

# **The relationship between management competencies and production results at Impala Platinum, Rustenburg mining operation.**

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**Abstract:** There is one main hypothesis in this study and it evaluates the impact of management competencies on production delivery. The study considers competencies associated with management and researches whether or not such management competencies are related to organisational production delivery. The study is performed using a quantitative research technique. The population of this study includes mine managers who work for a division of a South African platinum mining company in Rustenburg. Through linear regression analysis the research determines a relationship between the independent variable and the dependent variable. The result of this research shows that there is a relationship between management competencies and production results and also provides a ranking of these competencies in order of importance. The conclusion emphasises that there is a relationship between competencies and production results for the specific organisation under study. Key terms are competencies, production results, relationship and ranking of importance of specific competencies for a mine manager at Impala Platinum, Rustenburg mining operation.

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## **CHAPTER 1: Introduction, problem statement and objectives**

### **1.1) Introduction**

Year on year organisations complete their financial year end closures. Employee performance reviews are usually on the list of finalisations and are usually compared to the reviews of previous years (Venkatraman & Ramanujan, 1986). Various business resources, including financial, physical, information and human resources are compared in an attempt to devise methods to maximise profits in the upcoming year.

The overall performance of these resources, as well as the balance between them, is of cardinal importance for organisations to establish a competitive advantage and for business improvement. The human resource aspect is one of critical importance to the functioning of an organisation due to its intertwined nature in every other dimension of an organisation (Davidsson, 2013). Due to its complexity, the human resource aspect is also the most difficult to manage in organisations as humans react to physiological, social and psychological needs, making this asset an unpredictable one if not understood. In this research, the reference to the understanding of the human resource aspect is not meant in the academic sense of the word, but rather from a management competency perspective.

Management and management behaviour could play a significant role in the business outcomes and results of organisations (Coleman, 2007). This study aims to focus on production management and the managerial competencies of managers in the production department. The study further aims to investigate relationships between managerial competencies and production results.

### **1.2) Background**

Productivity is a key driving force in the generation of profit in organisations and the improvement thereof remains a conundrum for most organisations.

The attempts to improve productivity seem to be a continuous goal for organisations, but with an open ended problem.

Impala Platinum consists of five global operational units located in both South Africa and Zimbabwe. The operational unit selected for this study is situated in Rustenburg, South Africa. In general, the South African platinum mining industry utilises conventional, labour intensive mining methods and the specific unit under study is no different. In such organisations a focus on human resource input and product output, which equates to productivity, should be extensively managed as 62.5% of the unit production cost comprises of labour in a fixed and variable portion (Appendix B).

These conventional platinum mining operations have in recent years experienced a reduction in productivity where the amount of tonnes mined per production unit (shaft complex) has decreased and the number of people per production unit has increased. This in turn has increased unit costs making these mines globally uncompetitive.

The fixed labour cost portion, consisting of management and services, has increased. This implies that more management and first line managers have been deployed per production unit. The variable labour cost portion thereof consists of the production mining labour (mining crews), for which output per production crew has also decreased. This situation is unsustainable for a business and although various factors contribute, this study will focus on management in order to identify a relationship between production performance and the management competencies.

The Impala Platinum, Rustenburg mining operation consists of 12 producing shaft complexes and 5 general managers in charge of approximately 3 shaft complexes each. In most cases, each of the shaft complexes has one mine manager who is responsible for the overall management of the shaft and for the shaft's workforce which ranges between 1400 and 2800 employees. However, in the past 5 to 7 years, some of the larger shafts have been

divided into smaller sections and more mine managers have been appointed per shaft.

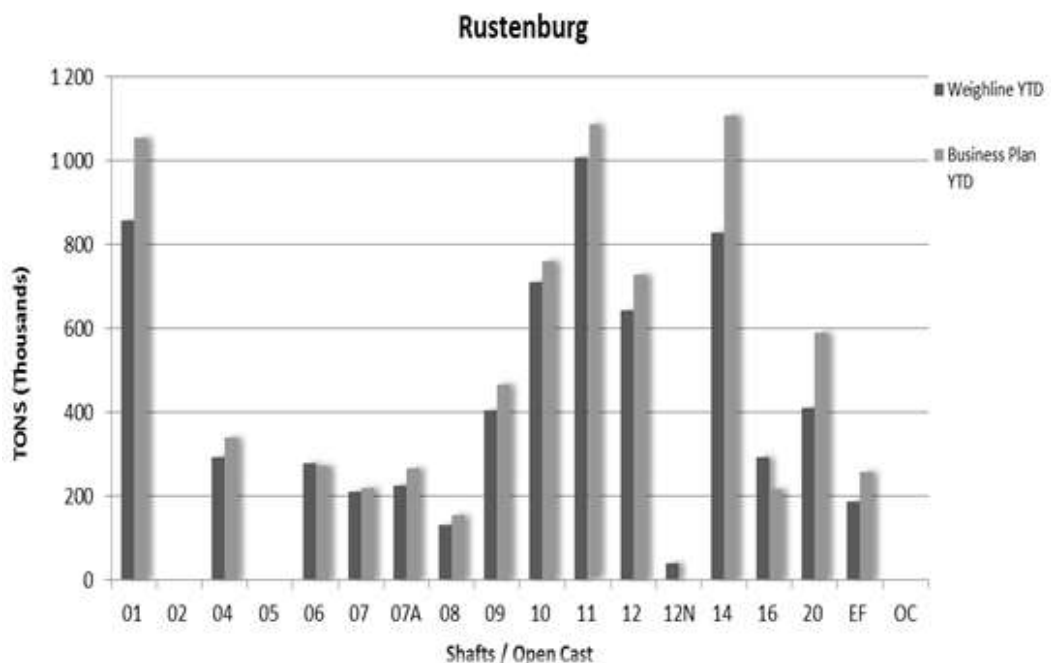
From a technical skill's perspective, mine managers are responsible for the planning, organising and supervising of the activities of a mine. The mine managers are responsible for planning future mine production; overseeing the development and tunnelling of the mine; checking the quality of stone, rock and minerals and inspecting the mine for danger. Mine managers also carry out generic management duties such as hiring staff, organising staff training, overseeing financial administration, and liaising and negotiating with suppliers, contractors and other stakeholders. These mine managers also ensure compliance to occupational health and safety guidelines which includes the planning and overseeing of maintenance on the mine as well as developing plans. Further, in the past three decades the need has risen for a mine to be managed in a corporate and social responsible manner (Hanann & Kapelus, 2004).

Reporting to the mine managers, are mine overseers (first line manager), who have the same responsibilities as a mine manager but for a smaller section/cluster of the shaft complex. They are thus responsible for the production of ore and the tunnelling and development of a section of the mine. Also reporting to the mine manager is an engineer who is mainly responsible for the provision of services and maintenance of equipment. Technical services departments such as geology, ventilation, rock engineering, surveying, safety, finance, human resources, unions and environmental department also report to the mine manager and fulfil a critical part of the control of operations at a shaft complex. Thus, the management of a shaft complex relates to the mine manager with overall responsibility, as well as an engineer and mine overseers. The mine managers will constitute the respondents of this study.

Towards the end of each financial year the mine manager, engineer and mine overseers will compile a business plan for the next financial year. In this business plan, all resources for production in the coming year are

planned according to criteria and include human resources, physical resources and financial resources. Although the ore body is consistent from a mining perspective, the planning criteria make provision for deviating circumstances in conditions, depth, maintenance and technology, based on 50 years of data collection. This creates a business plan (BP) that is measurable between all the business complexes on a level playing field and indicates planned tonnage versus produced tonnage, as illustrated in graph 1. For monitoring and control purposes this plan is broken down into monthly, weekly and daily targets to be achieved in terms of production tons as well as monitoring of expenses. Due to the complexity, harsh underground environment and labour intensity of the business, a mine manager on a shaft complex is required to have substantial interpersonal skills to communicate, coordinate, monitor and achieve these plans through available resources.

Graph1: Business planned tons vs. achieved (weigh line) tons for 2015 financial year per shaft complex



Source: Anonymous, (2015). SAP BEx\_Broadcaster report. 22 June 2015.

Although extensive research has been conducted on human behaviour, motivational factors (Maslow, 1943, Vroom, 1964), performance

management and models (Kaplan & Norton, 1992); the area of competencies in managers and the specific relationship to production delivered, remains sparse. Questions arise around the importance of these competencies in the mining environment. These questions need to be investigated and could possibly be part of a holistic approach in improved management performance.

The significance of this study and the active use thereof can lead to a competitive advantage in terms of intangible assets. In a study conducted by Motsoeneng, Schultz and Bezuidenhout (2003) the need for the industry has been stated. In this study by Motsoeneng et al.(page 4), the importance of interpersonal skills, leadership skills and communication skill is stated. Here the authors are identifying and discussing the need to develop mining engineers who move into management roles as well as the impact of the short comings in the development of these resources. With mining being an important backbone of the South African economy, they highlight (page 5): “...a decline in productivity and profit as a result of the inability to operate, manage and maintain existing mines satisfactorily...” Motsoeneng et al. conclude their study with the fact that technical ability in the majority dominates the necessary competencies required. This results in the loss of opportunities for improved productivity as well as the loss of employee motivation. This justifies the need to research the importance of management competencies as well as the possible relationship to production delivery in the industry. Literature recommends further research (Lee, Lee, Wu, 2010) in the relationship between management competencies and production output.

### 1.3) **Problem statement**

The increasingly demanding business environment together with declining productivity (Mitchell & Steen, 2014) creates the necessity to investigate areas where technical skills may not be the only driving factor to improved production output.

The problem is that this specific operation has an increase in the number of mine managers, a decrease in production results and an increase in production cost, resulting in an unprofitable business. It is therefore not clear whether there is a relationship between management competencies and an increase in production results.

### 1.3.1) **Research questions**

The following research questions need attention:

- Is there a relationship between management competencies and production output per business unit (shaft complex)?
- What does the literature state on management competencies including its relationship to production results?
- What is the current level of management competencies of mine managers at the Rustenburg operation?
- Do management competencies have a direct influence on production results of the business unit (shaft complex)?

### 1.4) **Objectives**

The following section sets out primary and secondary objectives to be achieved through this study in order for the research questions to be answered:

#### 1.4.1) **Primary objective**

The primary objective of this study is to analyse if there is a relationship between management competencies and production output per business unit (shaft complex).

#### 1.4.2) **Secondary objectives**

- Analysis of existing management competency theories.
- Evaluating the ranking of importance of various competencies of mine managers in relation to production output at the Rustenburg mining operation.
- Research whether management competencies in individual managers in a business unit, have a direct influence on production performance of the business unit.
- Provide a contribution of relevance of management competencies to production results.

The hypothesis stated is:

**There is a relationship between management competencies and production results at Impala Platinum, Rustenburg mining operation.**

#### 1.5) **Preliminary literature review**

##### 1.5.1) **Introduction**

Businesses revolve around the utilisation of financial, physical, information and human resources. Due to the fact that human resources contain the management of the business, it is considered to be central and more important compared to other resources in organisations (Gandolfi, Stone, 2016). The management level in organisations ensure, through decisions and interpersonal interactions, the optimal deployment of resources in order to attain a competitive business advantage through delivery of superior business results (Letwin, Wo, Folger, Rice, Taylor, Richard, Taylor, 2015). They are responsible for the planning, organising, leadership and monitoring of these resources. It is critical to deploy management resources with the correct skills in order to obtain this objective (Jaramillo, Bande, Varela, 2014).

### 1.5.2) **Literature definitions of competencies**

Human resources are considered to be one of the most valued assets in a business as every single piece of work is affected by people, which can have a significant impact on business performance (Sita & Pinapati 2013). It is thus imperative that people need to be managed with a high level of skill in order to attain maximum performance from this resource, not only due to the direct cost impact of salaries, but also the under delivery of production output.

Since the human resource function is considered key to the functioning of organisations, one would assume that organisations would invest vast amounts of tangible and intangible assets in support of this resources' development and manage these resources with a high degree of attention. One will further assume that organisations would invest effort and resources in developing their managerial levels that are directly responsible for developing and supporting (Herst, Walumbwa, Aryee, Butarbutar, Chen, 2015) their human resources and responsible to maximise the levels of productivity they receive from these resources. Unfortunately the contrary seems to be true in that new recruits in organisations are usually employed for their technical ability with little regard for their interpersonal skills (Collins & Kehoe, 2009).

Interpersonal skills refer to the ability to work with people (Smit & Cronje, 2002). The development of interpersonal skills in the workforce is often surrendered to the human resource department with little involvement from direct managers. Often organisations tend to neglect the development of interpersonal skills to such an extent that employees are expected to automatically gain and develop these skills through experience over time.

Conflict is likely to surface in instances where the development of human resources is solely delegated to the human resources department (Ceptureanu, 2016). The progress of employee development is often not reported to direct managers in a transparent manner and according to

sound human resource practices. On the other hand, organisations who rely on employees gaining experience in order to develop themselves is, more often than not, prone to damaging (Harvey, 2002) the organisation and its individuals (Knowles, 2013). Experience or experiential learning can only take place through “doing” which implies that employees learn through making errors (Hansen, 2000). This could be harmful to the organisation, the individual and the workplace and is unlikely to deliver the ultimate performance results.

This question became very pertinent in the 1980's as organisations realised that physical, information and financial resources are either well developed, or the focus of the global economy is moving towards human resource skill, innovation or productivity. Various models and theories have come to the forefront to address human resource effectiveness and productivity. The Six Sigma Fifth Discipline, Business Process Re-Engineering, Total Quality Management and the Balanced Scorecard, each promise significant organisational improvements (Fine, Hansen, Roggenhofer, 2008). The Balance Scorecard, as intended by its creators Kaplan and Norton (1992), focusses on individuals to perform in line with organisational strategy and goals. Organisations have spent huge amounts of money and time in implementing these methods although few studies have been conducted on the effectiveness of implementing (Awadallah & Allam, 2015) the balanced scorecard in organisations (Angel & Rampersad, 2007).

Although McClelland (1973) identified the concept of competencies in his seminal work, its prominence more recently came to the fore. The theory which has evolved in the human resource productivity circles is the core competencies of management. Recently, it is recognised that management requires some critical competencies to achieve this objective (Krajcovicova, Caganova, Cambal M, 2012). Competencies in this sense of the word, is described as a set of human behaviours that a manager possesses which will have an increased effect on employees that will drive effectiveness (Sita & Pinapati 2013).

The behaviour concept for managers is elaborated on by some to be attitudes, values, knowledge, capabilities and experience (Botha, van Vuuren, Kunene, 2015). Distinguishable characteristics in individuals to perform a specific job are also terminology used to describe management competencies (Mahlangu, Govender, n.d.). It is viewed to be a contributing factor in leadership and the effective operations of teams in an organisation. As Harvey (2002, 6) states in his paper:

*“The next decade will see second-tier social competencies promoted within successful mining companies. Measures to achieve this include a range of Human Resource (HR) incentives such as recruitment and career advancement based on broad competencies rather than narrow technical proficiency, humanities training for mining professionals and performance rewards that recognise social competence.”*

The competency of Interpersonal skills is defined as the ability to work with people and core competencies can thus be defined as the attributes a manager needs to possess in order to work with people (Smith & Cronje 2002). These attributes may include: Integrity, honesty, continual learning, oral communication, written communication, flexibility, problem solving, team building, customer service, technical credibility, accountability, decisiveness, influencing, negotiating, human capital management, leveraging diversity, conflict management, developing others, technology management, financial management, creativity, innovation, partnering, external awareness, vision, strategic thinking and entrepreneurship.

From such an extensive list, not every individual will possess these attributes to the same developed extent. Furthermore, some core competencies might have a higher value depending on the type of organisation and each organisation needs to evaluate which competency should be a prerequisite in their organisation for a specific managerial position.

The terms “competent” and “competency” were used indiscriminately among leadership schools in the past. Recently a distinction has appeared (Trivellas & Reklitis, 2014) where the term “competency” is referred to as an individual’s behavioural actions. The term “competent” in terms of a job specification is a broader view of technical skill and competencies supporting performance. This shifts the literature focus to competencies and the definition thereof.

Since McClelland (1973) proclaimed the term competency, debates have ranged in terms of the actual meaning of the term. The term “competency” is viewed by most authors as mostly referent to essential elements in human behaviours (Martinez, Moreno, Brage, 2014), consisting of attitudes, beliefs and values. It is specifically focussed on individuals rather than organisations (Bucur, 2013). In evaluating this focus point some authors define management competencies with terminology such as generic leadership competencies (Loufrani-Fedida & Missonier, 2015) and critical competencies. These generic competencies are referred to as writing skills, communication skills, ability to deal with ambiguity and change. However; the differences in terminology used should not be confused with the basic principle of behaviours illustrated by an individual. Hereafter, competencies are defined as conflict management, stress management, ethics and virtues for a specific management job. Collectively the generic competencies and job specific competencies of an individual could be viewed as a collective competency for a job.

The approach of distinguishing between types of competencies (Trivellas, Kakkos, Blanas, Santouridis, 2015) has also been an attempt to clarify the matter. According to this distinction, the first type is specific competencies referring to technical abilities to performing a task. The second type of competencies included items such as intelligence, information processing ability and key competencies. This clearly creates some confusion in finding a definitive understanding of what is termed by scholars as competencies.

In this paper, skills will be defined as the technical skills possessed by an individual. This refers to skills acquired regardless of behaviour towards attaining a qualification or training. For example, qualifications obtained at educational institutions such as degrees, diplomas and certificates. These skills will not form part of this research any further as the focus will be on management competencies.

Competencies are behavioural attributes of an individual and the level of such competencies is measured through the natural behaviour of an individual (Vincent, 2008). Changing behaviour or increasing a level of behavioural attributes can be obtained through a learning process. In layman terms, these are referred to as soft skills. In the business world however, it is the management competencies required to transgress from an employee to a manager (Draganidis & Mentzas, 2006). Thus, it is not the hard technical skill that is important here but the ability to attain or possess a cluster of management behaviours (competencies) to work with people.

### 1.5.3) **Literature definitions of production**

Production is the transformation of tangible, raw materials or intangible materials (ideas, information, knowledge) into goods or services, through the use of business resources. For a primary business (El-Gohary & Aziz, 2014), productivity is defined as follows:

$$\text{Productivity} = \frac{\text{Output}}{\text{Labour} + \text{Equipment} + \text{Materials}}$$

Thus, output is the production delivered, divided by the inputs resulting in a ratio defined as productivity. Productivity and performance are terminologies used interchangeably and if the input factors are standardised across a comparison in the same range, it implies that performance is directly related to production. In simple terms, productivity is doing more with less (Birchfield, 2012) but what is identified in literature is a need to invest in the development of human resources to obtain this situation.

Specifically, management competencies are mentioned as the key catalyst to improving production and the creation of wealth.

#### 1.5.4) **Studies conducted**

Scholars have attempted to research the importance of management competencies in the area of increased production. In a study by El-Gohary and Aziz (2014) in the construction industry in Egypt, the authors identified the influence of management competencies on productivity. These competencies were ranked as the third most important factor of influence on production during the data analyses.

One study conducted in a project construction environment (Pandya, 2014), estimated that a lack of management competencies, specific to the job, can have up to a 10% financial implication on business results. This implies that management competencies have a financial business advantage, and as identified by Wesselink, Blok, van Leur and Lans (2015), also has a distinct advantage for an individual regarding performance increases, promotion, development and company loyalty. The last named factor implies an indirect saving for the business as replacing competent resources is costly and thus, the importance of retaining talented people (Sita & Pinapati 2013) should not be underestimated. In terms of providing training in this field, literature makes it evident that developed competencies in managers decreases staff turnover and increases employee commitment, satisfaction and organisational performance (Aguta 2015). The shortage of competent people remains a prevalent business threat, which can only be countered by identifying the correct competencies for the specific job. Recruiting or developing talent in this regard is top priority.

Studies identified that management competencies goes far beyond technical capabilities (Pandya, 2014) and a transformation is required from a lower position to a supervisor or management position (Mahlangu & Govender, n.d.). Many organisations make the mistake of promoting their best performing technical employee to a higher position only to find a lack in

performance. This is due to the lack in competency development in transcending the individual into the management role.

On review of studies regarding the importance of competencies, a study utilising quantitative and qualitative approaches (Isik, Ardit, Dikmen, Birgonul, 2010) indicate that management competencies have an indirect influence on company performance. Studies in the project management area (Lampel, 2001) provide a clear relationship between the importance of competencies and project delivery. This specific study goes further and indicates that a difference exists between project management competencies and management competencies in a manufacturing firm.

In a study on management competencies in Greece (Trivellas & Reklitis, 2014), the research concludes that the levels of competencies in managers deliver enhanced job performance outcomes. It also states that there is a belief that higher job performance is present if the manager has a capability consistent with the job performance needs.

By evaluating management competencies through multiple regression analysis in three Romanian organisations (Bucur, 2013), competencies were identified and linked to different management levels as well as the level of development of these competencies. This study highlights the importance of competencies on different management levels and emphasises the need for organisations to identify the management competencies required for performance.

Through career satisfaction and the level of general management competencies in accounting firms, research (Trivellas, *et al.*, 2015) in Greece identified the enhanced performance of managers when a higher level of general management competencies are present. It states that general management competency levels provide a direct link to improved individual performance.

In a study conducted in the Spanish public administration management sector (Martinez, *et al.*, 2014), the research highlights that a key part in management performance is the management competencies component. It refers to the identification of behaviours required by managers for performance which is grouped in some twenty competencies to be used in training, recruiting and development.

In a comprehensive literature review study conducted (Bhardwaj & Punia, 2013) on managerial competencies and their relationship to managerial performance, the authors summarised critical points relative to management competencies. Observation studies on management competencies indicated increased productivity. The performance of a manager and organisational outcomes is increased by the level of developed management competencies. Benchmarking of management competencies in the organisation, or similar organisations, can predict development needs and correlate performance outcomes. The study also states that organisations utilising competency based managerial evaluations and development are more likely to perform better. They conclude in agreement to other scholars that competencies are behavioural attributes that can be identified and developed through training, coaching and performance reviews. The study concludes that highly developed competencies in management are the true assets in an organisation. It is identified that little research work has been done in the assessment of managerial competencies and the relationship with production output.

In extensive research conducted on project management work (Loufrani-Fedida & Missonier, 2015); the competency of team work is explored. It identifies the importance of success with specific reference to team work as well as the success when project managers have the competencies of team building and trust. The study has limitations, but it states the importance of team cooperation if this competency is present in individual managers.

Small business start-ups involving competencies, have been studied (Botha, *et al.*, 2015) and it was identified that management competencies

plays a critical role in the success of developing a business. This indicates that certain competencies are a key ingredient to success for this specific industry and the entrepreneur. In research conducted during economic turmoil (Savaneviciene, Ciutiene, Rutelione, 2014), the researchers identifies that young leaders poses a lower level of developed competencies. This indicates that competencies can be trained. What is of higher significance in this study, is that managers with higher develop competencies during these economic conditions, are readily employed. In other words, the higher the level of developed competency in an individual manager, the more likely the individual remains employed. This also implies a better performing resource which will be recruited or retained during such times.

#### 1.5.5) **Literature study conclusion**

Research conducted on all managers employed by an Iranian petroleum company (Darvish, Moogali, Moosavi, Panahi, 2012), confirms the hypothesis set by the authors that a relationship does indeed exist between management competencies and productivity in the specific organisation. In this study, six management competencies were identified, and through an empirical analysis, a relationship between the dependent variable, namely production, and the six independent variables of management competencies, was confirmed. This also confirms research results obtained in the steel industry (Lee, *et al.*, 2010) which indicate a relationship between management competencies and productivity.

It can be concluded through the literature study, that management competencies play a significant role in production delivery for organisations. It has been academically studied and a relationship does exist between management competencies and production results in the industries in which these studies have been conducted. However, specific to the platinum mining industry, no literature could be obtained regarding a similar study. Motsoeneng *et al.* (2003), stresses the importance of proper, relevant skills and competencies to be developed for mining engineers in the platinum

sector. Motsoeneng *et al.* (2003) also emphasises that organisations in this sector cannot afford to set this aspect aside as it can have a detrimental effect on the industry's future. It is apparent from the study from Motsoeneng *et al.* (2003) that pursuing a study in this field could have significant relevance for the industry in the current economic conditions and emphasis is placed on the need to pursue a study in this field.

## 1.6) **Research methodology**

### 1.6.1) **Research design**

The research was conducted from a positivism stance and necessitates a collection of data with a quantitative research approach which makes use of questionnaires and respondents (Bryman, Bell, Hirschshon, Dos Santos, Du Toit, Masange, Van Aardt, Wagner., 2015). Qualitative methods were not be applicable as no subjectivity can be accommodated due to the direct measure of competency levels in individuals. A cross-sectional research design was implemented with questionnaires contained within a simulation in order to establish behaviour.

### 1.6.2) **Sample strategy**

By making use of the electronic System Applications and Products (SAP) used within the organisation, data on the mine manager and general managers were obtain and is contained in Table 1. The population consisted of 18 mine managers and employees. Due to the size of the sample, comprehensive sampling was done and the entire population was included in the study.

Table 1: Impala extract of occupations

Cost Center		Employee Subgroup	Gender	Ethnic origin	Nationality	Date of birth
01MLOWER	Manager 1L	Management	Male	White	South African	15-08-1965
01MUPPER	Manager 1U	Management	Male	White	South African	19-04-1980
09MANOPS	Mine Manager 9#	Management	Male	African	South African	25-07-1975
10MANOPS	Mine Manager 10#	Executive Management	Male	White	South African	30-08-1976
11MANOPS	Mine Manager 11#	Executive Management	Male	White	South African	12-12-1961
04MANOPS	Mine Manager 4#	Executive Management	Male	White	South African	19-06-1984
09MANOPS	Mine Manager 9#	Executive Management	Male	African	South African	29-02-1984
ISXBEST	Best Practices	Management	Male	White	South African	07-06-1968
01MANOPS	Mine Manager 1#	Executive Management	Male	African	South African	05-09-1966
11MANOPS	Mine Manager 11#	Executive Management	Male	White	South African	27-10-1956
20MANOPS	Mine Manager 20#	Executive Management	Male	African	South African	27-07-1976
14MANOPL	14# Lower Manager	Executive Management	Male	White	South African	28-11-1965
14MANOPU	Mine Manager Upper	Executive Management	Male	African	South African	12-07-1964
16MANOPS	Mine Manager 16#	Executive Management	Male	African	South African	10-02-1971
20MANOPS	Mine Manager 20#	Executive Management	Male	African	South African	30-07-1976
12MANOPS	Mine Manager 12#	Executive Management	Male	White	South African	16-03-1968
ISXBEST	Best Practices	Executive Management	Male	African	South African	19-11-1967
10MANOPS	Mine Manager 10#	Executive Management	Male	African	South African	01-08-1983

### 1.6.3) Data collection methods

As explained in the research design, questionnaires were used to assess the competencies of the respondents and all questions were close ended. The questionnaires were structured to test the real life responses of the respondents in a work situation. Thus, these questionnaires were disguised in an innovative way by use of a computer based simulation and are referred to as a competency based assessments (McClarty & Gaertner, 2015). Thus, to assess the true behaviour of an individual the questionnaire was written into a computer based simulation of a real workplace scenario (Levy & Ramim, 2015).

Business statistics were obtained for the production produced per business unit, which forms the dependent variable. As far as possible, data was collected at a single point in time and patterns of association between variables were conducted in the data analysis.

Simulation exercises usually take the form of a role play during which an actual job, employee, customer and workplace situation is simulated. The

exercises are situations that require interpersonal skills and behaviours and respondents need to make competency-based decisions. The respondents, therefore, demonstrate their ability (by acting out or playing the role of a manager in this case) to deal with an interpersonal situation which frequently occurs in the job. The simulation required the respondents to handle a variety of problems involving services and programs, production, decreasing resources, irregularities in performance, labour relations, clientele, management information systems and policy. Before the assessment, the respondents received background information about a fictitious organisation (in this case a global furniture manufacturing company), including a description of the organisation's purpose and function, organisational charts, specific managerial responsibilities and character personalities. The participants study the information prior to starting the simulation assessment.

At the time of the assessment, the respondents received specific managerial problems requiring attention and action. These problems were presented in the form of various types of reports, e-mails, letters, memos and telephone calls. The respondent's task was to deal with these problems by making appropriate decisions and proposing solutions.

Although it is unclear who specifically developed computer base simulations for the purpose of conducting competency assessments, simulation-based assessments are popular techniques, versatile and applicable for a variety of purposes (Helm, 1965). The particular competency based assessments were developed by Evelex and are registered with the Health Professions Council of South Africa (HPCSA). Evelex facilitated these assessments with due consideration of the predetermined goals of the study. The intention was to ascertain how the person being assessed might react under real job conditions and pressures. Computer simulations were chosen as a popular and time effective option. Other advantages of using simulation-based assessments are that they allow individuals to be assessed without posing a risk to the work environment. Simulations are more consistent in that they measure the same competencies in all individuals and provide the same

course outcomes every time. Feedback is always consistent too. The human factor error is also decreased by these types of assessments as they are pre-designed and pre-programmed to eliminate human interpretation and judgement. Due to the fact that they are pre-designed, the reliability and validity of these assessment methods are increased.

From a mine manager job description, as contained in the background section of this paper, the following competencies were identified and summarised in Table 2 below. These competencies have also been clustered in groups. The simulation assessment included these competencies which are applicable to mine managers:

Table 2: Competencies contained in the simulation test

Competency	Description and Definition
<b>RESILIENCE</b>	The ability to recover or adjust easily to the environment.
Agility	The ability to adapt to change and to rapidly change direction.
Flexibility	The quality of being adaptable in terms of thoughts and opinions. The ability to be persuaded in a conversation. The ability to change opinion and accept the opinion of others. It entails understanding and appreciating different and opposing perspectives on an issue and adapting one's approach to the requirements of a changing situation.
<b>NETWORKING AND RELATIONSHIP BUILDING</b>	The ability to establish and maintain supportive systems with other individuals with common interests where information is shared. The ability to take action to develop a long term relationship with other individuals and customers.
Communication Techniques (Verbal, non-verbal, written, listening, questioning)	The ability to communicate effectively on an interpersonal level through verbal communication, non-verbal communication, written communication, listening and questioning.
Negotiation skills	The ability to set up a discussion with the intention to produce a settlement or agreement.
<b>DECISION MAKING</b>	The ability to make quick decisions with a high degree of accuracy using logical thinking methods.
Decisiveness	The ability to make quick, firm and resolute decisions.
Judgment	The ability to make accurate decisions.
<b>TRUST</b>	The extent to which an individual firmly believes in the reliability, ability, or strength of someone or something.
Trusting Peers/Fellow team members	The extent to which an individual believes in the reliability, ability and strength of his peers or fellow team members.
Trusting Management	The extent to which an individual believes in the reliability, ability and strength of their Management team and the decisions they make on their behalf.
Trusting organisation	The extent to which an individual believes in the reliability, ability and strength of the organisation.
Self-Trust	The extent to which an individual believes and has confidence in the reliability, ability and strength of themselves. The extent to which the individual trusts the decisions they make.

