site/homepublic.nsf/Content/Global+Competitiveness+Programme).