<b>Competency</b>	<b>Description and Definition</b>
<b>INTERPERSONAL SENSITIVITY</b>	The extent to which an individual is able to act in a sensitive manner towards all individuals and towards diversity in the team. The ability to practice empathy with others. The ability to follow social arrangements. The ability to display accuracy and/or appropriateness of perceptions, judgments, and responses towards others in a respectful manner.
<b>CONFLICT MANAGEMENT</b>	The ability to appropriately deal with conflict situations and to resolve conflict situations in a constructive manner. The ability to identify and handle conflict in a sensible, fair, and efficient manner.
<b>RISK TAKING &amp; RISK MANAGEMENT</b>	The ability to manage risk in the workplace. The ability to take calculated risks without harming the business or its people. The ability to take risks to benefit the self and environment.
<b>INNOVATION &amp; CREATIVE THINKING</b>	Innovation refers to the ability to create or introduce something new and out of the ordinary. Innovation involves deliberate application of information, imagination, and initiative in deriving greater or different value from resources. Creative thinking refers to the ability to create something new and is characterized by originality of thought or inventiveness and the ability to have and display imagination. The ability to look at problems or situations from a perspective that suggests unorthodox solutions.
<b>RESULTS FOCUS</b>	The ability to attain goals and objectives
Energy & Drive (Consistency)	Refers to an exertion of force. It refers to the level of energy a person consistently displays.
Enthusiasm	The ability to display eagerness towards something.
Motivation	Refers to the inner drive within a person to perform a specific task.
<b>INTEGRITY</b>	The quality of displaying honesty and strong moral principles. Ability to display consistency of actions, values, methods, measures, principles, expectations, and outcomes.
<b>STRATEGIC ALIGNMENT &amp; CALIBRATION</b>	Strategic alignment refers to the ability to focus on the overarching strategy and purpose of the organisation and to align daily tasks and decisions to the bigger picture. Calibration refers to the ability to adjust behaviour and actions to meet a standard.
<b>IMPACT &amp; INFLUENCE</b>	Impact refers to the ability to affect others and to influence them. Influence refers to the capacity or power to be a compelling force or produce effects on the behaviour and opinions of others. The power to affect other persons or events due to credibility and power.
<b>CUSTOMER FOCUS</b>	Ability to anticipate internal and external customers' needs, provide services in a respectful, timely and accurate manner and to establish and maintain effective customer relationships. Ability to demonstrate a desire to identify and serve client needs and take personal responsibility for correcting client service problems.
<b>ORGANISATIONAL AWARENESS</b>	Refers to acting with an understanding of the processes in the organisation such as legislation development, policy development, planning, budgeting and decision-making.
<b>INITIATIVE</b>	The ability to act in a proactive manner and to grasp opportunities or identify potential problems and take the initiative to follow through rather than wait for problems to arise. The ability to anticipate longer-term situations and take appropriate action to address them. The ability to Organize resources and activities to deal with problems or opportunities.
<b>PLANNING</b>	The ability to formulate a program for a definite course of action. The cognitive process of thinking about and anticipating a cause of action in a certain situation. This entails establishing priorities, setting expectations, defining accountabilities and delineating time frames.
<b>ORGANISING</b>	The ability to coordinate people and resources. This includes delegation.

#### 1.6.4) **Data analysis**

Statistical data on production results were obtained from the organisation's Mineral Resource Management (MRM) system. The variance between planned versus actual production were summarised over a time period and represents the dependent variable data.

From the simulation, the questionnaire data was collected and coded. The coded data was summarised into a data sheet and SPSS software was utilised for data analysis. Data level of measurement was of the ordinal type. The reliability was determined beforehand by obtaining the Cronbach's alpha coefficient. In order to determine the relationship between the independent variable and the dependent variable, the correlation coefficients was determined as well as the strength of the relationship in order to satisfy a secondary objective. As a final data analysis, the simple regression technique was used to determine the strongest independent variable on the dependent variable in order to determine a rank of management competencies in relation to production results.

#### 1.6.5) **Ethical considerations**

##### 1.6.5.1) **Company permission**

A request was lodged by means of written correspondence to the organisation in order to obtain permission to conduct the research. A copy of the written correspondence is contained in Appendix A.

##### 1.6.5.2) **Respondents' permission**

Each respondent was provided with electronic clarification regarding the background of the tests. This highlighted the fact that participation in the study was anonymous and completely voluntary. This communicate also stated that all data collected will be used only for statistical and analysis purposes and no respondent's personal identity will be revealed in the

study. However, each individual's results will be made available to him in a confidential manner by means of a written report. By means of a login screen, the respondents provided final consent and approval to participate in the research.

#### 1.6.5.3) **Confidentiality**

All respondents' information was held in strict confidentiality and personal feedback has been provided to each respondent. Identification was only used by the researcher to link the respondent's data to the dependent variable, and all further data analysis was treated anonymously. Should the organisation have confidentially requests, this request will be managed in the sense that no reference will be made to the respondent's names but through unidentifiable features such as respondent codes.

#### 1.7) **Demarcation of the study**

The human resource field is the focus of this study. A relationship between management competencies and production results at Impala Platinum's Rustenburg mining operation was researched. Management in the production operational department has been involved in the research.

#### 1.8) **Chapter layout**

This study's layout will be as follows:

##### **Chapter 1**

Chapter 1 contains an introduction and background to the organisation and the management dilemma researched. It includes the problem statement, research questions, research objectives, hypothesis and the research methodology. All ethical considerations has been addressed in this chapter and data collection set out.

## **Chapter 2**

A literature review on management competencies and production is contained in this chapter.

## **Chapter 3**

Research methodology is laid out and reasons provided for this methodology.

## **Chapter 4**

This section contains the data analysis and interpretation.

## **Chapter 5**

A conclusion and recommendation is presented in this chapter.

### **1.9) Conclusion**

The objective of the study was to determine the relationship between management competencies and production results per business unit (shaft complex). Should this relationship exist, the hypothesis was proven; if not, a null hypothesis were delivered.

## **CHAPTER 2: Literature review**

### **2.1) Introduction**

A paper termed; Testing for Competence Rather than Intelligence, produced by David C. McClelland, Professor of Psychology at Harvard University in 1973, caused a significant ripple amongst industrial psychologists. McClelland argued that academic qualifications are good predictors of work performance, but excellent performance in the work environment is not necessarily based hereon. He stated in his paper that on-the-job performance consisted of underlying personal characteristics or behaviours that he called competencies.

McClelland (1973) used the metaphor of an iceberg in his description of a person where knowledge and skill is the visible portion above water. Knowledge refers to typically academic learning and easily provable with certificates, diplomas and degrees. Skills are learned abilities irrespective of a person's behaviour towards the tasks for example, a boilermakers accoutred skills to weld steel.

According to McClelland's (1973) model the invisible section below the waterline comprises the majority of the iceberg. This section represents competencies which consist of self-concepts and values. For example, self-confidence which is the belief that a person can do a good job or trait, such as listening and writing abilities or behaviours which form part of communication competencies. The lower bottom of the iceberg represents motives which are driven by physiological needs that prompt actions to behaviours.

A vast amount of research was initiated after the publishing of McClelland's (1973) paper and a better understanding of his brought view followed. This literature study will firstly set out a better definition and understanding of competencies.

## 2.2) **Definitions of competencies**

According to the English dictionary the word competence is described as a state or quality of being able or fit. A person in the workplace is described as suitably fit for a specific position if he possesses the required knowledge, skill and competencies for that position. If a person is competent in a position, he has mastered the work tasks for a specific position (Vazirani, 2010).

Vazirani (2010) notes that observable, testable competencies relate to personal characteristics or personal competencies which must be included in the definition of competencies of an “effective” or “good” manager. Other authors state that the competency is the underlying characteristics of a person which provides for superior performance in a job and results in effectiveness (Boyatzis, 1982).

Competencies in professional jobs are regarded to be more important compared to non-professional jobs. This higher level of importance under professional jobs is due to the fact that professional persons occupying these jobs are more likely to possess a higher level of knowledge through a degree from a good university as well as a higher intellect compared to persons occupying non-professional jobs. It is argued that superior performance from individuals on a professional level is more dependable on motivation, interpersonal and managerial competencies (Spencer & Spencer 1993). This definition of competencies relates to production gains or efficiency in the workplace (Hoffman 1999).

The competency definitions provided in articles steered the focus towards what the personal characteristics exactly entail. In a study conducted by Siligman (1991) it was found that sales persons with a competency of optimism outperformed sales persons with higher knowledge and skill. Also, turnover and training costs were reduced by recruiting for persons who possessed the specific competency of optimism. This work inspired the development of behavioural job descriptions, which implies that each job is

defined by an occupational function whereupon specific competencies are defined to be present in order to have a fit for the position by an individual (Fogg, 1994). In short, it is termed a competency model for a specific occupational position.

### 2.3) **Competency models**

A competency model describes the job functions for a specific job and usually consists of 7 to 9 competencies. These competencies describe the required behavioural characteristics for an individual to fulfil the fitness for a position (Shippman & Ash, 2000). It can be used by the organisation for hiring purposes, performance management, career development, succession planning and organisational performance. The existence of such competency models in organisations may reduce turnover, compensation influence and lead to a competitive advantage (Vazirani, 2010). It stretches beyond the boundaries of an organisation's human resource department.

### 2.4) **Competencies required by managers**

In order to identify competencies required by managers, a general understanding of what great managers do needs to be sourced from literature.

Drucker (2005) argues that a great managers starts with managing himself. The author views the manager as a person who knows what his own strengths, values and ways of work are. The author further views the manager as a person who knows and understands his own fit within the specific role/team/organisation and who is able to know if and how he can contribute to the role/team/organisation (Drucker 2004). In short the author describes **self-concept** competencies of the manager.

In a study it was shown that if emotional intelligence competencies are possessed by a critical mass of managers in companies, these companies outperform their competition by 20% in terms of yearly earnings (Drucker

2005). According to Drucker these emotional intelligence competencies consist of the following competencies:

- **Self-awareness:** The knowledge of an individual's own strengths, weaknesses, drives, values and impact on others.
- **Self-regulation:** An individual's control of moods and disruptive impulses.
- **Motivation:** An individual's finding of the emotion of achievement for their own sake.
- **Empathy:** An individual's ability to understand other people's emotional state.
- **Social competencies:** These competencies consist of network building and the ability to build strong relationships with others and have them move in the same direction.

It has been found that very few managers understand their own personal way of approach to managing (Rooke & Torbert, 2005) and even fewer of these managers attempt to change these competencies. The described competencies can be grouped as the interpersonal sensitivity competencies (Drucker 2005). Interpersonal sensitivity competencies are described as the extent to which an individual is able to act in a sensitive manner towards all individuals and towards diversity in the team, the ability to practice empathy with others, to follow social arrangements and to display accuracy and/or appropriateness of perceptions, judgments, and responses towards others in a respectful manner.

**Visionary** competency is essential for managers as this provides the heading and picture of the future. The well-known story of the "broken window policy" adopted by Major Rudolf Giuliani of New York City proves this point. Major Giuliani set the vision of addressing any crime committed in New York City, irrespective of its severity. These crimes had to be processed by police and the court system according to Giuliani's vision. However; this story has an underlying prominent manager in the

background, not well known but captured in an article on management (Kim & Mauborgne, 2003). This article identifies police commissioner William Bratton, appointed in 1994, as laying the vision down of New York City becoming the safest city in America. He achieved his vision in a period of 2 years by reducing the average crime rate from 73% to 43%. His second significant competency he displayed was the ability to set simple, realistic **goals**. This was making the city safer block by block, precinct by precinct and then borough by borough.

**Planning** competencies come to the fore after setting goals, as great managers write action plans (Drucker 2004). Planning involves what to do in future, who will do it and when it will be done (Kumar & Suresh, 2006). Bratton focused on resources that could not be increased and planned his focus areas and points of attack. His planning resulted in understanding his “hot spot” areas and distribution of his available resources in such a manner that they were effectively and efficiently utilised. The planning competency illustrated in this paper (Kim & Mauborgne, 2003) is the ability to formulate a program for a definite course of action. The cognitive process of thinking about and anticipating a cause of action in a certain situation describes the planning competency. This entails establishing priorities, setting expectations, defining accountabilities and delineating time frames.

This equated to each policemen knowing that he had to contribute to the goal of making his patrol block safe, the police commanders were focused on their precincts and boroughs.

The research goes further and explains Bratton’s ability to overcome the political hurdle by **networking** with Major Giuliani and **persuading** him to put the courts publicly under pressure to process each arrest no matter how small. Networking and relationship building is displayed in this study as Bratton has the ability to establish and maintain supportive systems with other individuals with common interests where information is shared. The research also describes the action to develop a long term **relationship** with other individuals and customers. Customers in this case are the greater

community being served. He displayed **customer focus** as a competency by demonstrating a desire to identify and serve customer's needs, take personal responsibility for correcting service problems, provide services in a respectful, timeous, accurate manner and to establish and maintain effective customer relationships.

The broken window campaign was actually focussed on the courts and elevates the excuse of overloaded courts. This implied that police men knew that any arrest, no matter how small, will be processed. They have the support and motivation not to overlook any crime, which created the **trustworthy** belief in Bratton by his followers (Kim & Mauborgne 2003). The trust competency is the extent to which an individual firmly believes in the reliability, ability, or strength of someone or something.

**Trust** is a very difficult competency and the mastering of this competency is dependent on followers. It calls for "real" leadership which entails a manager to possess attributes of sincerity, honesty and integrity (Goffee & Jones, 2005).

**Integrity** is displaying honesty and strong moral principles. It's the ability to display consistency of actions, values, methods, measures, principles, expectations, and outcomes. Words are matched with deeds and other prominent leaders aren't copied. It's basically the personal value competency followers demand in order to establish trust between the parties.

**Risk** taking and risk management competency is the ability to manage risk in the workplace. It comprises the ability to take calculated risks without harming the business or its people and to take risks to benefit the self and environment.

One of the most important features in a manager's toolkit is the ability to manage change. All the great leaders identified in literature stepped into a leadership position and established change. By applying a few

competencies they were exceptional in (Buckingham, 2005) establishing change with great success. Change is one of the most difficult things to accomplish as the associated risk could lead to a short career span in the position if the change fails (Heifetz & Linsky, 2002).

The extent to which change is managed is what makes managers successful and not necessarily the scale of the change. Heifetz and Linsky (2002) identifies in their research that a manager will encounter a hostile environment if change is brought on. People resist change and letting go of habits; way of work, complex people networks, modus vivendi and the status quo are usually among the list people tend to resist mainly due to fear of the unknown. Managing change is required to turn the resistance energy into positive movement to a future vision. As change is established it is necessary for reflection and evaluation of progress to occur from time to time by the manager. **Social interaction** and the establishment of **partnerships** are crucial to avoid attacks to change.

Change can also be initiated externally by environmental factors such as economy, legislation, political, social, environmental changes. These changes require the competency of **resilience**, which includes the ability to adjust to the environment as well as the flexibility to take account of other people's views and standpoints and to change one's own opinion or perspective.

Any workplace consists of an element of **conflict**, whether change is present or not (Heifetz & Linsky, 2002). The competency to manage conflict is the ability to appropriately deal with conflict situations and to resolve conflict situations in a constructive manner. This implies the ability to identify and handle conflict in a sensible, fair, and efficient manner. The energy involved in conflict must be converted into positive energy as described in the study. This requires negotiation skills which imply the attribute to set up a discussion with the intention to produce a settlement or agreement.

Managers are required to possess the competency of clearly **communicating**. Vague messages cause great damage and confusion for organisations (Hamm, 2006). Effective managers also have the ability to **listen** to their followers and identify good ideas from them according to a study by Hamm (2006). Hamm continues by stating that good managers have an **awareness** of their behaviours and their jobs. Managers with high levels of awareness will avoid establishing one-way communication channels with their followers but will rather establish clear communication channels where feedback and input from followers is encouraged. Precise intentions must be understood by each individual in order for the individuals and teams to reach organisational goals.

Buckingham (2005) provides an elementary view that managers should know the individuals they work with more intimately in order to gain optimal performance from these individuals. The author compares people to chess pieces and before the manager can play the game he must know each chess piece's specific moves (Buckingham, 2005). Knowing individuals is important to attain maximum performance from the human resource and can be achieved through the manager's ability to communicate effectively on an interpersonal level through verbal communication, non-verbal communication, written communication, listening and questioning.

A manager's role revolves extensively around making quick **decisions** with a high level of accuracy using logical thinking methods (Tichy & Bennis, 2007). The decision making competency highlighted in the study not only describes firm and resolute decisions but also takes into account that decisions of a good manager must be of good judgement. This means that accurate decisions are taken and although the author admits that no manager will always make good judgements, it must be in a very high accurate percentile and to the benefit of the organisation.

With substantial decision making responsibility, managers can have an important influence on an organisation's strategy. Competitiveness among organisations has increased substantially in the past two decades and

organisations have more global competitors (Ulrich & Smallwood, 2004). This implies that strategic understanding and the strategic competencies for managers have to increase to keep up with the tide.

Research has shown that CEO's have the tendency to think that strategy is their sole responsibility (Ireland & Hitt, 2005). This approach is described as appropriate for its time, but the fast changing world requires more stakeholders to participate (Camillus, 2008) in the strategy. This implies that managers need to possess a greater competence of strategy in order to establish strategic alignment. Strategic alignment refers to the ability to focus on the overarching strategy and purpose of the organisation. This implies the alignment of daily tasks and decisions to the bigger picture as well as the calibration and adjustment of behaviour and actions to meet a goal.

Today, strategy requires greater scenario planning due to economic turmoil. The global business environment of today indicates higher levels of influence on all economies and the need to have more strategic competencies in an organisation (Dye, *et al.*, 2009). The specific research indicates that a greater degree of **monitoring** is required by managers in order to pre-empt a change in the business environment.

One of the biggest downfalls an organisation can face is the treat of becoming complacent. In order to counter complacency innovation is a requirement which must be driven in the fast changing world of today and for organisations it has almost become a matter of innovate or die. Having an innovative culture requires managers to have **creative-thinking** competencies (Amabile, 1998) in order for them to drive creativity. Selecting managers that don't have the required interpersonal skills, including the ability to possess an innovation competency (Kanter, 2006), would be a mistake. An **innovation** competency involves deliberate application of information, imagination, and initiative in deriving greater or different value from resources. Creative thinking refers to the ability to create something new and is characterised by originality of thought or inventiveness and the

ability to have and display imagination. It also entails the ability to look at problems or situations from a perspective that suggests unorthodox solutions.

Steve Bennett, CEO of Quiken and QuickBooks since 2000, established an increase in revenues and profits for the two companies of 47% and 65% respectively in seven years, through innovation and holding everybody accountable for bringing new ideas and delivering on them to the business (Hansen & Birkinshaw, 2007). This again illustrates that the innovation competency adds to the value chain of an organisation.

Alberto Alessi, heads a privately owned Italian design firm best known for the invention of a home espresso machine. Alessi expresses his innovation competency traits by giving his designers freedom to create as they see fit (Capozzi & Simpson, 2009). He also broke tradition by sourcing in innovation from some two hundred external designers from vastly different fields to kitchenware. History indicates that innovation secures sustainability and even long term survival during turbulent economic conditions (Nicholas, 2008). In short, innovation is the competency of managers to be able to connect the dots (Bower & Gilbert, 2007).

Displaying an **initiative** competency is required in managers in order for them to execute leading employees. Initiative competency for a manager involves the decision of knowing what to become in the future and taking the initiative to move or place the firm there (Manikutty, 2003). Managers do not simply follow standards but they also determine and set these standards (Manikutty, 2003). Managers need this behaviour in order for them to act proactively in identifying opportunities and problems and in order for them to take the initiative to grasp or counter events. This competency needs to be present in managers so they are able to identify longer term situations and take the initiative to follow through with actions rather than waiting for problems to arise.

In a study it was identified that 56% of companies embark on transformational change driven by a cost reduction, 27% are in a crisis situation and 50% want improved performance (Kruase, 2006). The executives participating in the study stated that lower management levels were oblivious to the need for transformation prior to the start of the initiative. It was identified that these management levels lacked the **organisational awareness** competency by failing to identify the state the firms were in prior to interventions. The **organising** competency is the ability of a manager to coordinate people and resources and includes the delegation of tasks. Organisational awareness is closely linked to initiative as managers must be able to organise and structure employees in order to avert crisis's through organisational transformation (Manikutty, 2003).

Of late, more organisations have identified that critical resources will not necessarily lie in technology advances or improved infrastructure, but rather in management resources with the necessary interpersonal competencies (Manikutty, 2003). Literature also indicates that followers are likely to imitate the behaviours of leaders (Jaramillo, *et al.* 2015) which in turn has an effect on the total organisational behaviour. The organisational behaviour is greatly determined by and through management and the awareness of creating a winning behaviour is identified as a success element (Hamm, 2006). Organisational behaviour also refers to an understanding of the organisation in terms of how it is run from a policy, strategy and decision making perspective.

Organisational awareness also involves the leadership development for succession as this is a vital part of sustaining an organisation. Having the right competencies can provide for a competitive advantage for an organisation and research indicates that some companies do succeed in leadership developing. This is done by developing the management resources in terms of managerial competencies (Conger & Fulmer, 2003). Having this organisational awareness competency present in the leadership of organisations initiates the development of leaders within the organisation and prevents the slow attrition of talent out of the organisation (Miles &

Watkins, 2007). This could prevent a potential crisis where a shortage of competent managers occurs once a generation of managers leave the organisation for retirement (Cohn, Khurana & Reeves, 2005). The organisational awareness competency is described as the ability of managers to have a “balcony” view of the organisation with employees on the “dance floor” (Day & Jung, 2000). This competency provides for the ability to identify talented people and developing them to enter the steps toward executive positions (Hoole & Bonnema, 2015).

Steger, Dik and Duffy (2012) go further in the identification of engagement of followers towards leadership. Engagement is critical in the establishment of meaningful work for followers and touches on the direction provided by leadership (Kellerman, 2007). Literature indicates that defining the concept of meaningful work in one sentence, has never been an easy task. Meaning is linked to one’s existence and includes the workplace as an inevitable part of one’s existence. Individuals find meaning in their lives when they are able to view their lives as purposeful, significant and understandable. Some authors refer to meaningfulness as a purpose or significance and the intentions a person has to be significant towards a purpose (Hoole & Bonnema, 2015).

This definition leads into the term engagement at work as an individual will increase engagement (increase energy and commitment) towards work if they find the work to be meaningful towards reaching a goal. This implies that engagement and an experience of meaningful work (goal orientated work) creates a sense of satisfaction experience within the individual due to the feeling of contribution. This in turn leads to greater benefits for the organisation and the individual (Geldenhuis, Taba & Venter, 2014). Critical to achieving this in the work environment is the leadership that provides the meaning in work towards reaching a goal. Albeit an extensive explanation of the term engagement, the connection thereof to the leadership and organisational awareness competencies, is of vital importance. According to research, this competency establishes the ability of managers to “stay in

touch” with their followers and to keep them engaged in work which leads to successful management (Kellerman, 2007).

Literature defines managers with the leadership ability to have the energy of inner motivation, an eagerness to drive towards something and the ability to display persistent energy to attain a certain outcome (Goleman, 2004). This energy and ability of managers to focus on results and display constant and persistent energy towards reaching goals, refers to the results focus competency. The example of Idris Jala’s, CEO of Malaysian Airline, is effective in explaining the importance of this competency. Idris Jala displayed a strong minded focus on profit and loss. His concentrated focus was on a profit result and turning the company from a “four month cash on hand” business into a sustainable long term flagship (Isern, *et al.*, 2009). The article continues to identify and discuss managers’ maintenance of energy in long term goals as a key **results focus** competency towards success.

The business of companies revolves around people and companies are highly reliant on their people to ensure the company functions. For this reason, managers are required to have the competency to effect people and to influence their behavioural and opinion level. This **impact and influence** competency creates an environment where employees are steered in a direction to attain goals and to make an organisational impact. This competency involves the manager to be involved with their employees and to hold employees and role players accountable for their actions. Reviewing actions require managers to ensure that the decisions that are made are based in grounded facts and that employees stay accountable for these actions (Aiken & Keller, 2006).

The **trust** competency is an important competency requirement for managers. Followers and peers are dependent on a manager’s trust competency to provide them with leadership and to delegate power. Trust is the extent to which an individual firmly believes in the reliability, ability or strength of someone or something (Mineo, 2014). It is thus instilled on many

levels and may be directed towards the self, followers, peer managers and the organisation. The display of this competency in the reverse direction is also included.

Reverse direction of trust implies that one party is vulnerable or at risk from another party. Thus, it implies a two way direction. It is further described as having unique implications in the workplace as all functions are dependent on it. This clearly indicates that this competency implies a relational concept that arises between people and has a high level of importance.

Trust relies on two fundamental concepts of competencies required in managers. Firstly, knowledge and skills needed for the job which is seen as a requirement for success. Secondly, character which can be divided into a belief to want to do good and the competency of **integrity**. Integrity can simply be described as doing what is said (Bligh, 2017). When a manager speaks, followers must have the confidence that the manager is truthful, sincere and has integrity, all of which comprise the essence of trust (Mineo, 2014).

This literature study explains a variety of management competencies from research conducted and clearly identifies the crucial competencies managers need in order for them to excel as managers and leaders. In the description of these competencies it becomes evident that the presence of competencies in managers may have benefits and desired outcomes for individuals, teams and organisations.

The most prominent outcomes of this study is the extent to which management competencies determine the success of teams and organisations and the extent to which they determine the production and bottom line in organisations. In the next section production and production management will be defined.

## 2.5) **Definitions of production and production management**

Production is the conversion of raw materials or services into assets which a person or firm is willing to pay for (Buffa (1975) cited by Gupta & Starr, (2006)). Raising production implies that output is increased with the same amount of input resources. This leads to a production growth through the increase of efficiency or simply stated as increased productivity. Inputs include all the required labour and capital directed at delivering the final output, product or service (Rodgers, 1998).

Optimal production refers to a state where maximum productivity is reached with current technology and maximum efficiency of human resource operation (Bemtum, 2012).

In order to measure an organisation's performance, various factors can be incorporated such as customer satisfaction and social responsibility. However, academics do agree that production and delivery of the final product remain the main focus of organisations (Santos & Brito, 2012).

Production management involves a process of planning, organising, directing and controlling activities in order to deliver a product or service. Buffa (1975) (cited by Gupta & Starr, (2006)) defines the management of production as decision making in order to deliver a product to a specific quality, at the required volume on a specific time or schedule. It includes an operating system to produce a product at the right quality, right quantity and right time to the right manufacturing cost (Kumar & Suresh, 2006).

## 2.6) **Impact of Management Competencies on success/results/output**

One study conducted in the petroleum industry identified a relationship between management competencies and employee productivity. Through quantitative analysis the study indicated a meaningful relationship between management competencies and employee productivity (Abbaszadeh, Eyni, Rabiei, 2012). This study, which consisted of semi-structured interviews

with 110 respondents in an organisation, indicated that higher competency levels of employees increased production delivery from 7% to 12.5% (Kolibacova, 2014). The study verifies the relationship between competencies and improved production and promotes further investigation into management and employees competencies.

By evaluating a sample of 258 small businesses in Malaysia the researcher indicated that management competencies, in terms of functioning, play a vital role in the survival and success of these organisations (Chye, Tat, Osman, Rasli, 2010). Studies in the pharmaceutical industries indicate a relationship of management competencies to sustainable organisations with specific reference to the control competency of management (Sgarea, *et al.*, 2011).

An interesting research study covering 11 000 organisations in 34 countries, reveal a relationship between management competencies measured by a management quality factor and production performance measured by Total Factor Productivity (TFP). These management practises included a wide variety of items but the item “*not promoting incompetent employees to senior positions*”, as measure by TFP, indicated a strong relationship to production performance (Bloom, Sadun & Van Reenen, 2016). The term “incompetent” here refers to management employees who do not possess the managerial competencies specific to their job (not technical skills). The study concluded that management can be viewed as capital in the production stream and raises output, which is dependent on management academic qualification, technical experience and management competencies.

## 2.7) **Conclusion**

Research work indicates the importance of management in an organisation and illustrates required competencies in successful managers and leaders. It also refers to devastating effects of poor management in organisations

with high profile scandals in recent times such as Enron, Tyco and FIFA management (Gandolfi & Stone, 2016).

Research conducted on managers indicates that some managers possess certain leadership competencies which made them excel and deliver exceptional performance in a specific situation at a specific point in time. However, studies conducted recently draws the attention to the competencies managers must have or develop to be successful. In brought terms, these competencies can be classified into competencies related to position, management of innovation, innovation, execution, interpersonal competencies, resilience and effective coping with problem anticipation and solving. According to the study, managers indicated to have more task achievement capabilities than effective employee management competencies (Khandwalla, 2004).

In a study that focused on the future of manufacturing in the United Kingdom, the author identifies that the majority of research needs still lie in the understanding of specific managerial behaviours to each industry (Homkes, 2014). This comparative study amongst organisations in the UK, United States and Germany, indicated that a deficiency in managerial competence from UK organisations, in comparison to US and German organisations, resulted in poorer performance.

The term production management was created due to the connection between production and management. This term indicates the importance of management to plan, organise, lead and control tasks. This function requires management competencies in order to make a complex coordination of employees function for the creation of valuable assets. In order for managers to deliver exceptional performance, competencies are identified through the literature study to establish this outcome (Gandolfi & Stone, 2016).

Although extensive research has been conducted to identify the magic element that successful managers must possess, it remains perplexed and

a complicated subject (Gandolfi & Stone, 2016). However, research evidence indicates that management competencies do relate positively to overall effectiveness and the increase of performance (Derue, *et al.*, 2011). It is evident from the preliminary literature study and this literature study that there is an overlap in research papers in terms of the managerial competencies needed to establish above normal performance and delivery as well as in the description of successful managers. Some authors have identified and confirmed this phenomenon (Mineo, 2014). This leads to the conclusion that management competencies for specific roles and jobs are important to successful management.

From the literature study it can be concluded that management competencies have a significant role in management performance which influences organisational behaviour and production delivery. No literature or research on this topic could be found for the platinum industry. This necessitates further investigation into the relationship between the management competencies and production for the specific industry.

## CHAPTER 3: Research methodology

### 3.1) Research design

The research undertaken aims to satisfy the explaining phenomena, in other words to attempt to explain something. In order to achieve the objective set out, the research was conducted from a positivism stance. Due to this, the research necessitated that the data be collected using a quantitative research approach and thus, making use of questionnaires and respondents (Bryman, *et al.*, 2015).

Questionnaires are established instruments used in social sciences to determine behaviours (Bird, 2009). This research captured behaviours through questionnaires in a numerical format and the data was analysed (Sukamolson, n.d.). The numerical data collected was analysed by use of mathematically based methods, specifically statistics, in order to draw a possible correlation. Although this method has the advantage of drawing possible correlations between managerial competencies and delivered production through the analysis of statistical results, the method is unable to point out the difference between individuals. A cross-sectional research design was implemented using questionnaires contained within a simulation, to establish behaviour.

Although subjectivists argue that human behaviour is an object of the reality observed and that qualitative methods are usable, it does err towards subjectivity which may be introduced by the observer. Qualitative methods rely on interviews, case studies, ethnographic research and discourse analysis, which is conducted by the researcher who may introduce subjectivity of the reality. This method does however create better understanding of respondent's answers as it can be further explored and clarified (Zawawi, n.d.). Qualitative methods were not useful for this study, as no subjectivity could be accommodated due to the direct measure of the level of individual's competencies and in measuring whether these competencies are present.

### 3.2) **Sample strategy**

As indicated by literature, managers require overarching competencies to operate at a senior manager level. This implies that some competencies would be generic to a senior manager level, but specific competencies must be present to perform the specific job in specific working environments (Rossouw, 2004).

This study followed an ex post facto design, meaning the dependent variable data was obtained (the observations were made after the event happened) and then a “back ward” analysis was conducted on the independent variables to determine a correlation on the phenomenon. This situation eliminated random sampling and all respondents were evaluated (Bronkhorst, 1996).

When randomisation is not possible, the sample should be taken from the same population (Kerlinger (1996) cited by Bronkhorst, (1996)). This study necessitated the isolation of mine managers who are directly responsible for production and who have been allocated as manager of a business unit or portion thereof. This ensured similarity and equivalence of the sample and increased validity (Kerlinger, (1996) cited by Bronkhorst, (1996)).

By making use of the electronic system (SAP) used within the organisation, data on the mine manager was obtained which is contained in Table 3.

Table 3: Impala extract of occupations; source Impala SAP data base

Cost Center		Employee Subgroup	Gender	Ethnic origin	Nationality	Date of birth
01MLOWER	Manager 1L	Management	Male	White	South African	15-08-1965
01MUPPER	Manager 1U	Management	Male	White	South African	19-04-1980
09MANOPS	Mine Manager 9#	Management	Male	African	South African	25-07-1975
10MANOPS	Mine Manager 10#	Executive Management	Male	White	South African	30-08-1976
11MANOPS	Mine Manager 11#	Executive Management	Male	White	South African	12-12-1961
04MANOPS	Mine Manager 4#	Executive Management	Male	White	South African	19-06-1984
09MANOPS	Mine Manager 9#	Executive Management	Male	African	South African	29-02-1984
ISXBEST	Best Practices	Management	Male	White	South African	07-06-1968
01MANOPS	Mine Manager 1#	Executive Management	Male	African	South African	05-09-1966
11MANOPS	Mine Manager 11#	Executive Management	Male	White	South African	27-10-1956
20MANOPS	Mine Manager 20#	Executive Management	Male	African	South African	27-07-1976
14MANOPL	14# Lower Manager	Executive Management	Male	White	South African	28-11-1965
14MANOPU	Mine Manager Upper	Executive Management	Male	African	South African	12-07-1964
16MANOPS	Mine Manager 16#	Executive Management	Male	African	South African	10-02-1971
20MANOPS	Mine Manager 20#	Executive Management	Male	African	South African	30-07-1976
12MANOPS	Mine Manager 12#	Executive Management	Male	White	South African	16-03-1968
ISXBEST	Best Practices	Executive Management	Male	African	South African	19-11-1967
10MANOPS	Mine Manager 10#	Executive Management	Male	African	South African	01-08-1983

The population consisted of 18 mine managers within the organisation. Comprehensive sampling was done due to the ex post facto design as explained. Thus, an attempt was made to include the whole population in the study.

### 3.3) Data collection methods

#### 3.3.1) Instruments and independent variables

In order to determine competencies of respondents, more than one instrument was used to measure the various competencies of each respondent which is commonly referred to as a battery of tests. The identified Evalex35 product used contains two instruments.

The first instrument used is the Organisational Personality Construct Scale (OPCS) which is a registered instrument with the Professional Board of Psychology which forms part of the Health Professions Council of South Africa. Research conducted by Bronkhorst (1977) lead to the development of the OPCS.

The OPCS consists of three psychometric instruments:

- Organisational Personality Construct Scale: Personality
- Organisational Personality Construct Scale: Work styles
- Organisational Personality Construct Scale: Values

The OPCS questionnaire consists of 276 paired statements covering Personality, Work-styles and Values. Respondents are required to select the statement that describes them best from a pair of statements. This ipsative format of the questionnaire was chosen by Bronkhorst (1996) to ensure the rejected statement in the pair is as important in the interpretation, as the chosen statement.

The OPCS measures 13 dimensions in total of which 8 of these dimensions relate to personality, 8 relate to work styles and 9 relate to values. The thirteen personality dimensions in the OPCS are described below:

- **Need for Affiliation:** The need to belong, to affiliate and to be accepted.
- **Need for Assertion:** The need to express own views, to dominate and to compete for attention.
- **Need for Challenge:** The need for challenge, demanding of self and preparedness to risk.
- **Need for Change:** The need for new and improved methods, processes and situations. This also includes openness to new ideas and progressive thinking.
- **Need for Composure:** The need to be composed and in control of own behaviour and emotions.
- **Need for Diversity:** The need for variation in routines and to have a wide range of interests.
- **Need for Self-Development:** The need to develop new competencies and insights.
- **Need for Social Extension:** The need for extension, interpersonal contact, interpersonal boldness and to be outgoing.

- **Need for Structure:** The need to give definition to tasks, situations and events.
- **Need for Surgency:** The need to be positive, excited and optimistic. This also refers to the ability to bounce back after a setback or adversity.
- **Need for Goal Direction:** The need to reach goals. This includes persistence and sticking to a plan.
- **Need to Control:** The need to influence and control people, events and situations.
- **Task Orientation:** The need to focus on one task and to complete the task thoroughly.

The eight work-style dimensions in the OPCS are described below:

- **Completer:** Likelihood to complete and follow through. This also refers to attention to detail.
- **Creator :** Likelihood to seek creative and original solutions.
- **Initiator:** Likelihood to initiate, shape, and transform.
- **Integrator:** Likelihood to actively integrate and involve role players and to build teams.
- **Judge:** Likelihood to thoroughly analyse, think through, consider and contemplate issues.
- **Operator:** Likelihood to be the operator, organiser and implementer.
- **Resourcer:** Likelihood to source lots of external information on issues and to be inquisitive.
- **Supporter:** Likelihood to support others and give recognition. Likelihood to help others achieve.

The nine value dimensions in the OPCS are as follows:

- **Managerial Thinking:** The belief that success lies in focussing on strategic, long-term issues.
- **Method:** The belief that unconventional, radical approaches are more likely to succeed.

- **Communications:** The belief in a wider, all-embracing network communication style.
- **Decisions:** The belief that success lies in a participative, consultative, decision making style.
- **Conflict:** The belief to resolve issues and confront differences.
- **Delegation:** The belief that success lies in structured delegation with a degree of prescription.
- **Expenditure:** The belief that success lies in an expenditure and expansionistic approach.
- **Performance Output:** The belief that success lies in being qualitative and thorough.
- **Time Perspective:** The belief that success lies in and fast paced and urgent approach.

The second instrument to be used is the Assessment Centre (AC) developed by Bronkhorst and Associates in 1980. The original Assessment Centre has evolved over the years to its present form and currently consists of a variety of exercises respondents need to complete. The AC consists of the following four exercises respondents need to complete:

- A problem analysis exercise to assess respondents' problem analytical competencies;
- An in-basket exercise to assess general management and project management competencies;
- A role-play exercise to assess staff management competencies; and
- A leaderless group discussion exercise to assess meeting management competencies.

The AC consists of five main exercise dimensions that each includes second order dimensions:

- **Problem Analysis (PA):** The ability to reduce problems to logical conclusions. The ability to source information and to take action to solve the problem:
  - **Analysis:** The ability to find facts and to get to the root cause of problems.
  - **Anticipation:** This refers to an intuitive feel for what is required in solving a problem.
  - **Reasoning:** The ability to reduce data to logical conclusions.
  
- **General Management (GM):** The ability to initiate action and to show insight and decisiveness. The ability to have sound judgement and to delegate and plan effectively:
  - **Action and Initiative:** Refers to the level of output.
  - **Decisiveness:** Refers to decisiveness, direction and approach to issues.
  - **Delegation:** Refers to the level of delegation and structure.
  - **Insight and understanding:** Refers to insight into and understanding of a range of managerial issues.
  - **Judgement:** Refers to sound judgement and consequences of actions/decisions.
  - **Scheduling/Planning:** Refers to competence in activities of programming and scheduling.
  - **Organisation:** Refers to the degree of utilisation and mobilisation of team members.
  - **Client Sensitivity:** Refers to the degree of sensitivity displayed towards the needs of clients.
  
- **Meeting Management (MM):** The ability to show the correct balance of dominance, debating, directing and good insight into the issue at hand:
  - **Debating:** Refers to the intensity and amount of provision of data and debating.

- **Directing:** Refers to the amount of direction and leadership displayed.
  - **Dominance:** Refers to the amount of influence and assertion displayed.
  - **Understanding/meeting:** Refers to the insight into and understanding of managerial issues.
- **Staff Management (ST):** The ability to give staff direction and to motivate and accommodate staff. This also refers to the ability to display a degree of understanding of issues at hand:
    - **Directional behaviour:** The ability to give direction and to structure tasks.
    - **Flexibility:** The ability to accommodate the ideas and thinking of other people.
    - **Motivational behaviour:** Refers to the level of competent motivation;
    - **Understanding/Staff:** Refers to insight into and understanding of managerial issues.
    - **Client Sensitivity:** Refers to the degree or extent of sensitivity towards the needs of clients.
    - **Charisma:** Refers to the amount of warmth exuded in communication with others.

These four dimensions form the sum towards a weighted dimension called Overall Competence Level which refers to the level of competence in General Management, Staff Management, Meeting Management and Problem Analysis.

Another dimension based on the AC is that of **Strategic Capacity** which refers to an individual's level of strategic thinking. Strategic Capacity includes the following dimensions:

- Strategic thinking within the General Management Exercise;
- Strategic thinking within the Meeting Management Exercise;

- Strategic thinking within the Staff Management Exercise;
- Strategic thinking within the Problem Analysis Exercise;
- System 40 Thinking: Translates corporate intent into strategy;
- System 50 Thinking: Determines strategic intent and direction within own business; and
- System 60 Thinking: Defines strategic intent across value chain or industries and anticipates mega-trends.

The AC is conducted over one day and the results of all four exercises are scored by one observer.

As explained in the research design, questionnaires were used to assess the competencies of the respondents and all questions were closed ended. The questionnaires were structured to test the real life responses of the respondents in the in-basket exercises and role play. Thus, these questionnaires were disguised in an innovative way by use of a computer based simulation of a real life situation. This is referred to as a competency based assessments (McClarty & Gaertner, 2015). Thus, to assess the true behaviour of an individual the questionnaire is written into a computer based simulation of a real workplace scenario (Levy & Ramim, 2015).

At the time of the assessment, the respondents received specific managerial problems that required attention and action. These problems were presented in the form of various types of reports, e-mails, letters, memos and telephone calls. The respondents' task was to deal with these problems by making appropriate decisions and proposing solutions.

Although it is unclear who specifically develop computer base simulations for the purpose of conducting competency assessments, simulation-based assessments are popular techniques, versatile and applicable for a variety of purposes (Helm, 1965).

In summary, performing the OPCS and AC on respondents assessed the competencies as described in the above paragraphs. A total of 39 competencies were assessed for the independent variable. These were used individually in correlating each to the dependent variable and assessing the research questions and hypothesis.

### 3.3.2) **Dependent variable**

The performance driver for a mining operation is to produce ore tonnage per period as this tonnage contains the commodity to be sold. In the case of this organisation this will consist of ore tonnage containing the platinum group metals. Each business unit (shaft complex) does intensive and detailed planning on the amount of ore tonnage to be produced prior to the commencement of each financial year. Resources are allocated accordingly and intense monitoring and control is exercised during the financial year in order to obtain the planned production and performance.

At the conclusion of the financial year the actual ore produced, captured on a daily basis, is summarised and compared to the planned produced tonnage. The variance between the planned and actual tonnage produced determines the performance in terms of resource utilisation, cost and profit. This variance percentage is used as the dependent variable in this study, as a positive variance implies a performance at a high level. A negative variance percentage indicate an under achievement in performance.

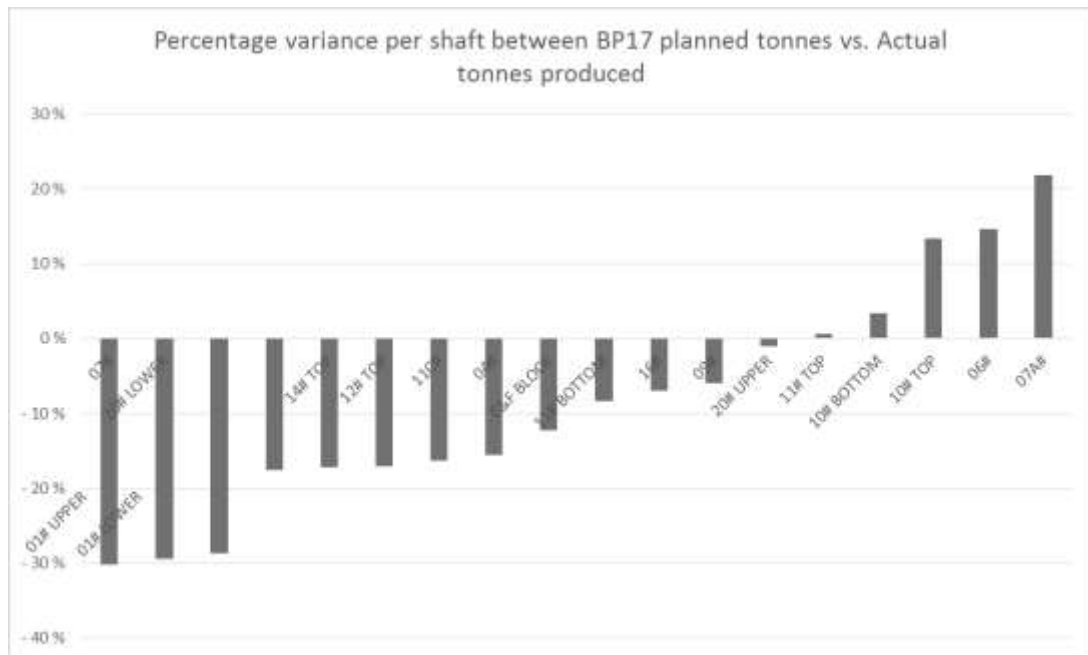
Business statistics were obtained for the production produced per business unit, which forms the dependent variable. Data was collected at a single point in time at the end of the organisations financial year in June 2017. The raw data was obtained from the organisations Mineral Resource Management (MRM) department and is contained in Appendix C.

### 3.4) Data analysis

#### 3.4.1) Dependent variable

The raw data collected from the MRM department was analysed and the total tonnage planned for the year was extracted. The actual tonnage produced was extracted and a percentage variance was determined per business unit (shaft complex). This summary is illustrated in Graph 2, below.

Graph 2: Percentage variance between Business Planned (BP17) production tonnes vs. actual production tonnes produced



#### 3.4.2) Independent variable

Each respondent logged into the Evelex internet based platform with their computer to complete the questionnaires and exercises in their workplace. Dr. P. V. Bronkhorst (psychologist) was responsible for the interpretation of the scoring and results.

The questionnaires, in-box exercises, role play simulations and leaderless meetings from the AC together with the psychometrics facilitated in the

Evelex, constituted the collection of the independent variables. The Evelex is a computer based platform which uses predetermined templates.

The scoring of the questionnaires contained in the exercises was recorded against a scoring template. For example, the in-box exercise recorded the actions taken by the respondent in terms of the items handled in the predetermined time. If 3 of the potential ten items are handled, a score of 3 out of 20 was allocated. If the 3 items handled was dealt with extensively, an additional 3 points was allocated giving a total score of 6 out of 20.

The same principle was followed with all competencies tested; allocating a score to the number of items dealt with and the quality it's been dealt with. This provided a raw score. Each response was coded for strategic thinking and a level of strategic thinking skills was allocated to the response. The higher the raw score in a specific competency, the more the competency existed within the respondent. Each respondent's raw scores per competency is summarised in Appendix D.

Each respondent with their respective raw score data per competency, was then allocated to the business unit (shaft complex) they are responsible for. This allocation per shaft is indicated in Table 4 below.

Table 4: Allocation of each respondent per respected shaft

Respondent Number:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Shaft:	07#	20# Lower	01# Upper	01# Lower	14# Top	12# Top	11C#	04#	E&F Block	11# Bottom	16#	09#	20# Upper	11# Top	10# Bottom	10# Top	06#	07A#

### 3.5) Conclusion

This chapter explained the research methodology followed in this study, the sample strategy, the sample used and the steps followed in gathering the data. The following chapter describes the statistical method followed in processing the data and discusses the findings from the data analysis.

## CHAPTER 4: Findings

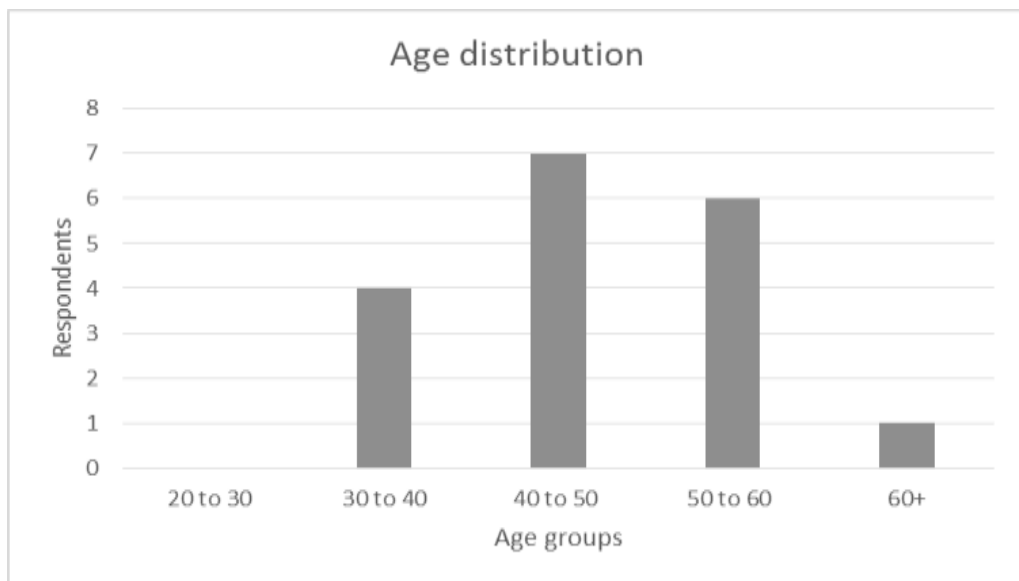
### 4.1) Introduction

In the previous chapter the data gathering method and the instrument used was explained. This chapter analyses data on the respondents and the statistical process followed. Also included is a summary and a presentation of the findings from the statistical analysis.

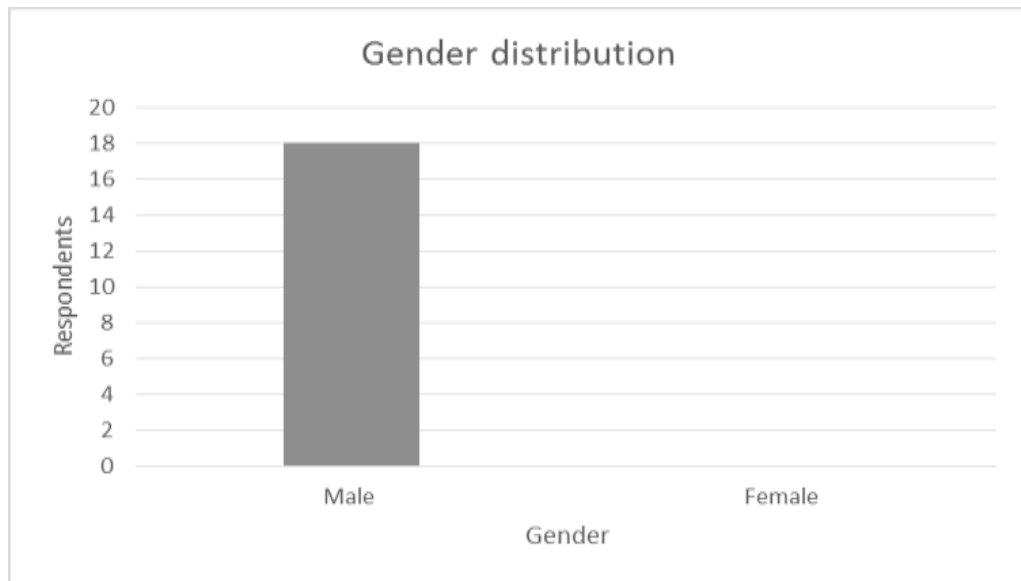
### 4.2) Biographical information of sample

The biographical information for the sample is contained in Graph 3, 4 and 5 below.

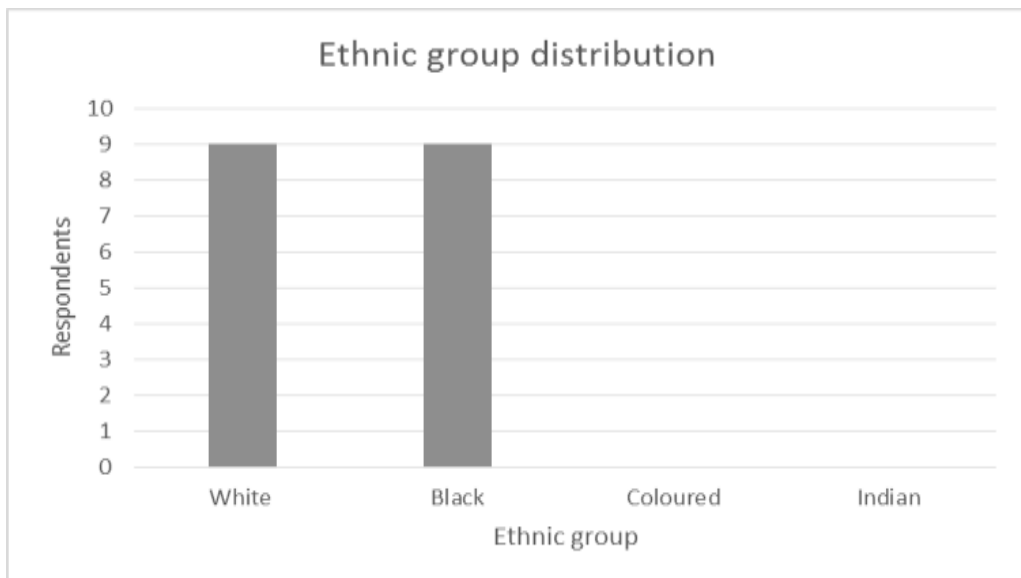
Graph 3: Biographical Information for the sample (N=18) on age range



Graph 4: Biographical Information for the sample (N=18) on gender



Graph 5: Biographical Information for the sample (N=18) on ethnic group



#### 4.3) Psychometric instrument evaluation

The reliability of the OPCS was determined by use of the Spearman rank-order coefficient and a  $r = 0.82$  was obtained. In a study of 156 managers (Bronkhorst, 1996), coefficients of equivalence for personality, work styles and values, were 0.84, 0.89 and 0.95 respectively. The Pearson-Correlation coefficient was applied and the reliability ranged from 0.67 to 0.91 for each construct scale tested.

The validity of the OPCS was determined by a correlation study of a sample of 100 managers within their current position level in their respective organisations. Confirmation of validity on the construct scales were obtained in terms of position, behavioural competencies and cognitive capacity (Bronkhorst, 1996).

To date neither the internal reliability nor construct validity for the AC has been determined. However, predictive validity for the AC has been determined by Bronkhorst (1996). In his study "Competence and Management Strategies of Successful Corporate Recovery Executives" Bronkhorst (1996) found that there is a high correlation between many of the competencies measured in the AC and successful corporate recovery CEO's.

In the Problem Analysis exercise it was found that successful CEO's showed a significantly stronger ability for analytical thinking ( $p < 0.001$ ). The successful CEO's fared better in the General Management Exercise ( $p < 0.025$ ) as well as in the Cognitive Capacity ( $p < 0.001$ ). The overall profile across all exercises in the AC showed the superiority of successful CEO's ( $p < 0.005$ ).

#### 4.4) **Statistical analysis of data**

In order to determine whether a correlation exists between the independent variables and dependent variable, the statistical method of simple linear regression analysis was applied between each individual competency (independent variable) and the variance between planned production and actual production delivered per annum (dependent variable). Simple linear regression calculations deliver a coefficient of determination which can range between 0 and 1. This means that the closer the coefficient of determination is to 1, the better the dependent variable is explained by the independent variable correlation.

Also, the correlation coefficient is calculated to express the strength of correlation between the dependent variable and the independent variable. The correlation coefficient varies between -1 and 1, meaning that the stronger the relationship between the variables, the closer the correlation coefficient value will be to either 1 or -1. The positive and negative symbol indicates the slope of the line. This is very clear if the variables are plotted on a graph and a trend line applied.

In order to explain the simple linear regression analysis and coefficients, the competency of planning will be used as an example. Firstly, the dependent variable was determined from the production data and summarised in a table. This was then filtered from worst performing business units (shaft complex) to best performing complex based on the percentage variance between planned tonnages versus actual tonnage delivered for a financial year, as per Table 5 below. It is the same data as graphically presented in Graph 2.

Table 5: Planned tonnage (BP17) versus actual tonnage produced and percentage variance

Business unit	Actual	BP	Variance	Percentage
	Tonnes	Tonnes	Tonnes	%
A	231 006	330 951	-99 945	-30 %
B	461 600	654 356	-192 756	-29 %
C	444 194	623 424	-179 230	-29 %
D	587 814	713 018	-125 204	-18 %
E	658 104	795 103	-136 999	-17 %
F	724 061	873 285	-149 224	-17 %
G	14 559	17 407	-2 849	-16 %
H	444 972	527 050	-82 078	-16 %
I	285 896	326 012	-40 116	-12 %
J	523 361	571 330	-47 968	-8 %
K	734 342	789 514	-55 172	-7 %
L	495 915	527 462	-31 547	-6 %
M	362 325	366 282	-3 957	-1 %
N	1 074 120	1 067 773	6 347	1 %
O	689 444	667 047	22 397	3 %
P	539 944	476 408	63 537	13 %
Q	504 741	440 189	64 552	15 %
R	186 236	152 930	33 306	22 %

For this explanation of the calculations, the competency of planning, which is the independent variable and represented by column Y in Table 6 below, is used. This column contains the score achieved out of a hundred by each respondent for the specific competency of planning and scheduling.

Important to note in this example is that respondents fifteen to eighteen scored significantly higher scores than other respondents. The average scores for the competencies were 45 points. Respondents fifteen to eighteen's combined score average for the planning and scheduling competency was 79 points. Also, their respective delivered performance in terms of production is above the business plan, as indicated in Table 5. Business units O, P, Q and R were respectively 3%, 13%, 15% and 22% over delivering production compared to planned production in the Business plan. This point is evaluated in more detail under Detailed Findings in Section 4.7.

The dependent variable (Table 5 data) represented by X is used in the simple regression analysis model represented in Table 6, below.

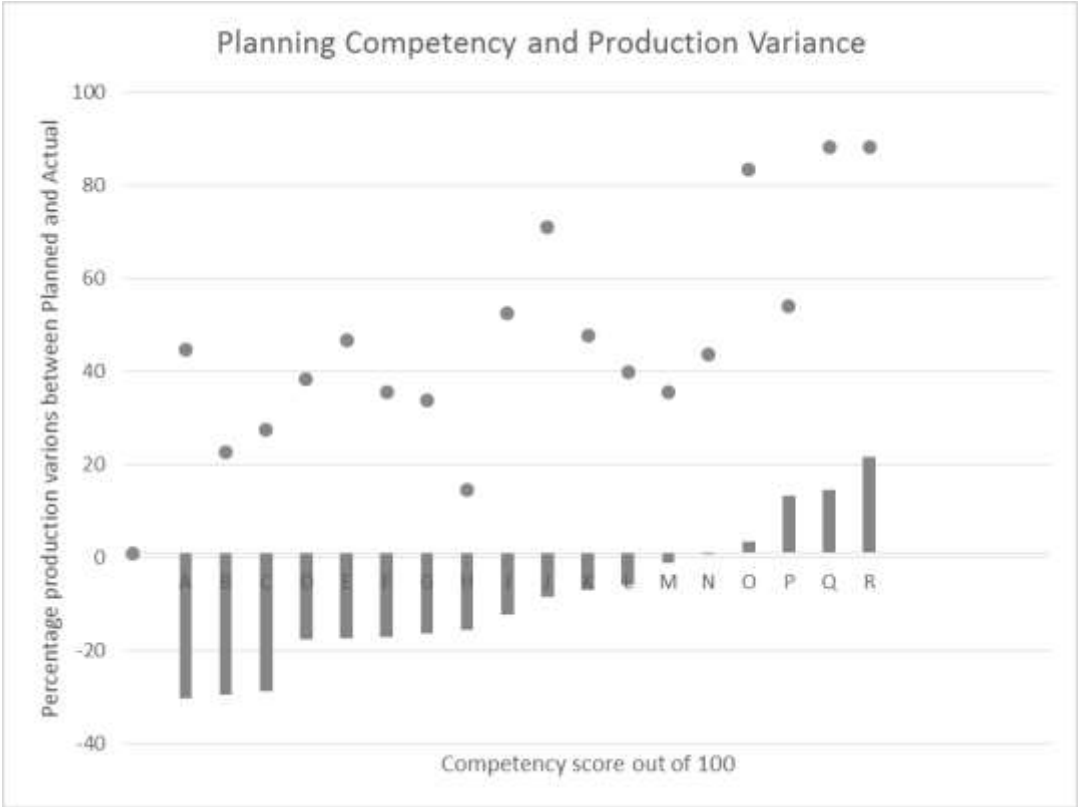
Table 6: Planning Competency and Production variance

Competency:													
Planning and scheduling (Raw scores represented in Y)													
Trend projection method for forecasting													
Respondent	Competency score	Factor	# Variance % to Business Plan	X	(X- $\bar{X}$ ) <sup>2</sup>	(X- $\bar{X}$ )(Y- $\bar{Y}$ )	(Y- $\bar{Y}$ ) <sup>2</sup>	$\bar{Y}$	(Y- $\bar{Y}$ ) <sup>2</sup>	$\bar{Y}$	(Y- $\bar{Y}$ ) <sup>2</sup>	( $\bar{Y}$ - $\bar{Y}$ ) <sup>2</sup>	
													Y
1	45	44.7	-30 %	-30	470.3	78.2	13	25	1002		522		
2	23	22.8	-29 %	-29	438.6	533.8	650	26	392889		487		
3	27	27.5	-29 %	-29	409.5	421.3	433	27	164752		454		
4	38	38.4	-18 %	-18	81.8	89.1	97	39	3427		91		
5	47	46.8	-17 %	-17	76.0	13.0	2	39	1987		84		
6	36	35.7	-17 %	-17	73.5	107.8	158	39	15003		82		
7	34	33.9	-16 %	-16	61.6	112.6	206	40	29554		68		
8	15	14.5	-16 %	-16	49.8	238.4	1140	41	1267235		55		
9	53	52.7	-12 %	-12	14.4	-16.7	19	44	1114		16		
10	71	71.0	-8 %	-8	0.0	2.7	517	48	199107		0		
11	48	47.7	-7 %	-7	2.3	-0.9	0	50	2239		3		
12	40	40.0	-6 %	-6	6.4	-21.0	69	51	823		7		
13	36	35.5	-1 %	-1	55.3	-95.0	163	56	16322		61		
14	44	43.8	1 %	1	83.0	-41.1	20	58	550		92		
15	84	83.5	3 %	3	140.9	418.1	1241	61	1338982		156		
16	54	54.2	13 %	13	477.4	129.2	35	71	370		530		
17	88	88.2	15 %	15	537.2	925.3	1594	73	2266916		596		
18	88	88.2	22 %	22	917.6	1209.0	1593	80	2264543		1018		
$\sum Y$	868.99	$\sum X$	-153.24	$\sum (X-\bar{X})^2 =$	3895.7	$\sum (X-\bar{X})(Y-\bar{Y}) =$	4104.0	$\sum (Y-\bar{Y})^2 =$	7951	$\sum (Y-\bar{Y})^2 =$	7966816	$\sum (\bar{Y}-\bar{Y})^2 =$	4323
$\bar{Y} = \sum Y / N =$	48.27722222	$\bar{X} = \sum X / N =$	-8.513326461					SST =	7951	SSE =	7966816	SSR =	4323
Now:	$\hat{Y} = b(0) + b(1)X$						Coefficient of Determination	$r^2 =$	0.544 (SSR/SST)				
							Correlation Coefficient	$r =$	0.737				
and	$b(1) = \frac{\sum (X-\bar{X})(Y-\bar{Y})}{\sum (X-\bar{X})^2}$												
	$= 1.0534554$												
and	$b(0) = \bar{Y} - b(1)(\bar{X})$												
	$= 57.245632$												

Correlation coefficient scale:	
0 - 0.25	= no or extremely weak relationship
0.25 - 0.5	= very weak relationship
0.5 - 0.75	= strong relationship
0.75 - 1	= very strong relationship

This calculation delivers a correlation coefficient (r) of 0.74. If the correlation coefficient scale is used, it can be regarded that the competency of planning has a strong relationship to the production performance (tonnage variance). The coefficient of determination ( $r^2 = 0.41$ ) can be multiplied with a 100 to be expressed as a percentage. In the example of the planning competency, 41% of the dependent variable (production performance) is explained by the planning competency. If the dependent variable (production percentage variance) is plotted with the independent variable, namely the planning competency, the relationship is clear as depicted in Graph 6.

Graph 6: Production percentage variance and planning competency



The above described statistical process was followed per competency and the calculation for each is contained in Appendix E.

The statistics applied on each competency (independent variable) against the production variance (dependent variable) was done and Table 7 provides a summary of the correlation coefficients per competency obtained via the statistical analysis.

Table 7: Competencies and correlation coefficient related to dependent variable

<b>Independent variable</b>	<b>Coefficient of Determination</b>	<b>Correlation Coefficient</b>
<b>Competency</b>		
Need for challenge	0.06	0.24
Need for self development	0.02	0.16
Need for social extension	0.10	0.31
Need for affiliation	0.02	0.14
Need for change	0.00	0.07
Need to control	0.25	0.50
Need for assertion	0.25	0.50
Need for structure	0.12	0.35
Need for surgency	0.38	0.62
Need goal direction	0.00	0.02
Need for composure	0.12	0.35
Creator Style	0.00	0.06
Decision	0.05	0.23
Initiator Style	0.05	0.23
Integrator Style	0.11	0.33
Supporter Style	0.02	0.13
Method	0.21	0.46
Completer Style	0.28	0.53
Operator Style	0.07	0.26
Approach to time	0.00	0.06
Approach to delegation	0.07	0.27
Approach to expenditure	0.04	0.21
Approach to communication	0.01	0.10
Approach to conflict	0.08	0.28
Approach to method on problem solving	0.20	0.45
Managerial/Strategic thinking	0.23	0.47
Leadership og people	0.12	0.34
Problem solving behaviour	0.36	0.60
Planning and scheduling	0.54	0.74
Need for composure	0.14	0.38
Creator Style	0.03	0.16
Resourcer Style	0.01	0.08
Performance output	0.02	0.13
Integrator Style	0.21	0.46
Supporter Style	0.05	0.22
Judge Style	0.41	0.64
Task orientation	0.01	0.08
Operator style	0.05	0.22
Diversity	0.06	0.24

This is the resultant data used to interpret the findings in order to satisfy the objectives of the study and answer the research questions.

#### 4.5) **Data summary and filtering**

Literature provides various articles and research papers that emphasise the importance of competencies which managers should possess as well as the increase in performance the presence of these competencies promote in a management role. The analysis of existing management competency theories indicates that a management role in a specific environment or industry requires specific competencies to be present for that job. This will enhance job performance and results delivery for a business and can contribute to a competitive advantage.

Literature provides managerial examples as well as descriptive competencies needed for specific managers to drive the success of business. Research work could not be obtained for the management competencies specific to a mine manager, albeit being fairly available in other industry sectors.

Impala Platinum, Rustenburg mining operation provided the opportunity to evaluate the competencies of mine managers and investigate whether a correlation exists in relation to production results delivered per business unit. All business units at this mining operation are similar in terms of operation and mining environment. Using the results obtained, a ranking of importance was conducted by filtering the correlation coefficient in a declining order which is depicted in Table 8 below.

Table 8: Correlation coefficients in declining order

<b>Independent variable</b>	<b>Coefficient of Determination</b>	<b>Correlation Coefficient</b>
<b>Competency</b>		
Planning and scheduling	0.54	0.74
Judge Style	0.41	0.64
Need for surgency	0.38	0.62
Problem solving behaviour	0.36	0.60
Completor Style	0.28	0.53
Need to control	0.25	0.50
Need for assertion	0.25	0.50
Managerial/Strategic thinking	0.23	0.47
Method	0.21	0.46
Integrator Style	0.21	0.46
Approach to method on problem solving	0.20	0.45
Need for composure	0.14	0.38
Need for structure	0.12	0.35
Need for composure	0.12	0.35
Leadership of people	0.12	0.34
Integrator Style	0.11	0.33
Need for social extension	0.10	0.31
Approach to conflict	0.08	0.28
Approach to delegation	0.07	0.27
Operator style	0.05	0.22
Need for challenge	0.06	0.24
Diversity	0.06	0.24
Initiator Style	0.05	0.23
Decision	0.05	0.23
Supporter Style	0.05	0.22
Operator style	0.05	0.22
Approach to expenditure	0.04	0.21
Creator Style	0.03	0.16
Need for self development	0.02	0.16
Need for affiliation	0.02	0.14
Supporter Style	0.05	0.22
Performance output	0.02	0.13
Approach to communication	0.01	0.10
Resourcer Style	0.01	0.08
Task orientation	0.01	0.08
Need for change	0.00	0.07
Approach to time	0.00	0.06
Creator Style	0.03	0.16
Need goal direction	0.00	0.02

The scale used in Chapter 3, was applied to the correlation coefficient in determining the strength of the relationship between an independent and dependent variable. This scale is cited again for ease of reference:

<b>Correlation coefficient scale:</b>		
0 - 0.25	=	no or extremely weak relationship
0.25 - 0.5	=	very weak relationship
0.5 - 0.75	=	strong relationship
0.75 - 1	=	very strong relationship

The same scale was applied to interpret the findings in order to determine if a relationship exists between the dependent and independent variable.

#### 4.6) **Findings**

When this scale is applied to the results contained in Table 8, it can be interpreted that a competency with a correlation coefficient ranging from 0.75 to 1 has a very strong relationship to production results. Competencies with a correlation coefficient ranging between 0.5 and 0.75 have a strong relationship to the production results and competencies with a correlation coefficient between 0.25 and 0.5 have a weak relationship to the production results. Any competency with a correlation coefficient below 0.25 has no or an extremely weak relationship to production results.

In describing the findings it is important to refer back to the research questions set out in Chapter 1. The first question raised was whether there is a relationship between management competencies and production output per business unit.

Each competency's strength in terms of correlation is different and ranges from very weak (or none) to strong. This implies that certain competencies for the position of a mine manager have a higher strength of relationship with the production results. In other words the higher the correlation coefficient, the stronger the relationship between the dependent and independent variable. As a correlation coefficient above 0.25 was obtained between competencies and production results, it is confirmed that a relationship exists.

The fact that this research findings indicate a relationship, confirms other research studies conducted in the petroleum industry where it was determined that a relationship between management competencies and production results exist (Darvish, Moogali, Moosavi, Panahi, 2012). This was also the case in the

steel industry (Lee, *et al.*, 2010) with a study that indicated a relationship between management competencies and production delivery.

Table 8 delivers two important findings. Firstly, the research results indicate that management competencies in individual managers in a business unit have a direct influence on the production performance of the business unit due to the correlation. Thus, a relationship exists. These managers possess competencies that have a strong correlation to delivering production results which are on par or above the expected production for the business unit. In other words, the business unit has a positive production variance between the planned production and the actual delivered production. Performance has been positive for the managers in the job and the production results reflect this to be the case.

Secondly, Table 8 provides the ranking of the importance of various competencies for mine managers in relation to production output at Impala, Rustenburg mining operation. The competencies ranked above 0.5 on the correlation scale constitutes that these competencies can be regarded as highly important and should be possessed by an employee to fulfil the role of a mine manager. This relates to research evidence that management competencies do indeed relate positively to overall effectiveness and the increase of performance (Derue, Nahrgang, Wellman, Humphrey, 2011). As per Mineo (2014), this ranking is an important phenomenon to understand for a specific management role in an industry as it can define the success of performance for a manager and production result delivery for the organisation.

#### 4.7) **Detailed finding evaluation**

In viewing the competencies that have a correlation coefficient with a strong relationship to production results, in this case in the range between 0.5 and 0.75, it is important to refer back to the general job description contained in Section 2 of Chapter 1.

In this background discussion pertinent points of a mine manager's functions were described and is cited again diminutively in conjunction with the

competencies with a strong relationship to production results (between 0.5 and 0.75 correlation coefficient).

Mine manager's functions entail the **planning, organising** and **monitoring** of activities related to a mine. These managers are responsible for **planning** future mine production, **overseeing** the development and tunnelling of the mine and **monitoring** the quality of stone, rock and minerals. They further **ensure compliance** to occupational health and safety guidelines that include **planning** and **overseeing** of maintenance on the mine, **developing plans** and inspecting the mine for danger which entails taking **corrective action** and **applying discipline** to work standards.

**Overseeing** financial administration; liaising/**negotiating** with suppliers, contractors and other stakeholders; hiring staff; **organising** staff training; as well as dealing with unions are also generic management duties carried out by mine managers.

Mine managers have a vast number of **reports** with various discipline skills, reporting to them. These include engineers; the human resource department and technical services departments such as geology, ventilation, rock engineering, surveying, safety, finance and the environmental department; all of which fulfil a critical part of the **control** of operations at a shaft complex. Although the mine manager is not a subject matter expert in all these diverse fields, he will be approached by reports to **resolve problems** in these fields. Management of a shaft complex relates to the mine manager who has **overall responsibility** for the **delivery of production**.

Based on the narrative description of the functions performed by mine managers, it is recognisable that key words highlighted in the description relate to a competence that must be possessed by the individual in order to excel in a mine manager position and deliver production results. Table 9, summarises the key words and pairs it with the competencies and descriptions with the highest correlation coefficient to delivered production results in this study.

Table 9: Mine manager job description key words and competencies

Key words	Competencies	Description
<b>Planning</b>	<b>Scheduling/ Planning</b>	Refers to competence in activities of programming and scheduling.
<b>Organising</b>	<b>Need to Control</b>	The need to influence and control people, events and situations.
<b>Monitoring</b>	<b>Judge</b>	The likeliness to thoroughly analyse, think through, consider and contemplate issues.
<b>Overseeing</b>	<b>Need for Surgency</b>	The need to be positive, excited and optimistic. This also refers to the ability to bounce back after a setback or adversity.
<b>Ensure compliance</b>	<b>Problem Analysis/ Anticipation/ Reasoning</b>	The ability to reduce problems to logical conclusions. The ability to source information and to take action to solve the problem. The ability to find facts and to get to the root causes of problems and includes an intuitive feel for what is required in solving a problem. The ability to reduce data to logical conclusions.
<b>Developing plans</b>	<b>Completor</b>	The likeliness to complete and follow through. This also refers to attention to detail.
<b>Corrective action</b>	<b>Need for Assertion</b>	The need to express own views, to dominate and to compete for attention.
<b>Applying discipline</b>		
<b>Problems resolved</b>		
<b>Overall responsibility</b>		

In view of Table 9 above, the findings in this section indicate that the competencies required by mine managers, as statistically determined in correlation with the production results delivered, are the best developed in the range of 0.5 to 0.75. The mine managers whose competency level falls within these parameters are the best performers in this organisation. In conjunction with the job description narrative, the association is apparent and the findings of this study confirm this.

What is unexpected is the high correlation coefficient obtained by the competency of surgency. The competency of surgency is the need to be positive, excited and optimistic. This also refers to the ability to bounce back after a setback or adversity. Although not described in the job description of a mine

manager, this research indicates that this competency is required as it bears a high correlation to delivering superior production results in this position.

Concluding the findings, it was established that respondents fifteen to eighteen scored the highest with a combined average of 76 points versus a 51 points average scored by all of the respondents (see Appendix D) for the highest rank competencies, based on correlation coefficients. This indicates that managers with a higher competence in planning/scheduling, judge competency, need for surgency, problem solving behaviour, completor competency, need for control and the need for assertion, also delivered higher production output. This is confirmed as respondents fifteen to eighteen is responsible for business units O, P, Q and R in Table 5, which indicates higher production delivery with 3%, 13%, 15% and 22% respectively over and above the required business planned production (as per Table 5 above).

#### 4.8) **Conclusion**

This chapter utilised the statistical analysis conducted on the data and answered the research question set out at the beginning of the study.

The findings confirmed the importance of management competencies that must be present in individuals in a management role. These competencies ensure better performance delivered in a management role as per other research studies conducted in literature.

The management competencies specifically applicable to a mine manager were described and ranked in degree of importance. Lastly, it confirmed the **hypothesis: there is a relationship between mine manager competencies and production results.**

The next chapter provides the conclusion of this study and the relevance in terms of management competencies to production results at Impala Platinum, Rustenburg mining operation as well as shortcomings and recommendations for future studies.

## **CHAPTER 5: Conclusion and Recommendations**

### **5.1) Introduction**

The aim of this research was to evaluate the relationship between management competencies and production results at Impala Platinum, Rustenburg mining operation. A hypothesis was posed that a relationship between management competencies and production results exist. Through a literature study the manager competencies were identified and it was determined that a specific managerial job requires specific management competencies that would cause an employee to excel in a specific management position within a specific industry or organisation.

Following the literature study, a quantitative research method was followed in order to gather data on managerial competencies. Through linear regression analysis a coefficient of correlation was determined for each competency tested with the production results delivered by each respondent for a financial year.

The data analysed provided the platform for findings to answer the research questions posed. This chapter provides a summary of the study, a conclusion on the significance of findings from this and previous research, an identification of shortcomings from the study and recommendations for proposed research work.

### **5.2) Conclusion to the study**

Conclusions were drawn after each chapter contained in the research study and this section will provide acmes of the study.

Previous conducted research indicates the importance of management competencies and literature comprehensively describes the meaning of competencies. Research and literature also indicate that certain management competencies have a higher importance for individuals in specific circumstances, roles, organisations and industries. Management competencies must be matched to the specific job description, role, organisation and industry. No research could be obtained for the specific competencies to be possessed for the role of a mine

manager. Literature further showed that a relationship was identified between production results and management competencies in other industries and that production results improved when managers were deployed with the correct competencies for the role.

The objective of the study was to determine if a relationship between management competencies and production results per business unit (shaft complex), exist. By following the research methodology data was gathered and a statistical analysis method was followed to process the data using linear regression analysis. This determined correlation coefficients between competencies and the production results of respondents.

The findings confirmed the importance of management competencies which need to be present in individuals in a management role to ensure better performance delivered in a management role, as per other research studies conducted in literature. The management competencies, specifically applicable to a mine manager, were ranked in degree of importance and each of these competencies was described.

Due to the findings obtained from the study and the fact that correlation coefficients with a strong relationship presented itself, this study confirmed the hypothesis: **there is a relationship between mine manager competencies and production results.**

The significance of the study is a contribution to research and confirmation of other studies that management competencies play an important role in delivering better job results. This study shows that in order for a manager to excel, they need to possess management competencies specific to the industry and organisation. This study further indicates that the following seven management competencies have the highest relationship to best production results at Impala Platinum, Rustenburg mining operation:

- **Judgement:** Refers to sound judgement and consequences of actions/decisions.

- **Scheduling/Planning:** Refers to competence in activities of programming and scheduling.
- **Scheduling/Planning competency:** Refers to competence in activities of programming and scheduling.
- **Control competency:** The need to influence and control people, events and situations.
- **Judge competency:** Likelihood to thoroughly analyse, think through, consider and contemplate issues.
- **Surgency competency:** The need to be positive, excited and optimistic. This also refers to the ability to bounce back after a setback or adversity.
- **Problem Analysis/ Anticipation/Reasoning competency:** The ability to reduce a problem to logical conclusions. The ability to source information and to take action to solve the problem. The ability to find facts and to get to the root cause of problems. Intuitive feel for what is required in solving a problem. The ability to reduce data to logical conclusions.
- **Completer competency:** Likelihood to complete and follow through. This also refers to attention to detail.
- **Assertion competency:** The need to express own views, to dominate and to compete for attention.

Surprisingly, in review of the job description of a mine manager, the only competency that is indistinct from the job description is surgency. This research identified this competency to be very important in terms of production results delivered.

The identification of these competencies has significance for training applications in order to develop these competencies in current employed managers within the organisation. It can also be applied for future recruitment, promotion and selection related processes in the organisation.

### 5.3) **Recommendation**

This study was conducted at Impala Platinum, Rustenburg mining operation and consisted of a small sample. In order to improve the validity of the study it is

recommended that the sample be increased to cover a wider spectrum of the mining industry in South Africa. This can be done in a single study or by applying the same methodology to other mining houses. Once the results have been obtained, the most important competencies to be possessed by a mine manager, can be defined.

This study utilised production results from a single financial year and it is recommended that the evaluation period be extended in future research. The longer the duration, the more an individual's performance can influence production results delivered and/or alleviate respondents that were placed at a specific business unit for a short period prior to the evaluation period and research conducted.

The results from the study can be used to develop and equip mine managers with the identified competencies. It can also be incorporated in training and succession planning for employees and be used as part of selection criteria for recruitment purposes.

Through literature and other research the importance of competencies have been identified and confirmed by this study. In order to improve organisational performance, it is recommended that similar studies are applied to other management levels in order to identify the required competencies for all levels of management – not only for mine managers.

#### 5.4) **Conclusion**

This chapter concluded the study by describing the research objectives that were met as well as the most important competencies that must be present in a mine manager employee for the specific role profile. This was extracted by listing the correlation coefficients obtained for each competency in relation to production results. Also, the hypothesis was affirmed in that a relationship between management competencies and production results do indeed exist.

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## **Appendix A: Company permission letter to conduct research**

Dear Sir,

I, Vernon Anfield, an employee in the service of Impala Platinum is currently enrolled for a Master Degree in Business Administration (MBA) at the University of the Free State. A research project has to be conducted as part of the fulfilment of the requirements in obtaining the mentioned degree.

It is my intent to conduct a research project that does not only fulfil such requirement, but can also positively contribute in human resource field, as well as the production results of the company. The research project will be made available to the company upon completion, containing all findings and if any, some recommendations.

The research contains one hypothesis:

There is a relationship between management competencies and production results at Impala Platinum, Rustenburg Mining Operation.

In order to prove the hypothesis or deliver a null hypothesis, a comprehensive sample of all mine management specific to production will be required to participate on a voluntary basis. The sample will consist of a total of 18 respondents and an estimation of 55 minutes of company time will be required to complete the questionnaire/simulation.

Your support in this regard will be greatly appreciated, by myself, the industry and also the academic community as such work can be used for further research.

For prove of approval can you kindly sign this letter on behalf of the company:

\_\_\_\_\_

Name: \_\_\_\_\_

On behalf of Impala Platinum Pty (Ltd)

## Appendix B: Cost breakdown

Month		YTD				20 SHAFT	Financial Year					Next FY	
Actual	Var B	Actual	Var B	Prev Yr	Var %	March 2016	Var E	Budget	Var B	Prev Yr	Var %	Budget	
						<b>Safety</b>							
233	161	1,158	504	0	0.0	STOP Observations	0	0	727	(727)	220	(100)	0
0	0	0	0	0	0.0	Fatals	0	0	0	0	0	0	0
0.00	0.00	0.00	0.00	0.00	0.0	Fatality Rate	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	0	0	0	9	100.0	Reportables	0	0	0	18	100	0	0
0	0	0	0	16	100.0	No. Lost times	0	0	0	33	100	0	0
0.00	0.00	0.00	0.00	3.53	100.0	LTIFR	0.00	0.00	40.00	40.00	5.34	100.00	0.00
0.00	0.00	0.00	0.00	1.12	100.0	Shifts Lost per 1000	0.00	0.00	0.00	0.00	1.41	100.00	0.00
						<b>Costs (R'000)</b>							
33,816	(2,064)	266,829	8,229	211,316	(26.3)	Package (Excl.)	0	360,582	370,875	370,875	290,927	100.0	549,500
5,095	221	43,689	2,365	40,883	(6.9)	Benefits	0	59,950	62,094	62,094	57,589	100.0	87,051
2,466	(209)	14,351	5,106	16,050	10.6	Bonuses	0	20,965	26,281	26,281	20,707	100.0	25,613
1,458	287	11,709	3,446	11,519	(1.6)	Overtime	0	17,247	20,406	20,406	17,985	100.0	25,885
7	(7)	3,340	281	3,614	7.6	Extra Production Shift	0	6,782	3,622	3,622	7,153	100.0	(70)
1,684	386	11,454	8,611	9,224	(24.2)	Labour Related	0	19,214	27,439	27,439	12,972	100.0	19,896
44,526	(1,385)	351,372	28,039	292,607	(20.1)	<b>Total Labour Cost</b>	0	484,748	510,715	510,715	407,333	100.0	707,875
10,614	4,294	73,808	49,724	34,561	(113.6)	Mining Contracts	0	118,983	164,413	164,413	51,703	100.0	171,364
128	417	1,751	2,471	2,456	28.7	Drill Steel	0	3,609	5,662	5,662	2,770	100.0	9,243
2,701	210	18,445	4,139	9,453	(95.1)	Explosives & Accessories	0	26,349	30,278	30,278	14,165	100.0	39,052
3,583	(357)	21,844	4,009	11,587	(88.5)	Support	0	29,933	34,299	34,299	19,999	100.0	30,590
490	146	4,015	958	3,241	(23.9)	Winding, Scrapers & Ropes	0	5,902	6,714	6,714	4,506	100.0	8,725
4,242	(936)	29,275	545	22,636	(29.3)	Engineering	0	38,257	39,738	39,738	31,858	100.0	38,422
2,887	1,374	24,975	9,081	21,175	(17.9)	Other Mining Stores	0	37,840	45,547	45,547	30,140	100.0	56,162
24,644	5,149	174,113	70,928	105,109	(65.7)	<b>Total Stores</b>	0	260,873	326,651	326,651	155,141	100.0	353,558
0	1,136	12,511	(3,538)	5,986	(109.0)	Compressors	0	16,426	11,752	11,752	9,517	100.0	33,348
0	4,343	41,059	1,804	35,394	(16.0)	Electricity	0	60,146	57,608	57,608	48,368	100.0	73,292
373	(13)	3,187	(421)	2,432	(31.0)	Water	0	4,195	3,787	3,787	3,357	100.0	4,193
373	5,466	56,756	(2,154)	43,812	(29.5)	Utilities	0	80,767	73,147	73,147	61,243	100.0	110,833
797	0	7,177	0	6,277	(14.3)	Renewals	0	9,570	9,570	9,570	2,204	100.0	20,096
(60)	162	1,178	(245)	1,091	(7.9)	Overheads	0	1,647	1,240	1,240	1,908	100.0	1,071
70,280	9,392	590,597	96,567	448,895	(31.6)	<b>Total costs before revenue</b>	0	837,605	921,323	921,323	627,829	100.0	1,193,433
0	(20,018)	(155,470)	4,820	(48,475)	(220.7)	Capital Off Reef Dev	0	(224,119)	(199,281)	(199,281)	(67,081)	100.0	(236,567)
70,280	(10,625)	435,127	101,387	400,420	(8.7)	<b>Total Costs After Capitalisation</b>	0	613,486	722,042	722,042	560,748	100.0	956,866

## Appendix B: Cost breakdown - continued

Month		YTD				20 SHAFT	Financial Year					Next FY	
Actual	Var B	Actual	Var B	Prev Yr	Var %	March 2016	Var E	Budget	Var B	Prev Yr	Var %	Budget	
0	(91)	465	(285)	395	17.9	<u>Production</u>							
0	(91)	465	(285)	395	17.9	Weighline Tons	0	(804)	1,003	(1,003)	562	(100.0)	1,143
15,243	(2,538)	80,738	(59,399)	48,779	65.5	Merensky Weighline Tons	0	(804)	1,003	(1,003)	562	(100.0)	1,143
936	(157)	5,937	(2,097)	4,482	32.5	Centares (Excl. Re/Pre dev)	0	(129,236)	187,256	(187,256)	75,591	(100.0)	212,355
103	24	885	(40)	667	32.8	Development Metres (Conv)	0	(8,821)	10,888	(10,888)	6,027	(100.0)	12,277
278	(161)	1,771	(1,004)	1,782	(0.6)	Secondary Metres	0	(1,127)	1,200	(1,200)	865	(100.0)	839
555	(21)	3,281	(1,052)	2,033	61.4	On Reef Metres	0	(3,049)	3,956	(3,956)	2,316	(100.0)	5,350
27	(31)	133	(379)	242	(45.2)	Off Reef Metres	0	(4,645)	5,732	(5,732)	2,846	(100.0)	6,087
18.30	(0.77)	15.98	3.73	12.79	(25.0)	Development Metres (Mech)	0	(316)	664	(664)	380	(100.0)	409
193	(76)	1,265	(1,027)	1,030	22.8	Replacement Factor (excl Sec)	0.00	16.80	19.33	19.33	14.64	100.00	18.57
0	(351)	1,603	(1,316)	1,400	14.4	Re/Pre Dev	0	(2,066)	3,017	(3,017)	1,339	(100.0)	4,426
94.70	1.04	72.43	(21.08)	72.26	0.2	Weighline Kilograms	0	(2,788)	3,890	(3,890)	2,004	(100.0)	4,401
17.76	(11.17)	17.61	(11.09)	11.04	(59.5)	Total Shaft % Swept	0.00	(60.36)	93.54	(93.54)	61.87	(100.00)	78.42
0.00	(3.85)	3.45	(0.45)	3.55	(2.9)	Off Reef %	17.61	(8.84)	6.53	(11.08)	11.79	(49.3)	6.22
0.00	(5.13)	5.76	0.41	8.09	(28.8)	Head Grade	0.00	(3.47)	3.88	(3.88)	3.57	(100.00)	3.85
28,609	(4,900)	164,163	(94,551)	111,330	47.5	Tons per Centare	0.00	(6.22)	5.36	(5.36)	7.43	(100.00)	5.38
0	(8,266)	25,976	(48,622)	12,381	109.8	Production Units	0	(254,166)	346,517	(346,517)	160,588	(100.0)	391,784
622	(983)	3,238	(9,999)	0	0.0	<u>Contractors Production</u>							
608	(46)	3,525	(1,295)	2,206	59.8	Tonnes - Contr	0	(57,236)	98,419	(98,419)	20,121	(100.0)	102,393
53	(25)	264	(222)	474	(44.2)	Centares (Excl) - Contr	0	(8,290)	17,466	(17,466)	940	(100.0)	18,009
555	(21)	3,261	(1,073)	1,732	88.3	Development - Contr	0	(5,083)	6,414	(6,414)	3,133	(100.0)	7,078
3	(37)	19	(346)	0	0.0	On Reef Dev - Contr	0	(458)	682	(682)	588	(100.0)	990
						Off Reef Dev - Contr	0	(4,625)	5,732	(5,732)	2,545	(100.0)	6,087
						Pre/Re Dev - Contr	0	(165)	474	(474)	0	0.0	688
						<u>Efficiency</u>							
						<u>Unit Cost</u>							
0	873	1,270	(353)	1,138	(11.6)	Cost / Tonne (R/Ton)	0	1,042	919	919	1,118	100.0	1,044
0	226,947	368,526	(133,044)	320,545	(15.0)	Cost / Kilogram (R/Kg)	0	300,395	236,826	236,826	313,349	100.0	271,170
0	326	374	(48)	266	(40.5)	Store Cost / Tonne (R/Ton)	0	324	326	326	276	100.0	309
861	28	1,061	(113)	944	(12.3)	Stores Cost / Prod Unit (R/Unit)	0	1,026	943	943	966	100.0	902
						<u>Productivity (Excl Mech)</u>							
0.0	(50.7)	32.7	(15.3)	31.4	4.4	Tonnes / Employee AW	0.0	(40.8)	47.6	(47.6)	32.7	(100.0)	42.8
19.6	(0.6)	12.6	(6.2)	10.1	24.8	Ca / Stoping Man (m2/man)	0.0	(14.0)	18.6	(18.6)	11.3	(100.0)	19.4
24.2	(0.6)	15.6	(7.4)	12.2	28.0	Ca / Panel Empl (m2/man)	0.0	(17.4)	22.8	(22.8)	13.7	(100.0)	23.8
311.1	(19.0)	197.2	(109.3)	156.3	26.1	Ca / Stoping Team (m2/team)	0.0	(223.1)	302.7	(302.7)	174.0	(100.0)	316.5
0.0	0.0	0.0	0.0	0.0	0.0	Ca / Ledging Team (m2/team)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18.2	(8.5)	14.8	(9.1)	12.5	18.0	On Reef / Team (m/team)	0.0	(17.2)	23.5	(23.5)	12.0	(100.0)	20.9
0.0	0.0	1.1	1.1	10.2	(89.2)	Off Reef / Team (m/team)	0.0	(1.1)	0.0	0.0	7.7	(100.0)	0.0
7.6	(7.5)	6.5	(7.8)	6.8	(4.4)	Re/Pre Dev / Team (m/team)	0.0	(8.3)	14.0	(14.0)	6.6	(100.0)	14.0
8.9	(2.0)	6.1	3.9	4.8	27.0	Production Units per Employee	0.0	0.0	1.8	(1.8)	5.1	(100.0)	2.2

## Appendix B: Cost breakdown - continued

Month		YTD				20 SHAFT	Financial Year					Next FY	
Actual	Var B	Actual	Var B	Prev Yr	Var %	March 2016	Var E	Budget	Var B	Prev Yr	Var %	Budget	
						<u>Labour</u>							
2,081	(83)	1,903	5	1,679	(13.4)	Total IS	0	1,923	1,934	1,934	1,724	100	2,245
1,195	(25)	1,070	36	913	(17.2)	Total IS (A Levels)	0	1,094	1,123	1,123	943	100	1,306
619	(37)	589	(28)	520	(13.1)	Total IS (B Levels)	0	585	567	567	534	100	665
240	(15)	219	1	188	(16.7)	Total IS (C Levels)	0	220	222	222	193	100	246
26	(4)	22	0	19	(15.7)	Total IS (D & E Levels)	0	21	22	22	19	100	28
1	(1)	4	(4)	39	89.6	Total IS (Learners & External)	0	3	0	0	35	100	0
1,162	(28)	1,089	121	935	(16.6)	Contractors in Service	1,089	0	1,190	101	956	(14)	1,054
1,734	(41)	1,496	122	1,354	(10.5)	Total AW	0	1,545	1,639	1,639	1,378	100	1,903
1,002	(19)	847	83	743	(14.0)	Total AW (A Levels)	0	880	944	944	758	100	1,098
512	(20)	460	15	420	(9.5)	Total AW (B Levels)	0	467	480	480	427	100	563
195	2	168	25	149	(12.7)	Total AW (C Levels)	0	176	195	195	154	100	217
23	(3)	18	2	16	(14.4)	Total AW (D & E Levels)	0	18	20	20	16	100	25
1	(1)	4	(4)	26	86.2	Total AW (Learners & External)	0	3	0	0	23	100	0
						<u>Prod Labour (Incl. Miners)</u>							
745	54	685	65	538	(27.4)	Total Stopping AW	0	718	762	762	552	100	834
605	47	550	62	443	(24.2)	Total Panel AW	0	580	622	622	454	100	681
0	0	0	0	0	0.0	Total Ledging AW	0	0	0	0	0	0	0
54	(24)	50	(20)	45	(11.0)	Total Re/Pre Dev AW	0	43	30	30	45	100	45
111	(10)	122	(29)	118	(3.2)	Total Dev AW	0	118	97	97	122	100	120
47	2	44	2	35	(26.0)	Total Conv Panel teams	0	45	47	47	36	100	51
0	0	0	0	0	0.0	Total Conv Ledging teams	0	0	0	0	0	0	0
12.87	0.43	12.60	0.70	12.78	1.4	Employee / Conv Panel Team	0.00	12.83	13.30	13.30	12.70	100	13.30

**Appendix C:** Anonymous, (2015). SAP BEx\_Broadcaster report. 22 June 2015.

**Rustenburg daily combined tons**

Year to date 2017					
Shaft/ Open Cast	Shaft	Weighline	Business Plan	Variance	Var. %
SHAFTS	01 SHAFT	1 078 711	1 432 994	-354 283	-25 %
	04 SHAFT	462 657	564 383	-101 726	-18 %
	06 SHAFT	525 210	474 733	50 478	11 %
	07 SHAFT	234 279	366 787	-132 508	-36 %
	07A SHAFT	186 237	152 930	33 307	22 %
	09 SHAFT	511 348	565 598	-54 251	-10 %
	10 SHAFT	1 258 998	1 348 017	-89 020	-7 %
	11 SHAFT	1 677 016	1 773 846	-96 830	-5 %
	12 SHAFT	754 615	944 559	-189 944	-20 %
	12N SHAFT	6 029	0	6 029	0 %
	14 SHAFT	957 508	1 186 463	-228 955	-19 %
	16 SHAFT	773 761	859 099	-85 338	-10 %
	20 SHAFT	862 424	1 107 696	-245 272	-22 %
	EF SHAFT	298 905	349 104	-50 200	-14 %
	<b>Result</b>	<b>9 587 696</b>	<b>11 126 209</b>	<b>-1 538 513</b>	<b>-14 %</b>
<b>Overall Result</b>		<b>9 587 696</b>	<b>11 126 209</b>	<b>-1 538 513</b>	<b>-14 %</b>

## Appendix D: Respondents' raw scores

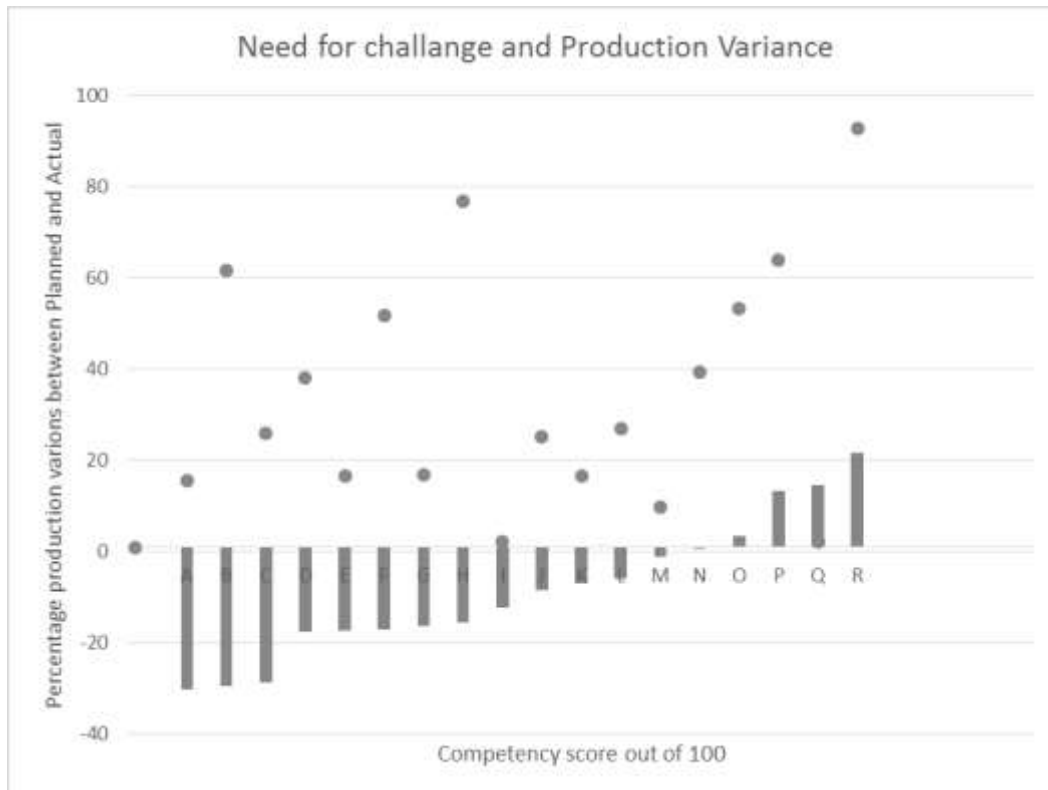
Competency	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Respondent	Need for challenge	Need for self development	Need for social extension	Need for affiliation	Need for change	Need to control	Need for assertion	Need for structure	Need for surgency	Need goal direction	Need for composure	Creator Style	Decision	Initiator Style	Integrator Style	Supporter Style	Method	Completer Style	Operator Style	Approach to Time	Approach to Delegation	Approach to Expenditure	Approach to Communication	Approach to Conflict
#1	16	19	98	79	13	66	91	6	23	64	2	31	86	15	53	26	79	17	45	8	86	2	28	53
#2	62	41	59	2	25	96	91	19	1	97	51	45	74	98	1	26	88	17	32	33	50	41	3	80
#3	26	54	7	67	40	92	94	40	0	47	26	85	43	25	17	7	97	37	21	33	19	41	29	87
#4	38	28	60	30	96	88	99	3	4	0	26	32	27	56	27	40	54	48	61	33	37	33	69	87
#5	17	54	60	77	15	15	60	41	26	32	64	12	27	13	27	79	38	95	32	33	61	41	57	61
#6	52	93	26	12	15	96	98	53	1	3	16	46	75	24	27	6	99	26	21	45	61	83	38	62
#7	17	93	2	77	83	66	37	41	41	46	50	33	0	84	40	96	69	16	33	2	37	83	15	9
#8	77	1	79	19	98	99	98	18	0	3	0	61	15	70	27	26	54	16	84	45	37	41	15	87
#9	2	6	90	19	42	88	84	85	41	6	26	33	42	2	16	96	69	1	97	13	28	41	69	9
#10	25	41	78	93	6	56	72	19	24	21	37	32	27	73	53	7	53	61	46	13	61	83	68	28
#11	16	18	38	42	98	45	71	85	2	20	16	74	15	72	17	7	24	61	84	13	61	41	69	21
#12	27	97	2	54	0	24	26	76	41	61	98	1	59	24	17	96	98	72	1	13	37	41	3	28
#13	10	1	49	77	57	92	100	6	0	61	26	21	27	55	80	40	69	9	61	45	76	12	87	53
#14	39	67	16	66	7	74	36	76	9	19	50	21	42	83	27	26	69	82	6	33	18	78	29	53
#15	53	28	71	53	1	23	46	85	42	74	26	1	75	70	80	15	39	60	46	45	86	0	15	53
#16	64	3	37	12	3	45	79	53	82	97	75	74	7	39	80	15	6	48	84	45	61	41	57	28
#17	2	78	38	65	73	7	8	25	41	42	92	85	21	42	23	54	55	69	72	12	13	6	50	77
#18	93	97	2	3	83	58	65	58	53	5	19	16	61	86	23	0	68	89	48	21	2	24	7	41

**Appendix D: Respondents' raw scores - continued**

Competency	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
Respondent	Approach to Method on Problem	Managerial/ Strategic Thinking	Leadership of people	Problem Solving Behaviour	Planning and scheduling	Need for composure	Creator Style	Resourcer Style	Performance output	Integrator Style	Supporter Style	Judge Style	Task orientation	Operator Style	Diversity	Approach to Delegation	Approach to Expenditure	Approach to Communication	Approach to Conflict	Approach to Method on Problem	Strategic Thinking	Leadership of people	Problem Solving Behaviour	Problem Solving and Reasoning
#1	65	32	80	71	45	2	31	86	15	53	26	79	17	45	8	86	2	28	53	65	32	80	71	45
#2	88	91	11	93	23	51	45	74	98	1	26	88	17	32	33	50	41	3	80	88	91	11	93	23
#3	83	90	11	92	27	26	85	43	25	17	7	97	37	21	33	19	41	29	87	83	90	11	92	27
#4	65	76	63	76	38	26	32	27	56	27	40	54	48	61	33	37	33	69	87	65	76	63	76	38
#5	65	22	11	35	47	64	12	27	13	27	79	38	95	32	33	61	41	57	61	65	22	11	35	47
#6	65	99	27	86	36	16	46	75	24	27	6	99	26	21	45	61	83	38	62	65	99	27	86	36
#7	88	31	46	41	34	50	33	0	84	40	96	69	16	33	2	37	83	15	9	88	31	46	41	34
#8	88	75	11	64	15	0	61	15	70	27	26	54	16	84	45	37	41	15	87	88	75	11	64	15
#9	56	1	79	35	53	26	33	42	2	16	96	69	1	97	13	28	41	69	9	56	1	79	35	53
#10	36	67	63	22	71	37	32	27	73	53	7	53	61	46	13	61	83	68	28	36	67	63	22	71
#11	65	66	2	63	48	16	74	15	72	17	7	24	61	84	13	61	41	69	21	65	66	2	63	48
#12	56	13	2	35	40	98	1	59	24	17	96	98	72	1	13	37	41	3	28	56	13	2	35	40
#13	56	21	91	13	36	26	21	27	55	80	40	69	9	61	45	76	12	87	53	56	21	91	13	36
#14	56	53	11	28	44	50	21	42	83	27	26	69	82	6	33	18	78	29	53	56	53	11	28	44
#15	14	13	79	3	84	26	1	75	70	80	15	39	60	46	45	86	0	15	53	14	13	79	3	84
#16	65	14	63	28	54	75	74	7	39	80	15	6	48	84	45	61	41	57	28	65	14	63	28	54
#17	14	57	66	28	88	21	80	48	37	43	76	63	32	96	13	33	9	37	11	52	18	55	7	69
#18	83	15	66	62	88	75	70	73	63	32	87	8	4	26	45	84	81	80	20	6	86	36	64	96

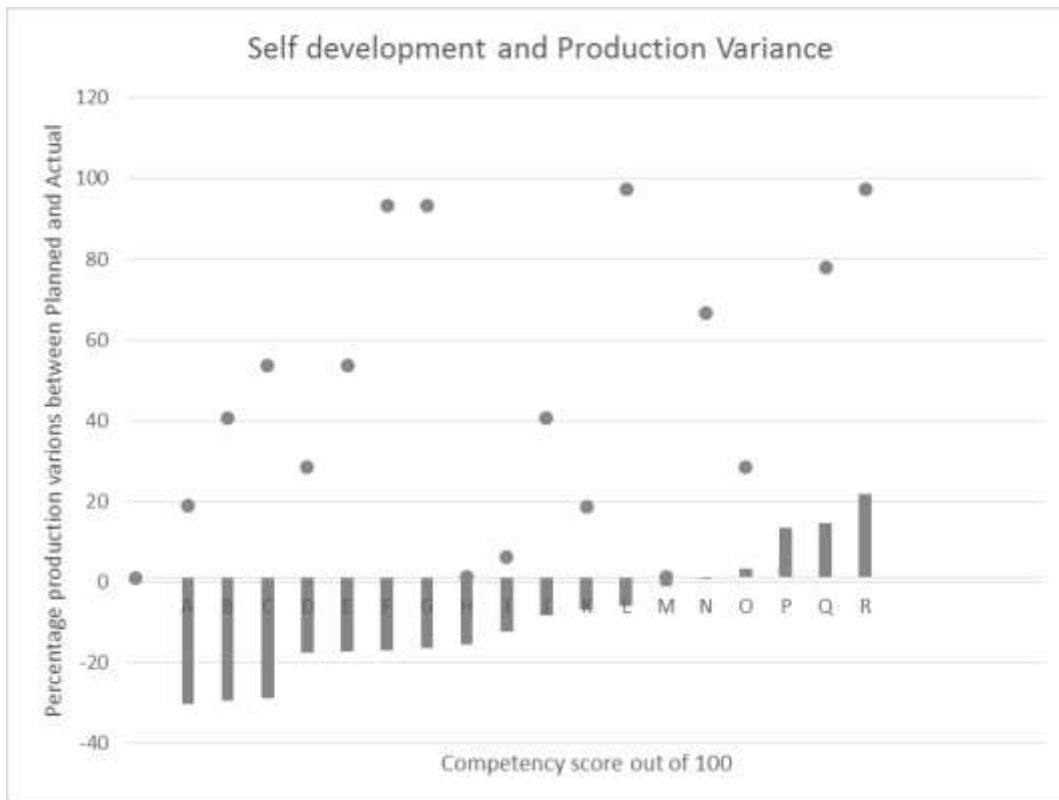
## Appendix E: Regression analysis calculations

Competency:													
Need for challenge (Raw scores represented in Y)													
Trend projection method for forecasting													
Respondent	Competency score	factor	# Variance % to Business plan										
	Y	1	X		(X- $\bar{X}$ ) <sup>2</sup>	(X- $\bar{X}$ )(Y- $\bar{Y}$ )		(Y- $\bar{Y}$ ) <sup>2</sup>	$\bar{Y}$	(Y- $\bar{Y}$ ) <sup>2</sup>		( $\bar{Y}$ - $\bar{Y}$ ) <sup>2</sup>	
1	16	15.6	-30 %	-30	470.3	427.3		388	26	138898		84	
2	62	61.7	-29 %	-29	438.6	-552.4		696	26	401781		79	
3	26	26.0	-29 %	-29	409.5	190.1		88	27	3886		74	
4	38	38.2	-18 %	-18	81.8	-25.8		8	32	903		15	
5	17	16.7	-17 %	-17	76.0	162.5		348	32	109546		14	
6	52	51.8	-17 %	-17	73.5	-140.8		270	32	47513		13	
7	17	16.8	-16 %	-16	61.6	145.5		343	32	106535		11	
8	77	76.9	-16 %	-16	49.8	-293.4		1728	32	2724635		9	
9	2	2.2	-12 %	-12	14.4	125.8		1100	34	1205189		3	
10	25	25.3	-8 %	-8	0.0	-1.2		101	35	5719		0	
11	16	16.5	-7 %	-7	2.3	-28.8		356	36	115226		0	
12	27	26.9	-6 %	-6	6.4	-21.3		71	36	1912		1	
13	10	9.7	-1 %	-1	55.3	-190.6		658	38	419934		10	
14	39	39.4	1 %	1	83.0	37.3		17	39	514		15	
15	53	53.3	3 %	3	140.9	212.9		322	40	72009		25	
16	64	64.0	13 %	13	477.4	626.5		822	45	574825		86	
17	2	2.2	15 %	15	537.2	-768.0		1098	45	1200760		97	
18	93	93.0	22 %	22	917.6	1745.5		3321	48	10417031		165	
$\Sigma Y$	636.23	$\Sigma X$	-153.24	$\Sigma(X-\bar{X})^2=$	3895.7	$\Sigma(X-\bar{X})(Y-\bar{Y})=$	1651.1	$\Sigma(Y-\bar{Y})^2=$	11733	$\Sigma(Y-\bar{Y})^2=$	17546816	$\Sigma(\bar{Y}-\bar{Y})^2=$	700
$\bar{Y}=\Sigma Y/N=$	35.34611111	$\bar{X}=\Sigma X/N=$	-8.513326461					SST=	11733	SSE=	17546816	SSR=	700
Now:	$\bar{Y}=b(0)+b(1)X$							Coefficient of Determination	$r^2=$	0.060	(SSR/SST)		
and	$b(1)=\frac{\Sigma(X-\bar{X})(Y-\bar{Y})}{\Sigma(X-\bar{X})^2}$							Correlation Coefficient	$r=$	0.244			
and	$b(0)=\bar{Y}-b(1)(\bar{X})$												
	$= 38.9542929$												



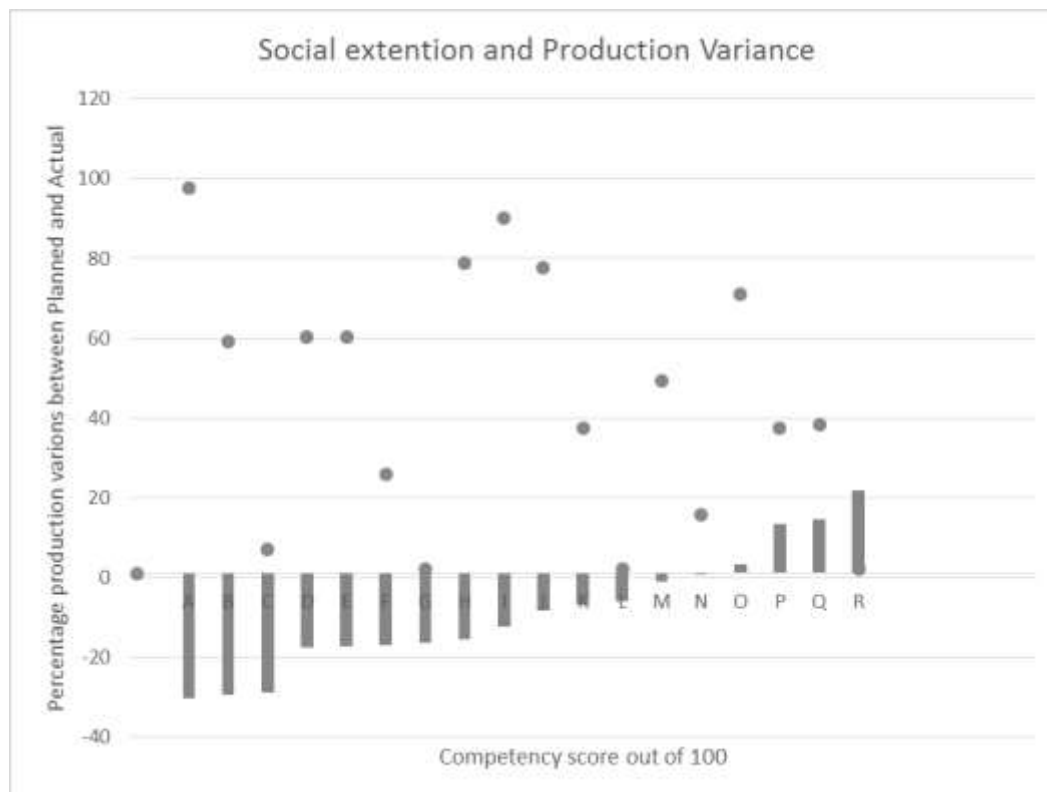
## Appendix E: Regression analysis calculations – continued

Competency:													
Need for self development (Raw scores represented in Y)													
Trend projection method for forecasting													
Respondent	Competency score	factor	# Variance % to Business plan		(X- $\bar{X}$ ) <sup>2</sup>	(X- $\bar{X}$ )(Y- $\bar{Y}$ )		(Y- $\bar{Y}$ ) <sup>2</sup>	$\bar{Y}$	(Y- $\bar{Y}$ ) <sup>2</sup>		( $\bar{Y}$ - $\bar{Y}$ ) <sup>2</sup>	
1	19	18.8	-30 %	-30	470.3	581.2		718	38	489217		63	
2	41	40.6	-29 %	-29	438.6	104.3		25	38	249		59	
3	54	53.5	-29 %	-29	409.5	-161.1		63	38	97		55	
4	28	28.3	-18 %	-18	81.8	155.9		297	42	72100		11	
5	54	53.6	-17 %	-17	76.0	-69.9		64	42	115		10	
6	93	93.4	-17 %	-17	73.5	-410.4		2291	42	4827700		10	
7	93	93.4	-16 %	-16	61.6	-375.8		2291	43	4827700		8	
8	1	1.4	-16 %	-16	49.8	312.2		1955	43	3818152		7	
9	6	6.2	-12 %	-12	14.4	149.4		1552	44	2390568		2	
10	41	40.6	-8 %	-8	0.0	-0.6		25	46	246		0	
11	18	18.5	-7 %	-7	2.3	-41.3		734	46	511737		0	
12	97	97.2	-6 %	-6	6.4	130.8		2669	46	6613039		1	
13	1	1.4	-1 %	-1	55.3	-328.7		1955	48	3818152		7	
14	67	66.7	1 %	1	83.0	192.4		446	49	143935		11	
15	28	28.5	3 %	3	140.9	-203.0		292	50	69654		19	
16	3	3.0	13 %	13	477.4	-930.6		1814	54	3279289		64	
17	78	78.0	15 %	15	537.2	751.0		1050	54	944446		72	
18	97	97.3	22 %	22	917.6	1567.0		2676	57	6649954		122	
$\Sigma Y$	820.25	$\Sigma X$	-153.24	$\Sigma(X-\bar{X})^2=$	3895.7	$\Sigma(X-\bar{X})(Y-\bar{Y})=$	1422.8	$\Sigma(Y-\bar{Y})^2=$	20918	$\Sigma(Y-\bar{Y})^2=$	38456351	$\Sigma(\bar{Y}-\bar{Y})^2=$	520
$\bar{Y}=\Sigma Y/Nr=$	45.56944444	$\bar{X}=\Sigma X/Nr=$	-8.513326461					SST=	20918	SSE=	38456351	SSR=	520
Now:	$\bar{Y}=b(0)+b(1)X$							Coefficient of Determination	$r^2=$	0.025 (SSR/SST)			
								Correlation Coefficient	$r=$	0.158			
and	$b(1)=\Sigma(X-\bar{X})(Y-\bar{Y})/\Sigma(X-\bar{X})^2$												
	=	0.3652141											
and	$b(0)=\bar{Y}-b(1)(\bar{X})$												
	=	48.6786313											



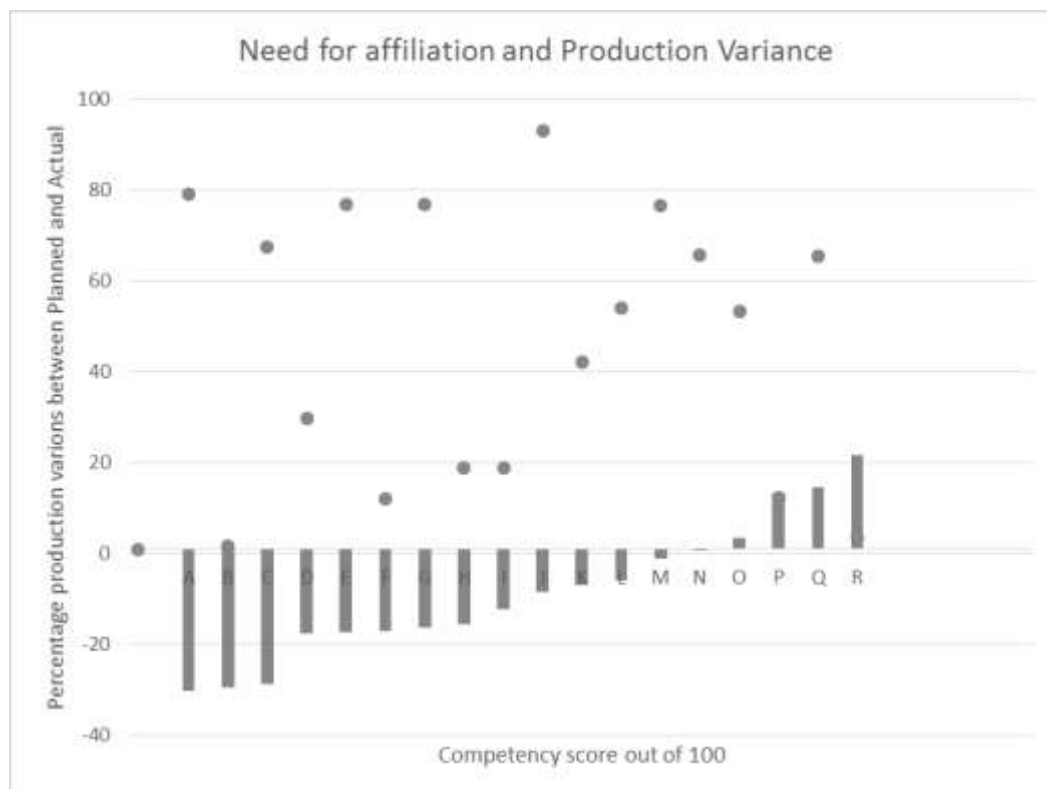
## Appendix E: Regression analysis calculations – continued

Competency:													
Need for social extension (Raw scores represented in Y)													
Trend projection method for forecasting													
Respondent	Competency score	factor	# Variance % to Business plan										
	Y	1	X		(X- $\bar{X}$ ) <sup>2</sup>	(X- $\bar{X}$ )(Y- $\bar{Y}$ )		(Y- $\bar{Y}$ ) <sup>2</sup>	$\bar{Y}$	(Y- $\bar{Y}$ ) <sup>2</sup>	( $\bar{Y}$ - $\bar{Y}$ ) <sup>2</sup>		
1	98	97.7	-30 %	-30	470.3	-1139.7		2762	59	7098484	196		
2	59	59.3	-29 %	-29	438.6	-295.4		199	59	19508	183		
3	7	7.0	-29 %	-29	409.5	772.3		1457	58	2101216	170		
4	60	60.3	-18 %	-18	81.8	-136.4		227	51	27891	34		
5	60	60.3	-17 %	-17	76.0	-131.9		229	51	28479	32		
6	26	25.9	-17 %	-17	73.5	164.9		370	51	118367	31		
7	2	2.1	-16 %	-16	61.6	338.6		1860	50	3451107	26		
8	79	78.8	-16 %	-16	49.8	-237.3		1130	50	1104976	21		
9	90	90.3	-12 %	-12	14.4	-171.0		2034	48	3776372	6		
10	78	77.8	-8 %	-8	0.0	3.8		1064	45	973361	0		
11	38	37.5	-7 %	-7	2.3	-11.7		58	44	437	1		
12	2	2.1	-6 %	-6	6.4	-109.2		1858	44	3444628	3		
13	49	49.4	-1 %	-1	55.3	31.3		18	40	1005	23		
14	16	15.8	1 %	1	83.0	-267.5		863	39	717563	35		
15	71	71.0	3 %	3	140.9	306.6		667	38	355133	59		
16	37	37.5	13 %	13	477.4	-167.9		59	31	465	199		
17	38	38.3	15 %	15	537.2	-158.9		47	30	75	224		
18	2	2.1	22 %	22	917.6	-1303.9		1853	26	3425246	382		
$\Sigma Y$	813.15	$\Sigma X$	-153.24	$\Sigma(X-\bar{X})^2=$	3895.7	$\Sigma(X-\bar{X})(Y-\bar{Y})=$	-2513.3	$\Sigma(Y-\bar{Y})^2=$	16754	$\Sigma(Y-\bar{Y})^2=$	26644315	$\Sigma(\bar{Y}-\bar{Y})^2=$	1621
$\bar{Y}=\Sigma Y/Nr=$	45.175	$\bar{X}=\Sigma X/Nr=$	-8.513326461					SST=	16754	SSE=	26644315	SSR=	1621
Now:	$\bar{Y}=b(0)+b(1)X$							Coefficient of Determination	$r^2=$	0.097 (SSR/SST)			
and	$b(1)=\frac{\Sigma(X-\bar{X})(Y-\bar{Y})}{\Sigma(X-\bar{X})^2}$							Correlation Coefficient	$r=$	0.311			
	= -0.6451477												
and	$b(0)=\bar{Y}-b(1)(\bar{X})$												
	= 39.6826467												



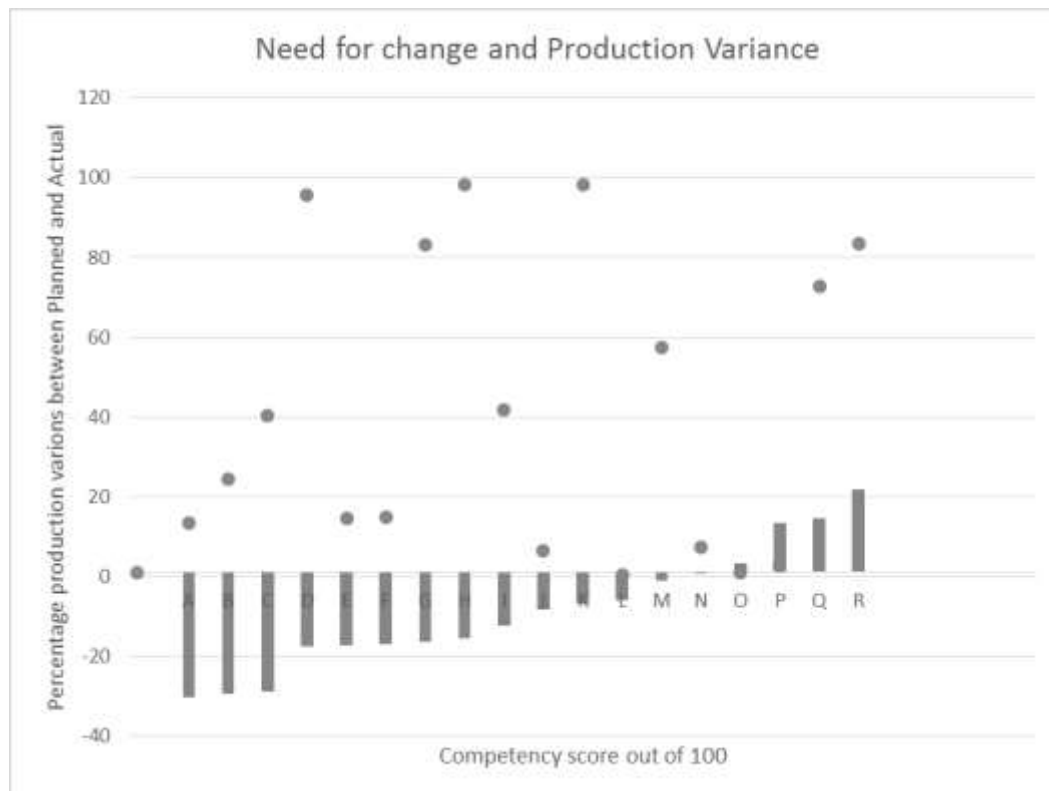
## Appendix E: Regression analysis calculations - continued

Competency:													
Need for affiliation (Raw scores represented in Y)													
Trend projection method for forecasting													
Respondent	Competency score	factor	# Variance % to Business plan										
	Y	1	X		(X- $\bar{X}$ ) <sup>2</sup>	(X- $\bar{X}$ )(Y- $\bar{Y}$ )		(Y- $\bar{Y}$ ) <sup>2</sup>	$\bar{Y}$	(Y- $\bar{Y}$ ) <sup>2</sup>		( $\bar{Y}$ - $\bar{Y}$ ) <sup>2</sup>	
1	79	79.3	-30 %	-30	470.3	-698.1		1036	53	915836		36	
2	2	1.8	-29 %	-29	438.6	950.0		2057	53	4225567		34	
3	67	67.5	-29 %	-29	409.5	-411.6		414	53	119940		31	
4	30	29.9	-18 %	-18	81.8	156.2		298	50	72009		6	
5	77	77.0	-17 %	-17	76.0	-260.6		894	50	66675		6	
6	12	12.0	-17 %	-17	73.5	301.2		1234	49	1493308		6	
7	77	76.8	-16 %	-16	61.6	-233.0		880	49	645802		5	
8	19	19.0	-16 %	-16	49.8	198.5		791	49	595429		4	
9	19	19.0	-12 %	-12	14.4	106.8		793	48	598970		1	
10	93	93.1	-8 %	-8	0.0	5.4		2111	47	4070616		0	
11	42	42.2	-7 %	-7	2.3	-7.5		24	47	320		0	
12	54	54.0	-6 %	-6	6.4	17.5		48	46	41		0	
13	77	76.7	-1 %	-1	55.3	220.0		876	45	638332		4	
14	66	65.8	1 %	1	83.0	169.8		348	45	79384		6	
15	53	53.2	3 %	3	140.9	72.7		37	44	249		11	
16	12	12.3	13 %	13	477.4	-761.4		1214	41	1445132		36	
17	65	65.4	15 %	15	537.2	424.7		336	41	73032		41	
18	3	3.3	22 %	22	917.6	-1327.0		1919	39	3670520		70	
$\Sigma Y$	848.13	$\Sigma X$	-153.24	$\Sigma(X-\bar{X})^2=$	3895.7	$\Sigma(X-\bar{X})(Y-\bar{Y})=$	-1076.6	$\Sigma(Y-\bar{Y})^2=$	15310	$\Sigma(Y-\bar{Y})^2=$	19311161	$\Sigma(\bar{Y}-\bar{Y})^2=$	298
$\bar{Y}=\Sigma Y/Nr=$	47.11833333	$\bar{X}=\Sigma X/Nr=$	-8.513326461					SST=	15310	SSE=	19311161	SSR=	298
Now: $\bar{Y}=b(0)+b(1)X$								Coefficient of Determination	$r^2=$	0.019 (SSR/SST)			
and	$b(1)=$	$\Sigma(X-\bar{X})(Y-\bar{Y}) / \Sigma(X-\bar{X})^2$						Correlation Coefficient	$r=$	0.139			
		$= -0.2763617$											
and	$b(0)=$	$\bar{Y}-b(1)(\bar{X})$											
		$= 44.7655755$											



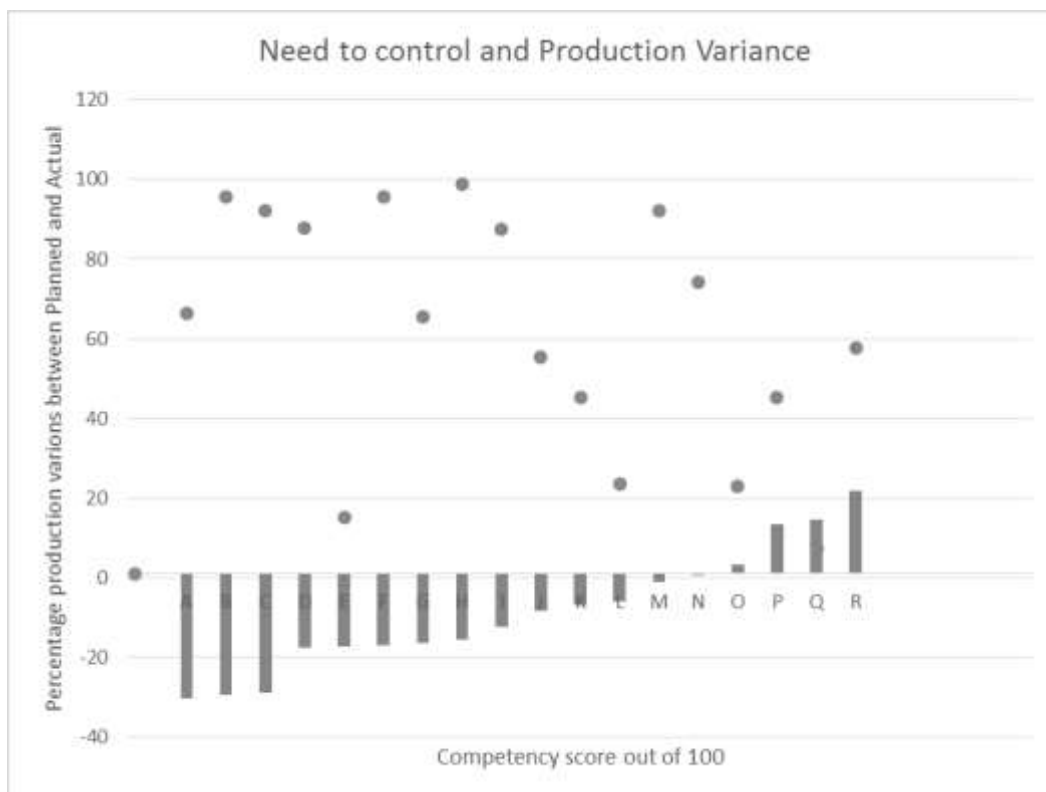
## Appendix E: Regression analysis calculations - continued

Competency:													
Need for change (Raw scores represented in Y)													
Trend projection method for forecasting													
Respondent	Competency score	factor	# Variance % to Business plan										
	Y	1	X		(X- $\bar{X}$ ) <sup>2</sup>	(X- $\bar{X}$ )(Y- $\bar{Y}$ )		(Y- $\bar{Y}$ ) <sup>2</sup>	$\bar{Y}$	(Y- $\bar{Y}$ ) <sup>2</sup>		( $\bar{Y}$ - $\bar{Y}$ ) <sup>2</sup>	
1	13	13.4	-30 %	-30	470.3	619.2		815	38	642797		14	
2	25	24.5	-29 %	-29	438.6	365.5		305	38	78412		13	
3	40	40.4	-29 %	-29	409.5	31.2		2	38	1448		12	
4	96	95.7	-18 %	-18	81.8	-486.0		2886	40	7784262		2	
5	15	14.6	-17 %	-17	76.0	238.3		748	40	537152		2	
6	15	14.9	-17 %	-17	73.5	232.4		734	40	517824		2	
7	83	83.1	-16 %	-16	61.6	-322.9		1692	41	2587226		2	
8	98	98.1	-16 %	-16	49.8	-396.3		3152	41	9323648		2	
9	42	41.7	-12 %	-12	14.4	1.1		0	41	1730		0	
10	6	6.4	-8 %	-8	0.0	-4.2		1269	42	1593940		0	
11	98	98.1	-7 %	-7	2.3	85.6		3150	42	9316854		0	
12	0	0.2	-6 %	-6	6.4	-105.7		1741	42	3031936		0	
13	57	57.4	-1 %	-1	55.3	114.7		238	43	32635		2	
14	7	7.2	1 %	1	83.0	-316.8		1210	44	1446092		3	
15	1	0.9	3 %	3	140.9	-487.6		1687	44	2842381		4	
16	3	2.8	13 %	13	477.4	-855.9		1534	46	2345725		14	
17	73	72.6	15 %	15	537.2	710.4		939	46	751229		16	
18	83	83.4	22 %	22	917.6	1255.9		1719	47	2674564		28	
$\Sigma Y$	755.48	$\Sigma X$	-153.24	$\Sigma(X-\bar{X})^2=$	3895.7	$\Sigma(X-\bar{X})(Y-\bar{Y})=$	678.9	$\Sigma(Y-\bar{Y})^2=$	23821	$\Sigma(Y-\bar{Y})^2=$	45509854	$\Sigma(\bar{Y}-\bar{Y})^2=$	118
$\bar{Y}=\Sigma Y/Nr=$	41.97111111	$\bar{X}=\Sigma X/Nr=$	-8.513326461					SST=	23821	SSE=	45509854	SSR=	118
Now: $\bar{Y}=b(0)+b(1)X$								Coefficient of Determination	$r^2=$	0.005 (SSR/SST)			
and	$b(1)=$	$\Sigma(X-\bar{X})(Y-\bar{Y}) / \Sigma(X-\bar{X})^2$						Correlation Coefficient	$r=$	0.070			
		$= 0.1742674$											
and	$b(0)=$	$\bar{Y}-b(1)(\bar{X})$											
		$= 43.4547065$											



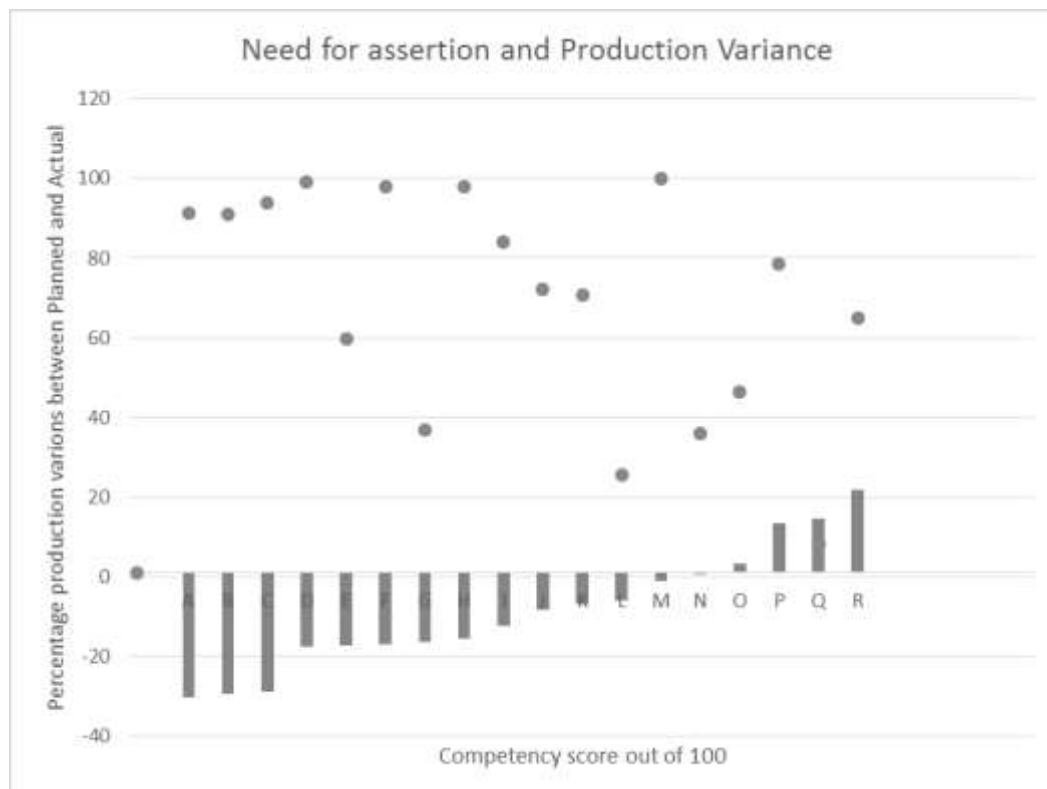
## Appendix E: Regression analysis calculations - continued

Competency: Need to control (Raw scores represented in Y)													
Trend projection method for forecasting													
Respondent	Competency score	factor	# Variance % to Business plan										
	Y	1	X		(X- $\bar{X}$ ) <sup>2</sup>	(X- $\bar{X}$ )(Y- $\bar{Y}$ )		(Y- $\bar{Y}$ ) <sup>2</sup>	$\bar{Y}$	(Y- $\bar{Y}$ ) <sup>2</sup>		( $\bar{Y}$ - $\bar{Y}$ ) <sup>2</sup>	
1	66	66.3	-30 %	-30	470.3	-77.5		13	85	2864		477	
2	96	95.7	-29 %	-29	438.6	-691.0		1088	84	985625		445	
3	92	92.2	-29 %	-29	409.5	-597.6		872	83	608263		416	
4	88	87.9	-18 %	-18	81.8	-227.9		635	72	298933		83	
5	15	15.1	-17 %	-17	76.0	415.2		2268	71	5077475		77	
6	96	95.6	-17 %	-17	73.5	-281.7		1079	71	967682		75	
7	66	65.5	-16 %	-16	61.6	-22.2		8	71	3308		63	
8	99	98.9	-16 %	-16	49.8	-255.2		1307	70	1459562		51	
9	88	87.6	-12 %	-12	14.4	-94.5		622	67	285130		15	
10	56	55.5	-8 %	-8	0.0	-0.8		52	63	15		0	
11	45	45.3	-7 %	-7	2.3	-26.6		304	61	66981		2	
12	24	23.6	-6 %	-6	6.4	-99.0		1529	60	2265104		7	
13	92	92.1	-1 %	-1	55.3	218.7		866	55	598360		56	
14	74	74.1	1 %	1	83.0	103.8		130	54	3125		84	
15	23	23.0	3 %	3	140.9	-470.9		1574	51	2404027		143	
16	45	45.4	13 %	13	477.4	-379.3		301	41	65507		485	
17	7	7.3	15 %	15	537.2	-1285.4		3076	39	9414558		545	
18	58	57.7	22 %	22	917.6	-152.9		25	32	1036		931	
$\Sigma Y$	1128.74	$\Sigma X$	-153.24	$\Sigma(X-\bar{X})^2=$	3895.7	$\Sigma(X-\bar{X})(Y-\bar{Y})=$	-3924.9	$\Sigma(Y-\bar{Y})^2=$	15748	$\Sigma(Y-\bar{Y})^2=$	24507554	$\Sigma(\bar{Y}-\bar{Y})^2=$	3954
$\bar{Y}=\Sigma Y/Nr=$	62.70777778	$\bar{X}=\Sigma X/Nr=$	-8.513326461					SST=	15748	SSE=	24507554	SSR=	3954
Now:	$\bar{Y}=b(0)+b(1)X$							Coefficient of Determination	$r^2=$	0.251	(SSR/SST)		
and	$b(1)=\frac{\Sigma(X-\bar{X})(Y-\bar{Y})}{\Sigma(X-\bar{X})^2}$							Correlation Coefficient	$r=$	0.501			
	$= -1.0074740$												
and	$b(0)=\bar{Y}-b(1)\bar{X}$												
	$= 54.1308226$												



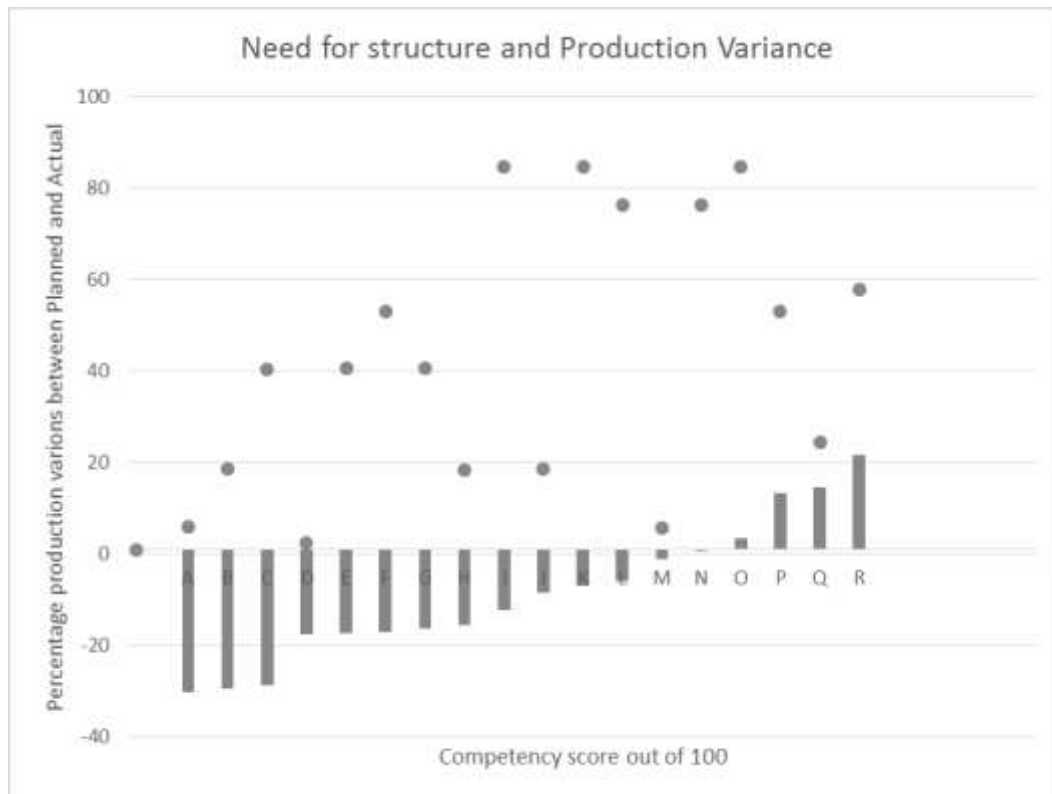
## Appendix E: Regression analysis calculations - continued

Competency:													
Need for assertion (Raw scores represented in Y)													
Trend projection method for forecasting													
Respondent	Competency score	factor	# Variance % to Business plan										
	Y	1	X		(X- $\bar{X}$ ) <sup>2</sup>	(X- $\bar{X}$ )(Y- $\bar{Y}$ )		(Y- $\bar{Y}$ ) <sup>2</sup>	$\bar{Y}$	(Y- $\bar{Y}$ ) <sup>2</sup>		( $\bar{Y}$ - $\bar{Y}$ ) <sup>2</sup>	
1	91	91.4	-30 %	-30	470.3	-469.5		469	90	142428		417	
2	91	90.9	-29 %	-29	438.6	-443.8		449	89	128271		389	
3	94	94.0	-29 %	-29	409.5	-491.7		591	89	246529		363	
4	99	99.0	-18 %	-18	81.8	-265.3		860	78	579504		73	
5	60	59.8	-17 %	-17	76.0	86.3		98	78	1459		67	
6	98	98.0	-17 %	-17	73.5	-242.7		801	78	494881		65	
7	37	36.8	-16 %	-16	61.6	258.5		1084	77	1096020		55	
8	98	97.9	-16 %	-16	49.8	-199.4		798	76	489425		44	
9	84	84.1	-12 %	-12	14.4	-54.7		208	73	15404		13	
10	72	72.3	-8 %	-8	0.0	0.3		7	70	4284		0	
11	71	70.8	-7 %	-7	2.3	1.6		1	68	4846		2	
12	26	25.6	-6 %	-6	6.4	-111.8		1949	67	3700327		6	
13	100	99.9	-1 %	-1	55.3	224.5		912	63	659626		49	
14	36	36.1	1 %	1	83.0	-306.2		1130	61	1197245		74	
15	46	46.5	3 %	3	140.9	-275.6		539	59	242716		125	
16	79	78.5	13 %	13	477.4	192.7		78	49	1		424	
17	8	8.1	15 %	15	537.2	-1427.5		3793	48	14327358		477	
18	65	64.9	22 %	22	917.6	-144.8		23	41	1770		814	
$\Sigma Y$	1254.59	$\Sigma X$	-153.24	$\Sigma(X-\bar{X})^2=$	3895.7	$\Sigma(X-\bar{X})(Y-\bar{Y})=$	-3669.3	$\Sigma(Y-\bar{Y})^2=$	13790	$\Sigma(Y-\bar{Y})^2=$	23332094	$\Sigma(\bar{Y}-\bar{Y})^2=$	3456
$\bar{Y}=\Sigma Y/Nr=$	69.69944444	$\bar{X}=\Sigma X/Nr=$	-8.513326461					SST=	13790	SSE=	23332094	SSR=	3456
Now:	$\bar{Y}=b(0) + b(1)X$							Coefficient of Determination	$r^2=$	0.251 (SSR/SST)			
and	$b(1)=\frac{\Sigma(X-\bar{X})(Y-\bar{Y})}{\Sigma(X-\bar{X})^2}$							Correlation Coefficient	$r=$	0.501			
	= -0.9418641												
and	$b(0)=\bar{Y}-b(1)(\bar{X})$												
	= 61.6810475												



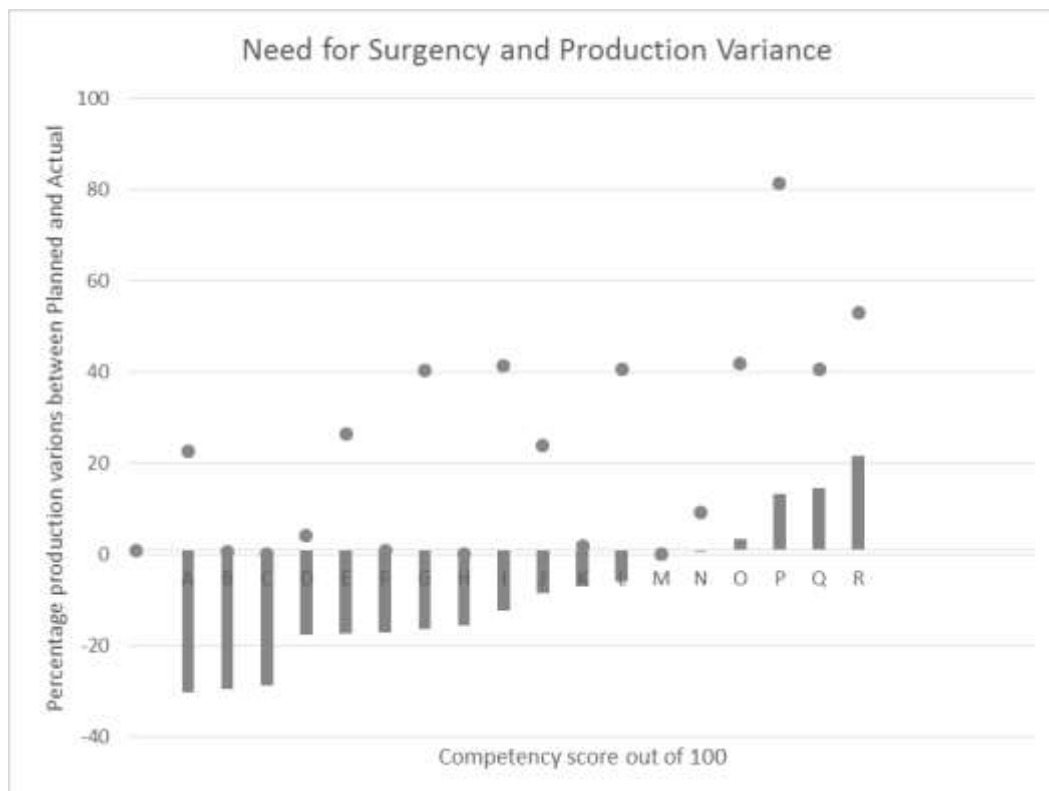
## Appendix E: Regression analysis calculations - continued

Competency:													
Need for structure (Raw scores represented in Y)													
Trend projection method for forecasting													
Respondent	Competency score	factor	# Variance % to Business plan										
	Y	1	X		(X- $\bar{X}$ ) <sup>2</sup>	(X- $\bar{X}$ )(Y- $\bar{Y}$ )		(Y- $\bar{Y}$ ) <sup>2</sup>	$\bar{Y}$	(Y- $\bar{Y}$ ) <sup>2</sup>		(Y- $\bar{Y}$ ) <sup>2</sup>	
1	6	5.9	-30 %	-30	470.3	821.1		1434	29	2038596		212	
2	19	18.6	-29 %	-29	438.6	525.8		630	30	374012		197	
3	40	40.5	-29 %	-29	409.5	65.8		11	30	894		184	
4	3	2.5	-18 %	-18	81.8	373.1		1701	38	2885101		37	
5	41	40.6	-17 %	-17	76.0	27.1		10	38	957		34	
6	53	53.2	-17 %	-17	73.5	-80.8		89	38	1273		33	
7	41	40.6	-16 %	-16	61.6	24.8		10	38	939		28	
8	18	18.4	-16 %	-16	49.8	178.9		642	39	389267		22	
9	85	84.9	-12 %	-12	14.4	-156.0		1692	41	2583412		6	
10	19	18.7	-8 %	-8	0.0	-2.9		629	44	372761		0	
11	85	84.7	-7 %	-7	2.3	62.5		1678	45	2539281		1	
12	76	76.4	-6 %	-6	6.4	82.6		1065	45	977598		3	
13	6	5.6	-1 %	-1	55.3	-283.3		1453	49	2093920		25	
14	76	76.4	1 %	1	83.0	297.4		1066	50	980143		37	
15	85	84.8	3 %	3	140.9	487.7		1688	52	2570374		63	
16	53	53.1	13 %	13	477.4	204.0		87	58	1162		215	
17	25	24.6	15 %	15	537.2	-444.4		368	59	117696		242	
18	58	58.0	22 %	22	917.6	430.3		202	64	20697		413	
$\Sigma Y$	787.39	$\Sigma X$	-153.24	$\Sigma(X-\bar{X})^2=$	3895.7	$\Sigma(X-\bar{X})(Y-\bar{Y})=$	2613.8	$\Sigma(Y-\bar{Y})^2=$	14455	$\Sigma(Y-\bar{Y})^2=$	17948083	$\Sigma(\bar{Y}-\bar{Y})^2=$	1754
$\bar{Y}=\Sigma Y/Nr=$	43.74388889	$\bar{X}=\Sigma X/Nr=$	-8.513326461					SST=	14455	SSE=	17948083	SSR=	1754
Now:	$\hat{Y}=b(0)+b(1)X$							Coefficient of Determination	$r^2=$	0.121 (SSR/SST)			
								Correlation Coefficient	$r=$	0.348			
and	$b(1)=\frac{\Sigma(X-\bar{X})(Y-\bar{Y})}{\Sigma(X-\bar{X})^2}$												
	$= 0.6709445$												
and	$b(0)=\bar{Y}-b(1)(\bar{X})$												
	$= 49.4558588$												



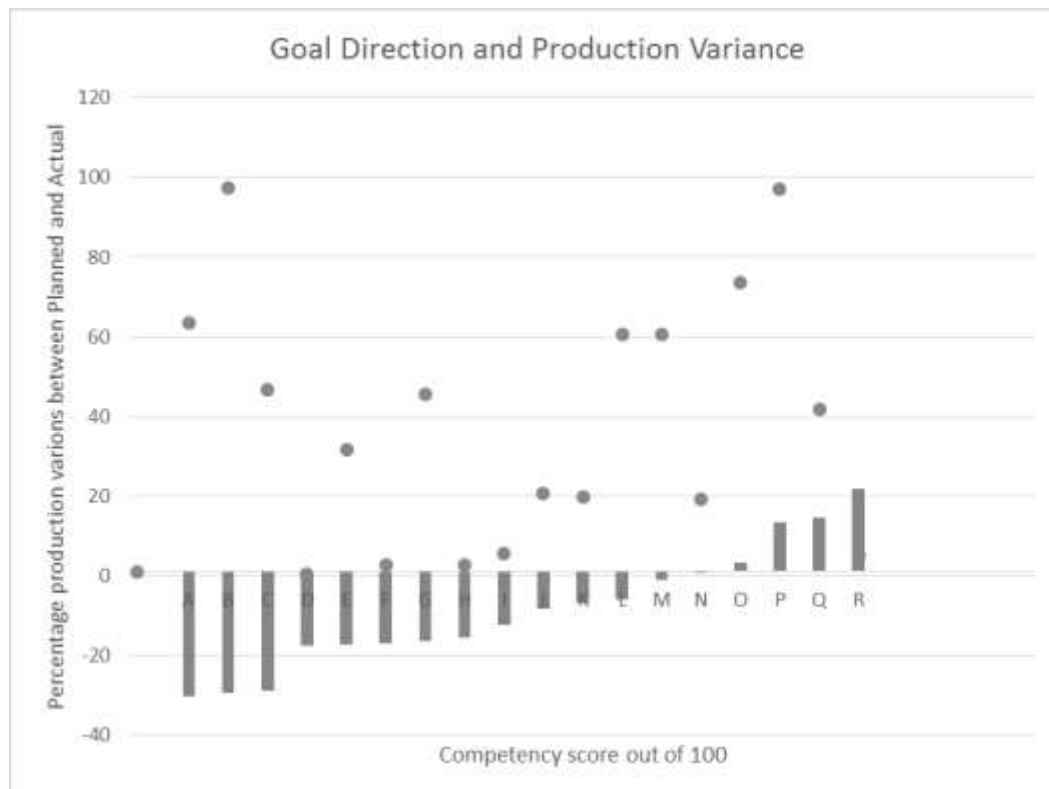
## Appendix E: Regression analysis calculations - continued

Competency:													
Need for surgency (Raw scores represented in Y)													
Trend projection method for forecasting													
Respondent	Competency score	factor	# Variance % to Business plan										
	Y	1	X		(X- $\bar{X}$ ) <sup>2</sup>		(X- $\bar{X}$ )(Y- $\bar{Y}$ )		(Y- $\bar{Y}$ ) <sup>2</sup>	$\bar{Y}$	(Y- $\bar{Y}$ ) <sup>2</sup>	(Y- $\bar{Y}$ ) <sup>2</sup>	
1	23	22.7	-30 %	-30	470.3		26.2		1	3	450	440	
2	1	0.5	-29 %	-29	438.6		489.2		546	4	297058	410	
3	0	0.2	-29 %	-29	409.5		479.5		562	4	315134	383	
4	4	4.3	-18 %	-18	81.8		177.5		385	15	144830	77	
5	26	26.4	-17 %	-17	76.0		-22.3		7	15	397	71	
6	1	0.8	-17 %	-17	73.5		198.1		534	16	284264	69	
7	41	40.5	-16 %	-16	61.6		-130.4		276	16	55453	58	
8	0	0.1	-16 %	-16	49.8		168.3		568	17	322809	47	
9	41	41.3	-12 %	-12	14.4		-66.1		304	20	68949	13	
10	24	24.0	-8 %	-8	0.0		0.0		0	24	575	0	
11	2	1.9	-7 %	-7	2.3		-33.5		482	25	230151	2	
12	41	40.6	-6 %	-6	6.4		42.3		280	26	57141	6	
13	0	0.2	-1 %	-1	55.3		-175.9		560	31	313508	52	
14	9	9.2	1 %	1	83.0		-134.2		217	33	43279	78	
15	42	42.0	3 %	3	140.9		214.7		327	35	81235	132	
16	82	81.5	13 %	13	477.4		1259.7		3324	45	10512527	447	
17	41	40.6	15 %	15	537.2		387.1		279	46	56831	503	
18	53	53.2	22 %	22	917.6		887.9		859	53	649699	858	
$\Sigma Y$	429.97	$\Sigma X$	-153.24	$\Sigma(X-\bar{X})^2=$	3895.7	$\Sigma(X-\bar{X})(Y-\bar{Y})=$	3768.2	$\Sigma(Y-\bar{Y})^2=$	9510	$\Sigma(Y-\bar{Y})^2=$	13434289	$\Sigma(Y-\bar{Y})^2=$	3645
$\bar{Y}=\Sigma Y/Nr=$	23.88722222	$\bar{X}=\Sigma X/Nr=$	-8.513326461					SST=	9510	SSE=	13434289	SSR=	3645
Now: $\hat{Y}=b(0)+b(1)X$								Coefficient of Determination	$r^2=$	0.383	(SSR/SST)		
								Correlation Coefficient	$r=$	0.619			
and	$b(1)=$	$\Sigma(X-\bar{X})(Y-\bar{Y}) / \Sigma(X-\bar{X})^2$											
		$=$	0.9672598										
and	$b(0)=$	$\bar{Y}-b(1)(\bar{X})$											
		$=$	32.1218208										



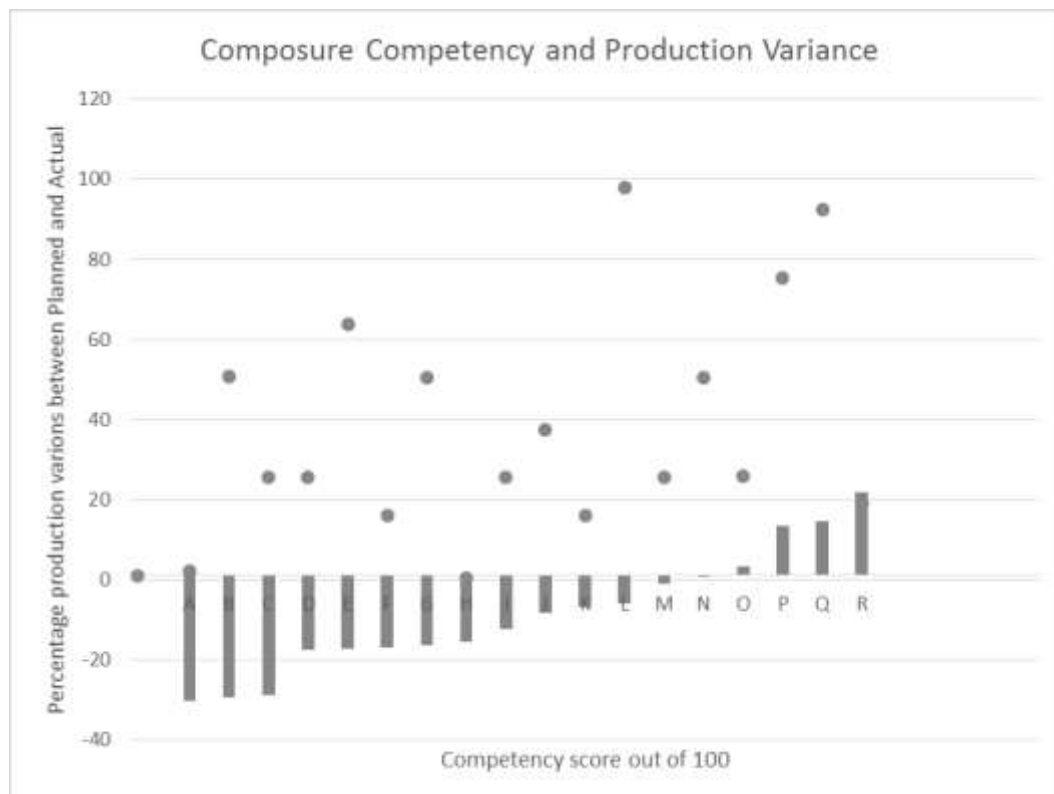
## Appendix E: Regression analysis calculations - continued

Competency:													
Need goal direction (Raw scores represented in Y)													
Trend projection method for forecasting													
Respondent	Competency score	factor	# Variance % to Business plan										
	Y	1	X		$(X-\bar{X})^2$	$(X-\bar{X})(Y-\bar{Y})$		$(Y-\bar{Y})^2$	$\bar{Y}$	$(Y-\bar{Y})^2$		$(\bar{Y}-\bar{Y})^2$	
1	64	63.6	-30 %	-30	470.3	-542.8		627	39	316855		1	
2	97	97.5	-29 %	-29	438.6	-1233.2		3467	39	11353125		1	
3	47	46.7	-29 %	-29	409.5	-163.7		65	39	352		1	
4	0	0.5	-18 %	-18	81.8	345.1		1455	39	2116822		0	
5	32	31.5	-17 %	-17	76.0	61.8		50	39	352		0	
6	3	2.7	-17 %	-17	73.5	308.1		1291	39	1659601		0	
7	46	45.6	-16 %	-16	61.6	-54.7		49	39	9		0	
8	3	2.6	-16 %	-16	49.8	254.0		1295	39	1669007		0	
9	6	5.6	-12 %	-12	14.4	125.3		1092	39	1179494		0	
10	21	20.7	-8 %	-8	0.0	-2.1		319	39	89154		0	
11	20	19.9	-7 %	-7	2.3	-28.5		350	39	108748		0	
12	61	60.7	-6 %	-6	6.4	56.0		490	39	184068		0	
13	61	60.6	-1 %	-1	55.3	163.5		484	38	178924		0	
14	19	19.2	1 %	1	83.0	-177.0		378	38	128689		0	
15	74	73.6	3 %	3	140.9	415.8		1227	38	1330585		0	
16	97	97.1	13 %	13	477.4	1278.2		3422	38	11057055		1	
17	42	41.7	15 %	15	537.2	71.4		9	38	1036		1	
18	5	5.1	22 %	22	917.6	-1015.1		1123	38	1249461		1	
$\Sigma Y$	694.79	$\Sigma X$	-153.24	$\Sigma(X-\bar{X})^2=$	3895.7	$\Sigma(X-\bar{X})(Y-\bar{Y})=$	-137.9	$\Sigma(Y-\bar{Y})^2=$	17192	$\Sigma(Y-\bar{Y})^2=$	32623335	$\Sigma(\bar{Y}-\bar{Y})^2=$	5
$\bar{Y}=\Sigma Y/Nr=$	38.59944444	$\bar{X}=\Sigma X/Nr=$	-8.513326461					SST=	17192	SSE=	32623335	SSR=	5
Now: $\bar{Y}=b(0)+b(1)X$								Coefficient of Determination	$r^2=$	0.000	(SSR/SST)		
								Correlation Coefficient	$r=$	0.017			
and	$b(1)=$	$\Sigma(X-\bar{X})(Y-\bar{Y}) / \Sigma(X-\bar{X})^2$											
		$=$	-0.0354071										
and	$b(0)=$	$\bar{Y}-b(1)(\bar{X})$											
		$=$	38.2980123										



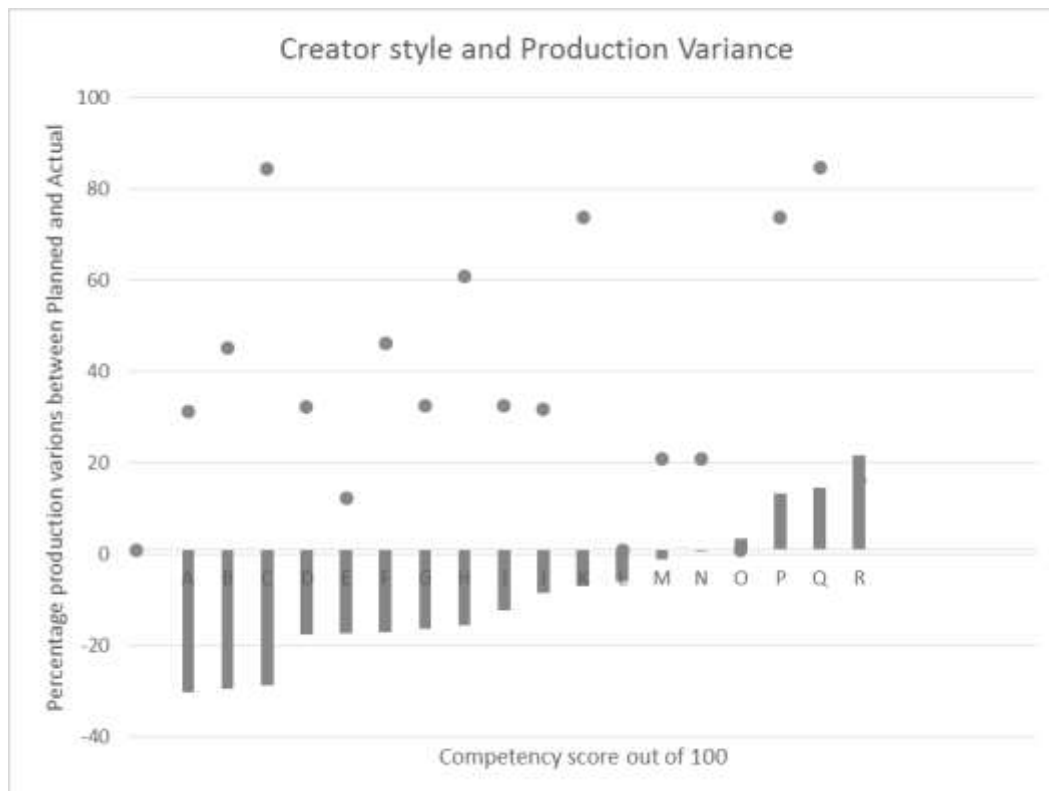
## Appendix E: Regression analysis calculations - continued

Competency:													
Need for composure (Raw scores represented in Y)													
Trend projection method for forecasting													
Respondent	Competency score	factor	# Variance % to Business plan		(X- $\bar{X}$ ) <sup>2</sup>	(X- $\bar{X}$ )(Y- $\bar{Y}$ )	(Y- $\bar{Y}$ ) <sup>2</sup>	$\bar{Y}$	(Y- $\bar{Y}$ ) <sup>2</sup>	( $\bar{Y}$ - $\bar{Y}$ ) <sup>2</sup>			
1	2	2.2	-30 %	-30	470.3	796.3	1348	25	1812333		201		
2	51	50.7	-29 %	-29	438.6	-246.9	139	25	7799		188		
3	26	25.6	-29 %	-29	409.5	269.6	177	26	23064		175		
4	26	25.6	-18 %	-18	81.8	119.9	176	33	22481		35		
5	64	63.8	-17 %	-17	76.0	-217.0	619	33	308807		33		
6	16	16.0	-17 %	-17	73.5	196.0	523	33	256618		31		
7	50	50.4	-16 %	-16	61.6	-90.4	132	34	6735		26		
8	0	0.3	-16 %	-16	49.8	272.6	1491	34	2221575		21		
9	26	25.7	-12 %	-12	14.4	50.1	175	36	22153		6		
10	37	37.3	-8 %	-8	0.0	-0.2	3	39	1209		0		
11	16	15.9	-7 %	-7	2.3	-35.0	527	40	260904		1		
12	98	98.0	-6 %	-6	6.4	149.7	3493	41	11524357		3		
13	26	25.6	-1 %	-1	55.3	-98.6	176	44	22647		24		
14	50	50.5	1 %	1	83.0	105.6	134	45	7028		35		
15	26	25.7	3 %	3	140.9	-156.2	173	47	21747		60		
16	75	75.4	13 %	13	477.4	797.9	1334	53	1583218		204		
17	92	92.5	15 %	15	537.2	1241.4	2869	54	7707087		230		
18	19	18.9	22 %	22	917.6	-606.2	400	59	145575		393		
$\Sigma Y$	700.03	$\Sigma X$	-153.24	$\Sigma(X-\bar{X})^2=$	3895.7	$\Sigma(X-\bar{X})(Y-\bar{Y})=$	2548.5	$\Sigma(Y-\bar{Y})^2=$	13889	$\Sigma(Y-\bar{Y})^2=$	25955338	$\Sigma(\bar{Y}-\bar{Y})^2=$	1667
$\bar{Y}=\Sigma Y/Nr=$	38.89055556	$\bar{X}=\Sigma X/Nr=$	-8.513326461					SST=	13889	SSE=	25955338	SSR=	1667
Now: $\hat{Y}=b(0) + b(1)X$								Coefficient of Determination	$r^2=$	0.120 (SSR/SST)			
and	$b(1)=\Sigma(X-\bar{X})(Y-\bar{Y})/\Sigma(X-\bar{X})^2$							Correlation Coefficient	$r=$	0.346			
	= 0.6541851												
and	$b(0)=\bar{Y}-b(1)(\bar{X})$												
	= 44.459847												



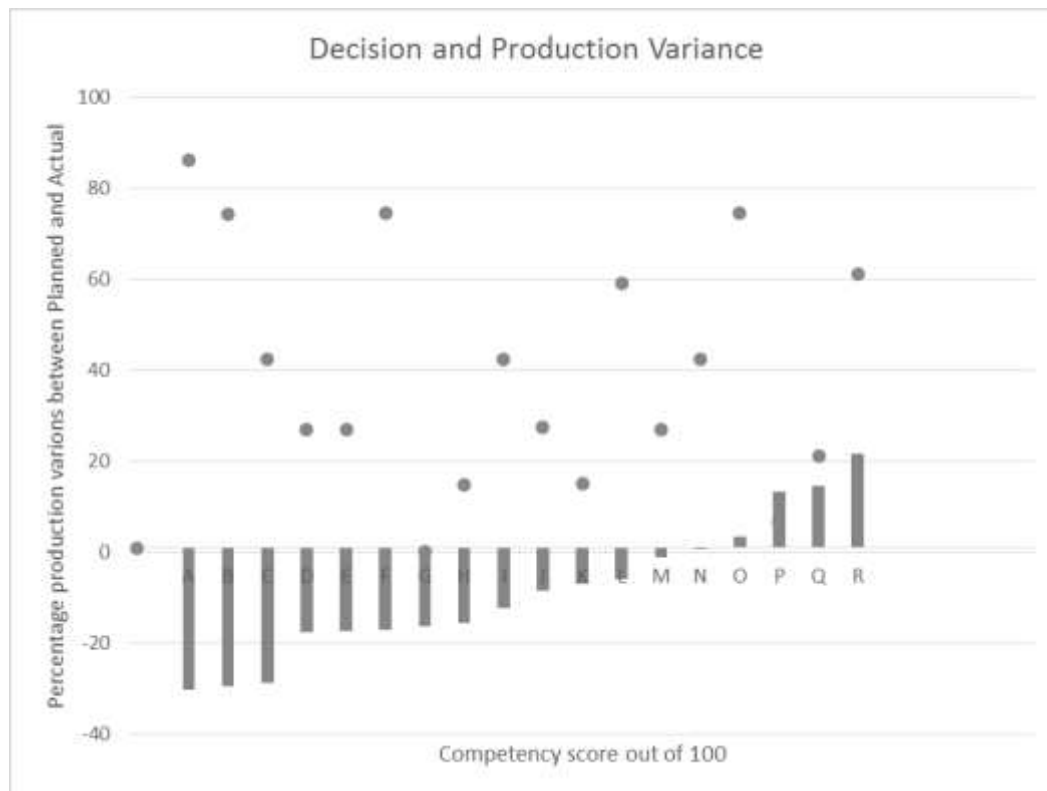
## Appendix E: Regression analysis calculations - continued

Competency:													
Creator Style (Raw scores represented in Y)													
Trend projection method for forecasting													
Respondent	Competency score	factor	# Variance % to Business plan										
	Y	1	X		(X- $\bar{X}$ ) <sup>2</sup>		(X- $\bar{X}$ )(Y- $\bar{Y}$ )		(Y- $\bar{Y}$ ) <sup>2</sup>	$\bar{Y}$	(Y- $\bar{Y}$ ) <sup>2</sup>	( $\bar{Y}$ - $\bar{Y}$ ) <sup>2</sup>	
1	31	31.3	-30 %	-30	470.3		166.0		59	41	741	5	
2	45	45.2	-29 %	-29	438.6		-129.2		38	41	51	4	
3	85	84.6	-29 %	-29	409.5		-921.9		2075	41	3963725	4	
4	32	32.3	-18 %	-18	81.8		61.0		45	40	175	1	
5	12	12.2	-17 %	-17	76.0		233.6		718	40	498717	1	
6	46	46.3	-17 %	-17	73.5		-62.7		53	40	50	1	
7	33	32.5	-16 %	-16	61.6		50.9		42	40	91	1	
8	61	60.9	-16 %	-16	49.8		-154.4		479	40	174509	1	
9	33	32.6	-12 %	-12	14.4		24.4		42	39	80	0	
10	32	31.7	-8 %	-8	0.0		-0.9		53	39	475	0	
11	74	73.8	-7 %	-7	2.3		53.0		1209	39	1288224	0	
12	1	0.9	-6 %	-6	6.4		-96.4		1450	39	2098489	0	
13	21	21.0	-1 %	-1	55.3		-133.7		324	38	91652	1	
14	21	21.0	1 %	1	83.0		-164.0		324	38	91876	1	
15	1	0.9	3 %	3	140.9		-452.2		1451	38	2102963	1	
16	74	73.9	13 %	13	477.4		762.7		1219	37	1310142	5	
17	85	84.8	15 %	15	537.2		1062.4		2101	37	4065147	5	
18	16	16.2	22 %	22	917.6		-691.3		521	36	254731	9	
$\Sigma Y$	701.87	$\Sigma X$	-153.24	$\Sigma(X-\bar{X})^2=$	3895.7	$\Sigma(X-\bar{X})(Y-\bar{Y})=$	-392.6	$\Sigma(Y-\bar{Y})^2=$	12203	$\Sigma(Y-\bar{Y})^2=$	15941838	$\Sigma(\bar{Y}-\bar{Y})^2=$	40
$\bar{Y}=\Sigma Y/Nr=$	38.99277778	$\bar{X}=\Sigma X/Nr=$	-8.513326461					SST=	12203	SSE=	15941838	SSR=	40
Now: $\hat{Y}=b(0)+b(1)X$								Coefficient of Determination		$r^2=$	0.003	(SSR/SST)	
								Correlation Coefficient		$r=$	0.057		
and	$b(1)=\Sigma(X-\bar{X})(Y-\bar{Y})/\Sigma(X-\bar{X})^2$												
	$= -0.1007763$												
and	$b(0)=\bar{Y}-b(1)(\bar{X})$												
	$= 38.1348359$												



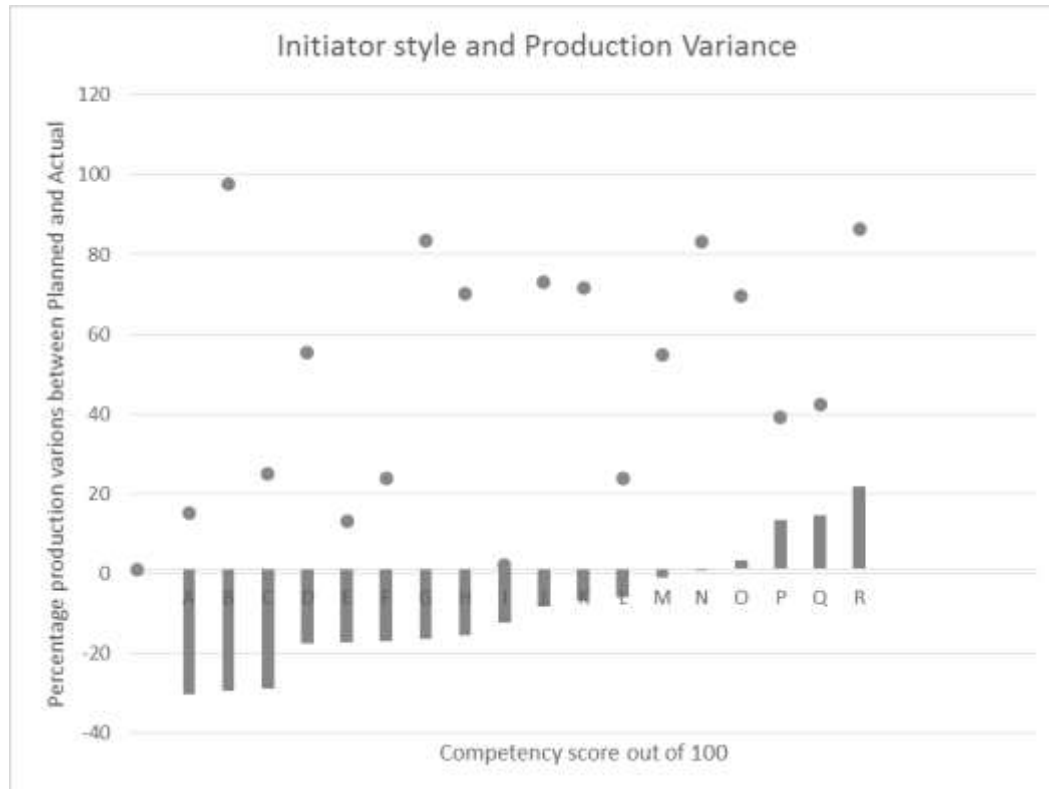
## Appendix E: Regression analysis calculations - continued

Competency:													
Decision (Raw scores represented in Y)													
Trend projection method for forecasting													
Respondent	Competency score	factor	# Variance % to Business plan										
	Y	1	X		(X- $\bar{X}$ ) <sup>2</sup>		(X- $\bar{X}$ )(Y- $\bar{Y}$ )		(Y- $\bar{Y}$ ) <sup>2</sup>	$\bar{Y}$	(Y- $\bar{Y}$ ) <sup>2</sup>	(Y- $\bar{Y}$ ) <sup>2</sup>	
1	86	86.3	-30 %	-30	470.3		-998.9		2122	49	4143756	73	
2	74	74.4	-29 %	-29	438.6		-716.8		1171	48	1203090	68	
3	43	42.5	-29 %	-29	409.5		-47.4		5	48	1372	64	
4	27	27.0	-18 %	-18	81.8		119.8		175	44	22055	13	
5	27	26.9	-17 %	-17	76.0		115.6		176	44	22219	12	
6	75	74.6	-17 %	-17	73.5		-294.6		1180	44	1222439	11	
7	0	0.1	-16 %	-16	61.6		315.0		1610	43	2592212	10	
8	15	14.8	-16 %	-16	49.8		179.2		644	43	395801	8	
9	42	42.3	-12 %	-12	14.4		-8.1		5	42	1427	2	
10	27	27.4	-8 %	-8	0.0		-1.5		163	40	18516	0	
11	15	15.0	-7 %	-7	2.3		-38.5		637	40	386761	0	
12	59	59.3	-6 %	-6	6.4		48.3		364	39	92747	1	
13	27	26.9	-1 %	-1	55.3		-98.5		176	37	22137	9	
14	42	42.4	1 %	1	83.0		20.1		5	37	1409	13	
15	75	74.7	3 %	3	140.9		409.4		1189	36	1242018	22	
16	7	6.8	13 %	13	477.4		-729.7		1115	32	1228773	74	
17	21	21.1	15 %	15	537.2		-443.3		366	31	118844	83	
18	61	61.1	22 %	22	917.6		634.1		438	28	142203	143	
$\Sigma Y$	723.53	$\Sigma X$	-153.24	$\Sigma(X-\bar{X})^2=$	3895.7	$\Sigma(X-\bar{X})(Y-\bar{Y})=$	-1535.8	$\Sigma(Y-\bar{Y})^2=$	11542	$\Sigma(Y-\bar{Y})^2=$	12857780	$\Sigma(\bar{Y}-\bar{Y})^2=$	605
$\bar{Y}=\Sigma Y/Nr=$	40.19611111	$\bar{X}=\Sigma X/Nr=$	-8.513326461					SST=	11542	SSE=	12857780	SSR=	605
Now: $\bar{Y}=b(0)+b(1)X$								Coefficient of Determination	$r^2=$	0.052 (SSR/SST)			
								Correlation Coefficient	$r=$	0.229			
and	$b(1)=\frac{\Sigma(X-\bar{X})(Y-\bar{Y})}{\Sigma(X-\bar{X})^2}$												
	= -0.3942302												
and	$b(0)=\bar{Y}-b(1)(\bar{X})$												
	= 36.839901												



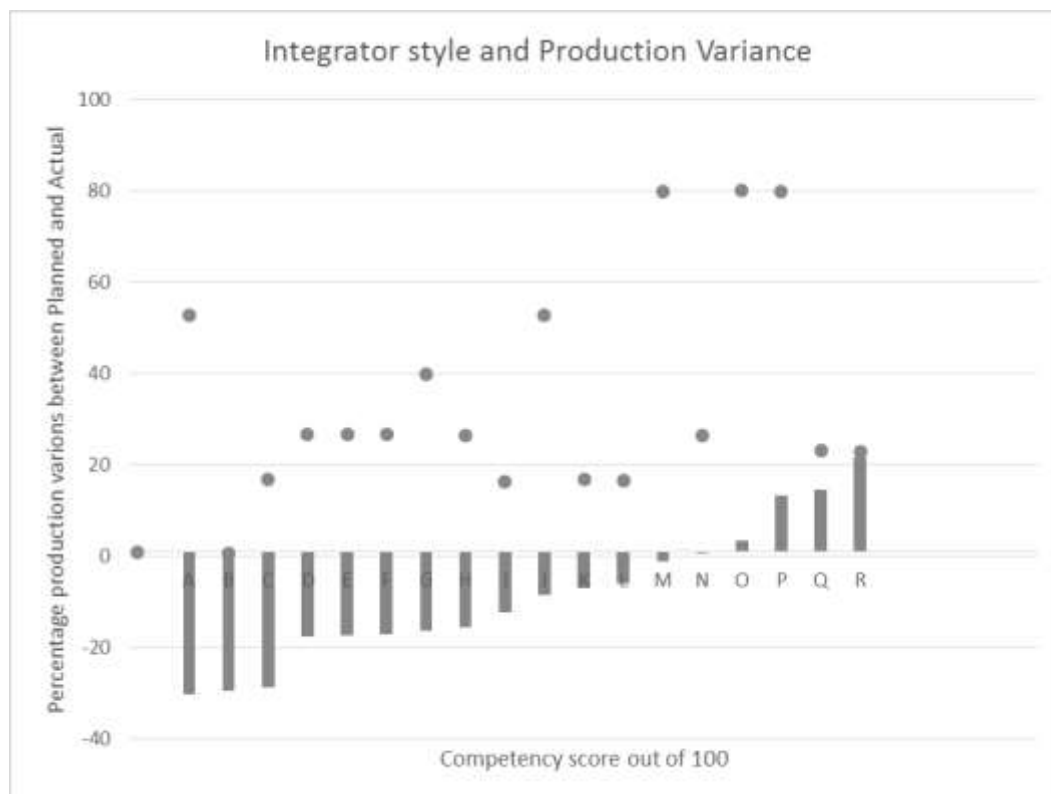
## Appendix E: Regression analysis calculations - continued

Competency:													
Initiator Style (Raw scores represented in Y)													
Trend projection method for forecasting													
Respondent	Competency score	factor	# Variance % to Business plan		(X- $\bar{X}$ ) <sup>2</sup>	(X- $\bar{X}$ )(Y- $\bar{Y}$ )		(Y- $\bar{Y}$ ) <sup>2</sup>	$\bar{Y}$	(Y- $\bar{Y}$ ) <sup>2</sup>		(Y- $\bar{Y}$ ) <sup>2</sup>	
1	15	15.2	-30 %	-30	470.3	792.8		1337	42	1746319		96	
2	98	97.7	-29 %	-29	438.6	-962.6		2112	42	4058821		90	
3	25	25.1	-29 %	-29	409.5	538.5		708	43	466478		84	
4	56	55.5	-18 %	-18	81.8	-34.5		15	48	1681		17	
5	13	13.2	-17 %	-17	76.0	335.7		1483	48	2160371		16	
6	24	23.9	-17 %	-17	73.5	238.1		771	48	558357		15	
7	84	83.6	-16 %	-16	61.6	-250.4		1017	48	871183		13	
8	70	70.3	-16 %	-16	49.8	-130.9		344	49	74792		10	
9	2	2.2	-12 %	-12	14.4	187.9		2455	50	6017418		3	
10	73	73.0	-8 %	-8	0.0	2.5		455	52	145552		0	
11	72	71.7	-7 %	-7	2.3	30.4		398	52	106754		0	
12	24	23.9	-6 %	-6	6.4	-70.4		773	53	560896		1	
13	55	54.7	-1 %	-1	55.3	22.4		9	55	2080		11	
14	83	83.2	1 %	1	83.0	287.2		994	56	829740		17	
15	70	69.7	3 %	3	140.9	213.2		323	57	63954		29	
16	39	39.2	13 %	13	477.4	-272.7		156	62	13577		97	
17	42	42.3	15 %	15	537.2	-217.9		88	62	2121		110	
18	86	86.4	22 %	22	917.6	1050.8		1203	65	1247680		187	
$\Sigma Y$	930.78	$\Sigma X$	-153.24	$\Sigma(X-\bar{X})^2=$	3895.7	$\Sigma(X-\bar{X})(Y-\bar{Y})=$	1760.3	$\Sigma(Y-\bar{Y})^2=$	14641	$\Sigma(Y-\bar{Y})^2=$	18927775	$\Sigma(Y-\bar{Y})^2=$	795
$\bar{Y}=\Sigma Y/Nr=$	51.71	$\bar{X}=\Sigma X/Nr=$	-8.513326461					SST=	14641	SSE=	18927775	SSR=	795
Now: $\hat{Y}=b(0)+b(1)X$								Coefficient of Determination	$r^2=$	0.054	(SSR/SST)		
								Correlation Coefficient	$r=$	0.233			
and	$b(1)=\frac{\Sigma(X-\bar{X})(Y-\bar{Y})}{\Sigma(X-\bar{X})^2}$												
	= 0.4518546												
and	$b(0)=\bar{Y}-b(1)(\bar{X})$												
	= 55.5567855												



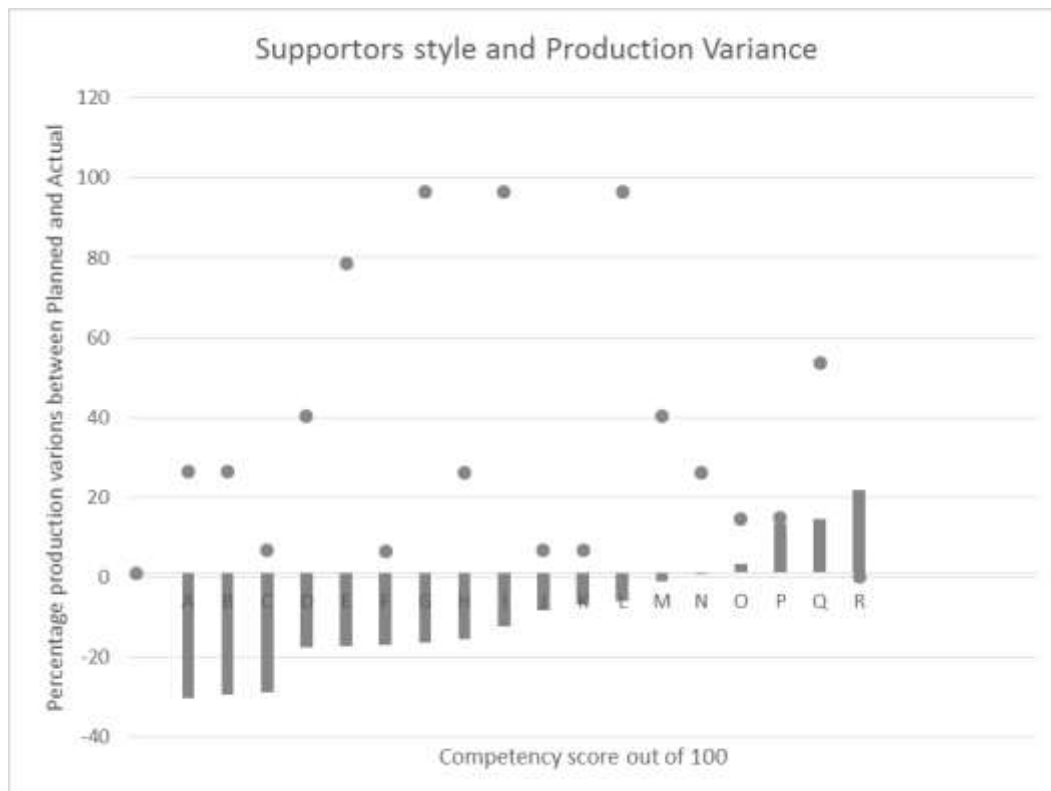
## Appendix E: Regression analysis calculations - continued

Competency:													
Integrator Style (Raw scores represented in Y)													
Trend projection method for forecasting													
Respondent	Competency score	factor	# Variance % to Business plan										
	Y	1	X		(X- $\bar{X}$ ) <sup>2</sup>		(X- $\bar{X}$ )(Y- $\bar{Y}$ )		(Y- $\bar{Y}$ ) <sup>2</sup>	$\bar{Y}$	(Y- $\bar{Y}$ ) <sup>2</sup>	( $\bar{Y}$ - $\bar{Y}$ ) <sup>2</sup>	
1	53	52.7	-30 %	-30	470.3		-381.6		310	24	65999	134	
2	1	0.6	-29 %	-29	438.6		723.9		1195	24	1425881	125	
3	17	16.8	-29 %	-29	409.5		370.4		335	24	101259	116	
4	27	26.9	-18 %	-18	81.8		74.8		68	30	1717	23	
5	27	26.8	-17 %	-17	76.0		73.0		70	30	1881	22	
6	27	26.8	-17 %	-17	73.5		71.5		69	31	1820	21	
7	40	39.9	-16 %	-16	61.6		-37.1		22	31	307	18	
8	27	26.5	-16 %	-16	49.8		60.6		74	31	2222	14	
9	16	16.3	-12 %	-12	14.4		71.2		353	33	113229	4	
10	53	52.9	-8 %	-8	0.0		2.1		317	35	69763	0	
11	17	16.9	-7 %	-7	2.3		-27.8		333	36	100067	1	
12	17	16.5	-6 %	-6	6.4		-47.1		346	36	108626	2	
13	80	80.0	-1 %	-1	55.3		333.4		2012	39	3732974	16	
14	27	26.6	1 %	1	83.0		-78.1		74	40	2205	24	
15	80	80.1	3 %	3	140.9		534.4		2026	41	3788124	40	
16	80	79.8	13 %	13	477.4		977.0		2000	47	3685212	136	
17	23	23.2	15 %	15	537.2		-277.3		143	47	14394	153	
18	23	23.0	22 %	22	917.6		-367.0		147	51	15311	261	
$\Sigma Y$	632.23	$\Sigma X$	-153.24	$\Sigma(X-\bar{X})^2$	3895.7	$\Sigma(X-\bar{X})(Y-\bar{Y})$	2076.3	$\Sigma(Y-\bar{Y})^2$	9894	$\Sigma(Y-\bar{Y})^2$	13230992	$\Sigma(Y-\bar{Y})^2$	1107
$\bar{Y} = \Sigma Y / N =$	35.12388889	$\bar{X} = \Sigma X / N =$	-8.513326461					SST =	9894	SSE =	13230992	SSR =	1107
Now: $\hat{Y} = b(0) + b(1)X$								Coefficient of Determination	$r^2 =$	0.112	(SSR/SST)		
								Correlation Coefficient	$r =$	0.334			
and	$b(1) = \Sigma(X-\bar{X})(Y-\bar{Y}) / \Sigma(X-\bar{X})^2$												
	= 0.5329634												
and	$b(0) = \bar{Y} - b(1)(\bar{X})$												
	= 39.6611805												



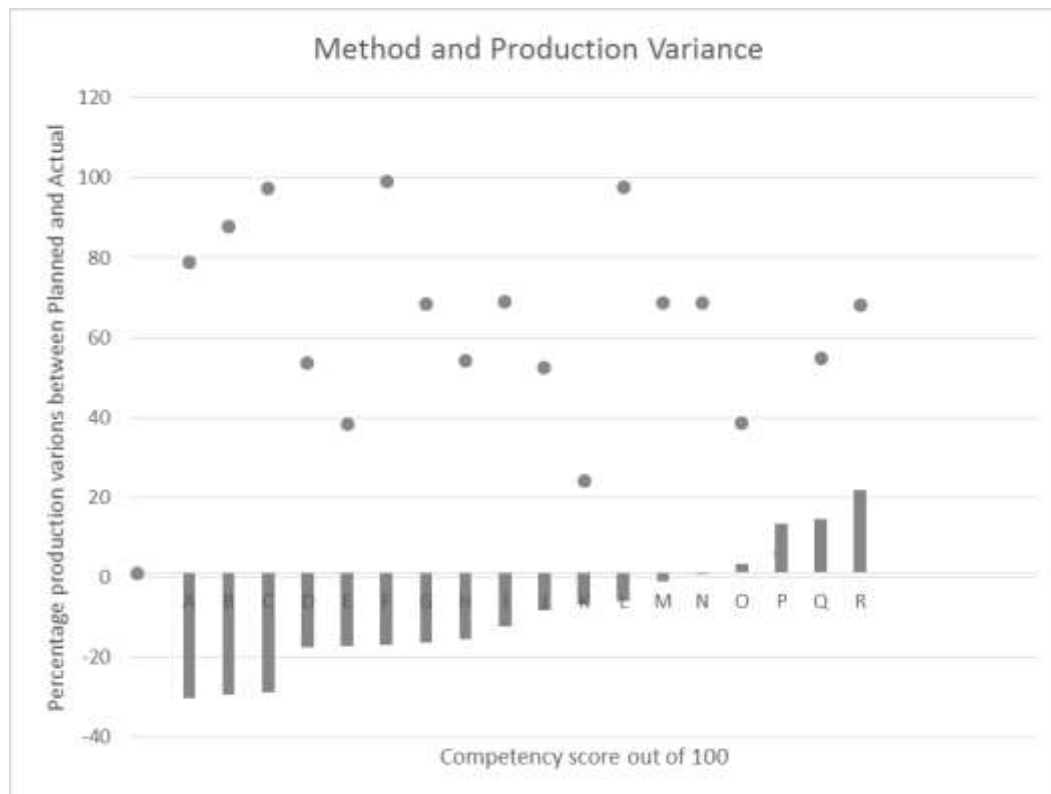
## Appendix E: Regression analysis calculations - continued

Competency:													
Supporter Style (Raw scores represented in Y)													
Trend projection method for forecasting													
Respondent	Competency score	factor	# Variance % to Business plan										
	Y	1	X		(X- $\bar{X}$ ) <sup>2</sup>		(X- $\bar{X}$ )(Y- $\bar{Y}$ )		(Y- $\bar{Y}$ ) <sup>2</sup>	$\bar{Y}$	(Y- $\bar{Y}$ ) <sup>2</sup>	(Y- $\bar{Y}$ ) <sup>2</sup>	
1	26	26.3	-30 %	-30	470.3		227.7		110	43	7043	40	
2	26	26.4	-29 %	-29	438.6		218.9		109	43	6860	37	
3	7	6.6	-29 %	-29	409.5		611.3		913	43	820922	35	
4	40	40.2	-18 %	-18	81.8		-30.8		12	39	823	7	
5	79	78.5	-17 %	-17	76.0		-363.3		1737	39	2751140	6	
6	6	6.5	-17 %	-17	73.5		260.3		922	39	837744	6	
7	96	96.4	-16 %	-16	61.6		-467.7		3549	39	11917055	5	
8	26	26.2	-16 %	-16	49.8		75.2		113	39	7612	4	
9	96	96.5	-12 %	-12	14.4		-226.0		3553	38	11949714	1	
10	7	6.8	-8 %	-8	0.0		-3.5		904	37	804352	0	
11	7	6.6	-7 %	-7	2.3		-46.1		912	36	819810	0	
12	96	96.4	-6 %	-6	6.4		150.9		3549	36	11917055	1	
13	40	40.4	-1 %	-1	55.3		26.1		12	35	786	5	
14	26	26.2	1 %	1	83.0		-97.0		113	34	7612	7	
15	15	14.6	3 %	3	140.9		-263.7		493	33	229133	12	
16	15	14.8	13 %	13	477.4		-481.1		485	30	220980	40	
17	54	53.6	15 %	15	537.2		388.5		281	30	51656	46	
18	0	0.1	22 %	22	917.6		-1114.2		1353	28	1829931	78	
$\Sigma Y$	663.13	$\Sigma X$	-153.24	$\Sigma(X-\bar{X})^2=$	3895.7	$\Sigma(X-\bar{X})(Y-\bar{Y})=$	-1134.5	$\Sigma(Y-\bar{Y})^2=$	19120	$\Sigma(Y-\bar{Y})^2=$	44180226	$\Sigma(Y-\bar{Y})^2=$	330
$\bar{Y}=\Sigma Y/Nr=$	36.84055556	$\bar{X}=\Sigma X/Nr=$	-8.513326461					SST=	19120	SSE=	44180226	SSR=	330
Now: $\hat{Y}=b(0)+b(1)X$				Coefficient of Determination				$r^2=$	0.017 (SSR/SST)				
				Correlation Coefficient				$r=$	0.131				
and	$b(1)=\frac{\Sigma(X-\bar{X})(Y-\bar{Y})}{\Sigma(X-\bar{X})^2}$												
	$= -0.2912208$												
and	$b(0)=\bar{Y}-b(1)(\bar{X})$												
	$= 34.3612974$												



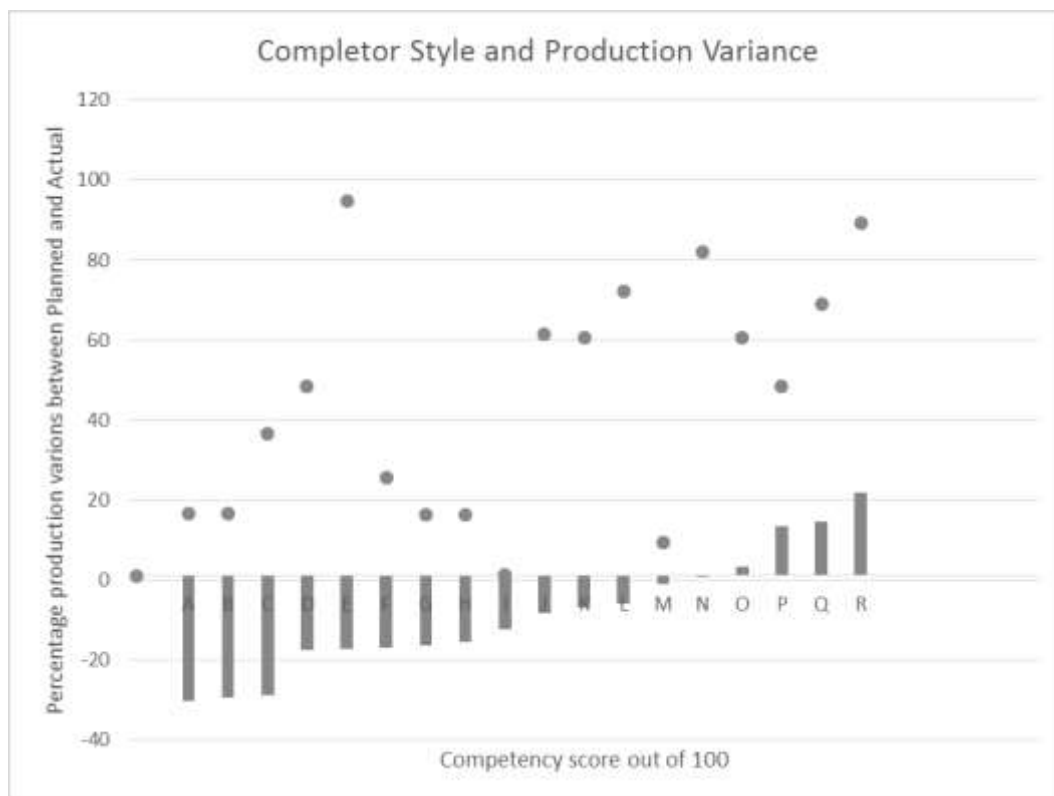
## Appendix E: Regression analysis calculations - continued

Competency:													
Method (Raw scores represented in Y)													
Trend projection method for forecasting													
Respondent	Competency score	factor	# Variance % to Business plan		(X- $\bar{X}$ ) <sup>2</sup>	(X- $\bar{X}$ )(Y- $\bar{Y}$ )	(Y- $\bar{Y}$ ) <sup>2</sup>	$\bar{Y}$	(Y- $\bar{Y}$ ) <sup>2</sup>		( $\bar{Y}$ - $\bar{Y}$ ) <sup>2</sup>		
	Y	1	X										
1	79	79.0	-30 %	-30	470.3	-355.5	269	79	36006		284		
2	88	87.9	-29 %	-29	438.6	-530.6	642	79	306738		265		
3	97	97.4	-29 %	-29	409.5	-705.5	1215	78	1249864		247		
4	54	53.6	-18 %	-18	81.8	80.9	80	70	698		49		
5	38	38.2	-17 %	-17	76.0	212.6	595	69	309744		46		
6	99	99.2	-17 %	-17	73.5	-313.8	1339	69	1537256		44		
7	69	68.5	-16 %	-16	61.6	-46.6	35	69	1110		37		
8	54	54.2	-16 %	-16	49.8	59.1	70	68	255		30		
9	69	68.9	-12 %	-12	14.4	-24.1	40	66	810		9		
10	53	52.5	-8 %	-8	0.0	-1.2	101	62	2324		0		
11	24	24.2	-7 %	-7	2.3	-58.5	1473	61	2098474		1		
12	98	97.7	-6 %	-6	6.4	88.9	1233	61	1288718		4		
13	69	68.7	-1 %	-1	55.3	45.2	37	57	1002		33		
14	69	68.8	1 %	1	83.0	56.6	39	56	912		50		
15	39	38.7	3 %	3	140.9	-283.1	569	53	280858		85		
16	6	5.8	13 %	13	477.4	-1239.1	3220	46	10332478		288		
17	55	54.9	15 %	15	537.2	-178.6	59	45	21		324		
18	68	68.1	22 %	22	917.6	167.9	31	39	1399		554		
$\Sigma Y$	1126.39	$\Sigma X$	-153.24	$\Sigma(X-\bar{X})^2=$	3895.7	$\Sigma(X-\bar{X})(Y-\bar{Y})=$	-3026.1	$\Sigma(Y-\bar{Y})^2=$	11047	$\Sigma(Y-\bar{Y})^2=$	17448667	$\Sigma(\bar{Y}-\bar{Y})^2=$	2351
$\bar{Y}=\Sigma Y/Nr=$	62.57722222	$\bar{X}=\Sigma X/Nr=$	-8.513326461					SST=	11047	SSE=	17448667	SSR=	2351
Now: $\hat{Y}=b(0)+b(1)X$								Coefficient of Determination		$r^2=$	0.213	(SSR/SST)	
								Correlation Coefficient		$r=$	0.461		
and	$b(1)=\frac{\Sigma(X-\bar{X})(Y-\bar{Y})}{\Sigma(X-\bar{X})^2}$												
	$= -0.7767694$												
and	$b(0)=\bar{Y}-b(1)(\bar{X})$												
	$= 55.9643309$												



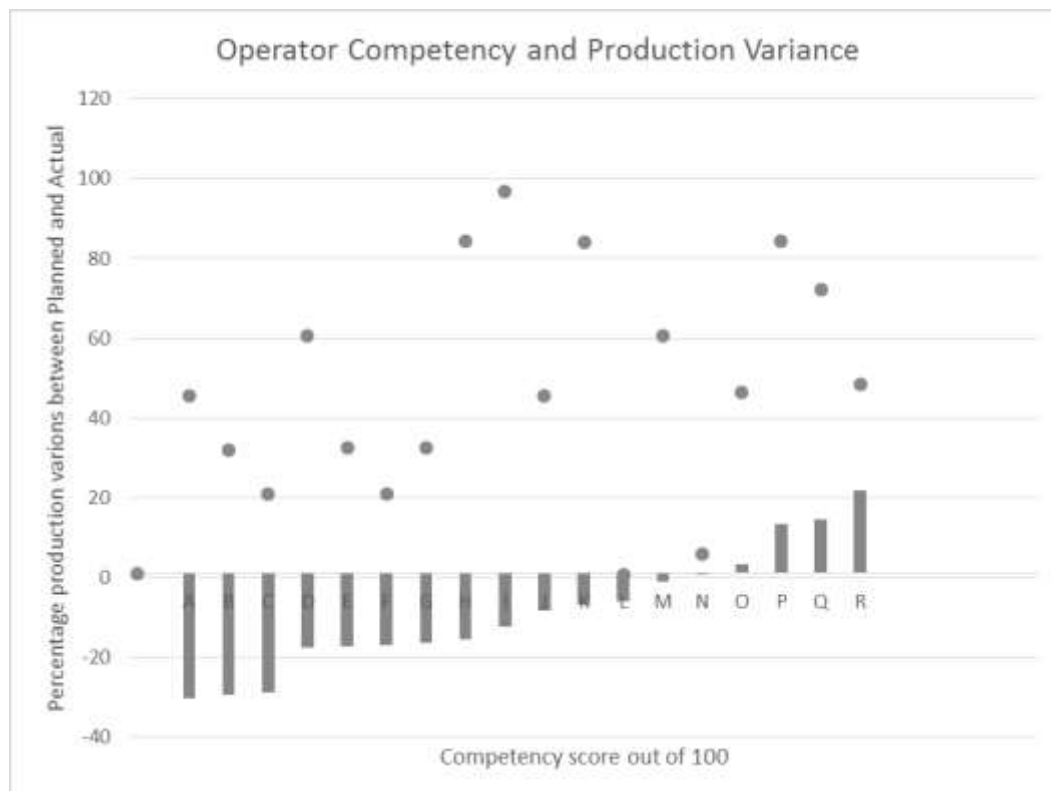
## Appendix E: Regression analysis calculations - continued

Competency:													
Completor Style (Raw scores represented in Y)													
Trend projection method for forecasting													
Respondent	Competency score	factor	# Variance % to Business plan										
	Y	1	X		$(X-\bar{X})^2$	$(X-\bar{X})(Y-\bar{Y})$		$(Y-\bar{Y})^2$	$\bar{Y}$	$(Y-\bar{Y})^2$		$(\bar{Y}-\bar{Y})^2$	
1	17	16.6	-30 %	-30	470.3	634.9		857	24	706765		495	
2	17	16.7	-29 %	-29	438.6	610.7		850	24	694824		462	
3	37	36.6	-29 %	-29	409.5	187.0		85	25	2377		431	
4	48	48.3	-18 %	-18	81.8	-22.6		6	37	1771		86	
5	95	94.9	-17 %	-17	76.0	-427.3		2403	37	5327830		80	
6	26	25.6	-17 %	-17	73.5	173.7		410	37	148104		77	
7	16	16.3	-16 %	-16	61.6	231.9		873	38	733157		65	
8	16	16.4	-16 %	-16	49.8	207.6		865	39	719872		52	
9	1	1.2	-12 %	-12	14.4	169.3		1993	42	3965795		15	
10	61	61.3	-8 %	-8	0.0	1.8		240	46	31807		0	
11	61	60.6	-7 %	-7	2.3	22.5		218	47	24920		2	
12	72	72.1	-6 %	-6	6.4	66.5		690	48	382000		7	
13	9	9.3	-1 %	-1	55.3	-271.4		1333	53	1751835		58	
14	82	82.0	1 %	1	83.0	329.7		1311	55	1509164		87	
15	60	60.5	3 %	3	140.9	173.9		215	58	23767		148	
16	48	48.3	13 %	13	477.4	54.2		6	68	1778		502	
17	69	69.0	15 %	15	537.2	536.6		536	70	218074		565	
18	89	89.3	22 %	22	917.6	1317.4		1891	77	3247733		966	
$\Sigma Y$	825.1	$\Sigma X$	-153.24	$\Sigma(X-\bar{X})^2=$	3895.7	$\Sigma(X-\bar{X})(Y-\bar{Y})=$	3996.6	$\Sigma(Y-\bar{Y})^2=$	14783	$\Sigma(Y-\bar{Y})^2=$	19491573	$\Sigma(\bar{Y}-\bar{Y})^2=$	4100
$\bar{Y}=\Sigma Y/Nr=$	45.83888889	$\bar{X}=\Sigma X/Nr=$	-8.513326461					SST=	14783	SSE=	19491573	SSR=	4100
Now:	$\bar{Y}=b(0)+b(1)X$						Coefficient of Determination	$r^2=$	0.277 (SSR/SST)				
							Correlation Coefficient	$r=$	0.527				
and	$b(1)=\frac{\Sigma(X-\bar{X})(Y-\bar{Y})}{\Sigma(X-\bar{X})^2}$												
	$= 1.0258778$												
and	$b(0)=\bar{Y}-b(1)(\bar{X})$												
	$= 54.5725217$												



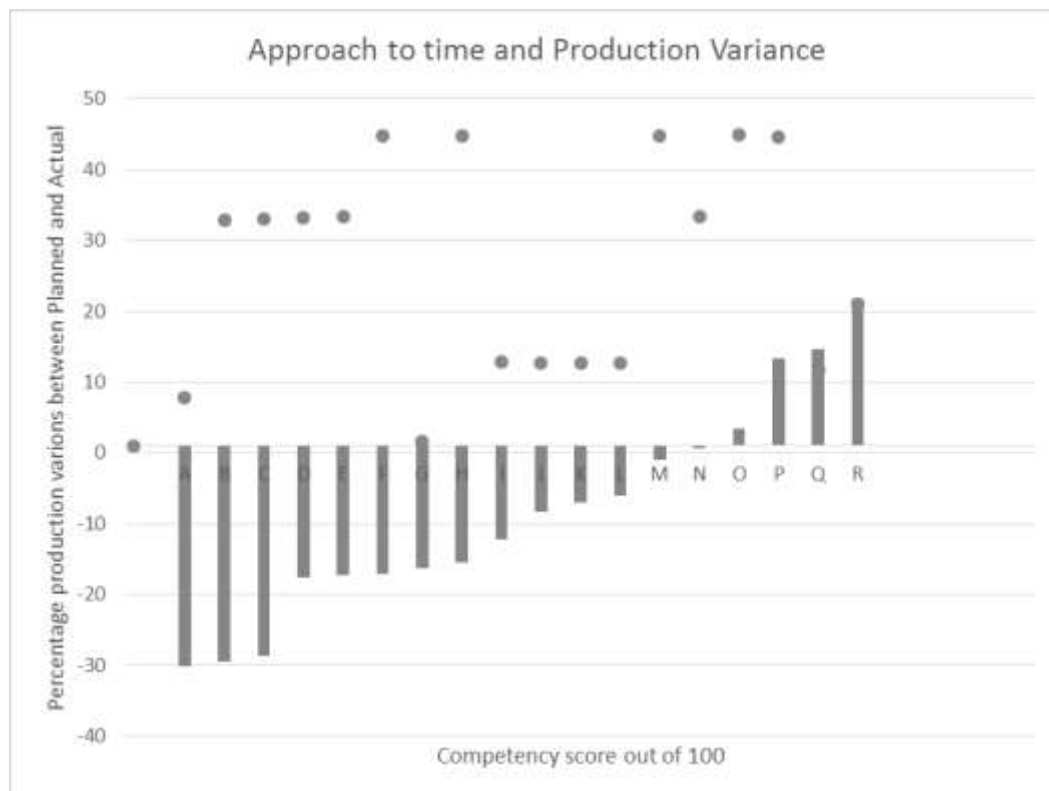
## Appendix E: Regression analysis calculations - continued

Competency:													
Operator Style (Raw scores represented in Y)													
Trend projection method for forecasting													
Respondent	Competency score	factor	# Variance % to Business plan										
	Y	1	X		(X- $\bar{X}$ ) <sup>2</sup>		(X- $\bar{X}$ )(Y- $\bar{Y}$ )		(Y- $\bar{Y}$ ) <sup>2</sup>	$\bar{Y}$	(Y- $\bar{Y}$ ) <sup>2</sup>	(Y- $\bar{Y}$ ) <sup>2</sup>	
1	45	45.4	-30 %	-30	470.3		68.1		10	38	1265	108	
2	32	32.1	-29 %	-29	438.6		345.6		272	39	57691	100	
3	21	20.8	-29 %	-29	409.5		561.5		770	39	561379	94	
4	61	60.5	-18 %	-18	81.8		-108.4		144	44	6886	19	
5	32	32.5	-17 %	-17	76.0		140.2		259	44	51115	17	
6	21	21.0	-17 %	-17	73.5		236.7		762	44	548785	17	
7	33	32.5	-16 %	-16	61.6		126.1		258	45	50816	14	
8	84	84.4	-16 %	-16	49.8		-252.9		1283	45	1436863	11	
9	97	96.8	-12 %	-12	14.4		-183.1		2331	47	4991285	3	
10	46	45.5	-8 %	-8	0.0		-0.4		9	49	1321	0	
11	84	84.2	-7 %	-7	2.3		54.3		1269	49	1404952	1	
12	1	0.7	-6 %	-6	6.4		-121.1		2287	50	5225853	1	
13	61	60.5	-1 %	-1	55.3		89.0		143	52	6848	13	
14	6	5.9	1 %	1	83.0		-388.3		1817	53	3281123	19	
15	46	46.4	3 %	3	140.9		-25.9		5	54	1733	32	
16	84	84.3	13 %	13	477.4		780.3		1275	59	1418324	109	
17	72	72.1	15 %	15	537.2		545.4		554	60	231911	123	
18	48	48.4	22 %	22	917.6		-3.9		0	63	2344	210	
$\Sigma Y$	874.08	$\Sigma X$	-153.24	$\Sigma(X-\bar{X})^2=$	3895.7	$\Sigma(X-\bar{X})(Y-\bar{Y})=$	1863.2	$\Sigma(Y-\bar{Y})^2=$	13448	$\Sigma(Y-\bar{Y})^2=$	19280493	$\Sigma(Y-\bar{Y})^2=$	891
$\bar{Y}=\Sigma Y/Nr=$	48.56	$\bar{X}=\Sigma X/Nr=$	-8.513326461					SST=	13448	SSE=	19280493	SSR=	891
Now:	$\hat{Y}=b(0)+b(1)X$							Coefficient of Determination	$r^2=$	0.066	(SSR/SST)		
								Correlation Coefficient	$r=$	0.257			
and	$b(1)=$	$\Sigma(X-\bar{X})(Y-\bar{Y}) / \Sigma(X-\bar{X})^2$											
		$= 0.4782743$											
and	$b(0)=$	$\bar{Y}-b(1)(\bar{X})$											
		$= 52.6317054$											



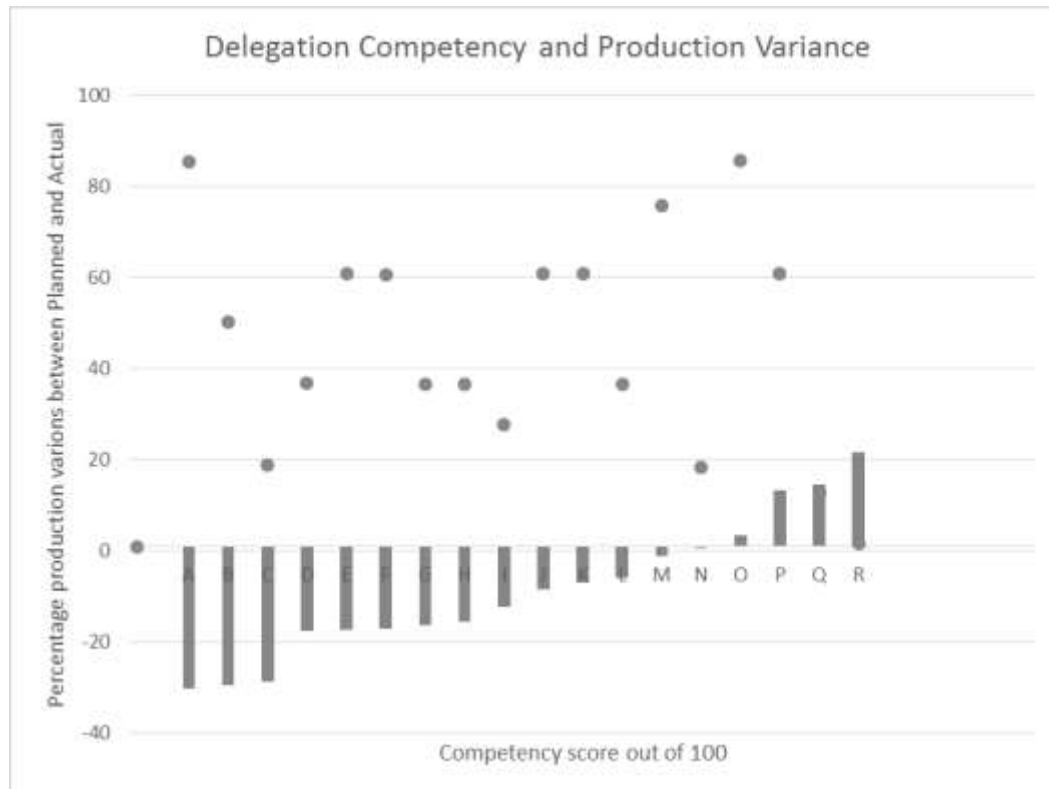
## Appendix E: Regression analysis calculations - continued

Competency:													
Approach to Time (Raw scores represented in Y)													
Trend projection method for forecasting													
Respondent	Competency score	factor	# Variance % to Business plan		(X- $\bar{X}$ ) <sup>2</sup>	(X- $\bar{X}$ )(Y- $\bar{Y}$ )		(Y- $\bar{Y}$ ) <sup>2</sup>	$\bar{Y}$	(Y- $\bar{Y}$ ) <sup>2</sup>		(Y- $\bar{Y}$ ) <sup>2</sup>	
	Y	1	X										
1	8	7.7	-30 %	-30	470.3	413.8		364	26	127045		2	
2	33	32.9	-29 %	-29	438.6	-127.3		37	26	16		1	
3	33	33.1	-29 %	-29	409.5	-126.4		39	26	35		1	
4	33	33.3	-18 %	-18	81.8	-58.1		41	26	65		0	
5	33	33.4	-17 %	-17	76.0	-57.2		43	26	95		0	
6	45	44.7	-17 %	-17	73.5	-153.2		319	26	75366		0	
7	2	1.7	-16 %	-16	61.6	197.6		634	26	399483		0	
8	45	44.8	-16 %	-16	49.8	-126.9		323	26	77485		0	
9	13	12.9	-12 %	-12	14.4	52.9		195	27	33166		0	
10	13	12.7	-8 %	-8	0.0	-1.7		199	27	34664		0	
11	13	12.7	-7 %	-7	2.3	-21.6		200	27	35101		0	
12	13	12.7	-6 %	-6	6.4	-35.7		199	27	34556		0	
13	45	44.8	-1 %	-1	55.3	133.4		322	27	76902		0	
14	33	33.4	1 %	1	83.0	60.2		44	27	104		0	
15	45	45.0	3 %	3	140.9	215.5		330	28	81045		0	
16	45	44.6	13 %	13	477.4	387.5		315	28	72916		2	
17	12	11.7	15 %	15	537.2	-351.5		230	28	47640		2	
18	21	20.9	22 %	22	917.6	-178.2		35	29	187		3	
$\Sigma Y$	482.82	$\Sigma X$	-153.24	$\Sigma(X-\bar{X})^2=$	3895.7	$\Sigma(X-\bar{X})(Y-\bar{Y})=$	223.3	$\Sigma(Y-\bar{Y})^2=$	3868	$\Sigma(Y-\bar{Y})^2=$	1095872	$\Sigma(Y-\bar{Y})^2=$	13
$\bar{Y}=\Sigma Y/N=$	26.82333333	$\bar{X}=\Sigma X/N=$	-8.513326461					SST=	3868	SSE=	1095872	SSR=	13
Now: $\hat{Y}=b(0)+b(1)X$								Coefficient of Determination	$r^2=$	0.003	(SSR/SST)		
								Correlation Coefficient	$r=$	0.058			
and	$b(1)=$	$\Sigma(X-\bar{X})(Y-\bar{Y}) / \Sigma(X-\bar{X})^2$											
		$=$	0.0573265										
and	$b(0)=$	$\bar{Y}-b(1)(\bar{X})$											
		$=$	27.311373										



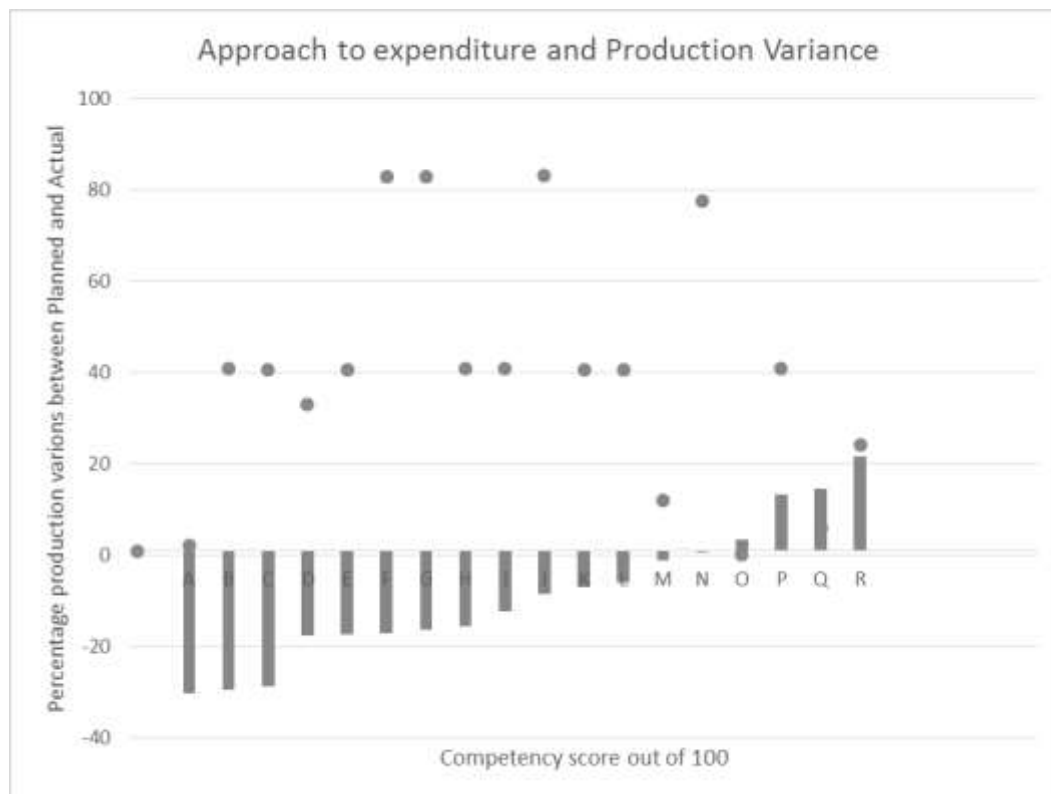
## Appendix E: Regression analysis calculations - continued

Competency:													
Approach to Delegation (Raw scores represented in Y)													
Trend projection method for forecasting													
Respondent	Competency score	factor	# Variance % to Business plan										
	Y	1	X		(X- $\bar{X}$ ) <sup>2</sup>		(X- $\bar{X}$ )(Y- $\bar{Y}$ )		(Y- $\bar{Y}$ ) <sup>2</sup>	$\bar{Y}$	(Y- $\bar{Y}$ ) <sup>2</sup>	(Y- $\bar{Y}$ ) <sup>2</sup>	
1	86	85.5	-30 %	-30	470.3		-856.1		1558	56	2169626	90	
2	50	50.3	-29 %	-29	438.6		-88.1		18	55	1060	84	
3	19	18.8	-29 %	-29	409.5		551.7		743	55	524812	78	
4	37	36.9	-18 %	-18	81.8		82.5		83	50	2142	16	
5	61	61.0	-17 %	-17	76.0		-129.9		222	50	25919	14	
6	61	60.8	-17 %	-17	73.5		-126.5		217	50	24554	14	
7	37	36.7	-16 %	-16	61.6		73.3		87	49	2557	12	
8	37	36.7	-16 %	-16	49.8		66.2		88	49	2617	10	
9	28	27.9	-12 %	-12	14.4		68.9		331	48	91641	3	
10	61	61.1	-8 %	-8	0.0		1.8		225	46	26858	0	
11	61	61.0	-7 %	-7	2.3		22.8		223	45	26292	0	
12	37	36.7	-6 %	-6	6.4		-23.7		88	45	2617	1	
13	76	75.9	-1 %	-1	55.3		221.6		889	43	660390	11	
14	18	18.5	1 %	1	83.0		-251.0		760	42	549357	16	
15	86	85.8	3 %	3	140.9		471.8		1580	41	2232292	27	
16	61	61.0	13 %	13	477.4		326.2		223	37	26198	91	
17	13	12.9	15 %	15	537.2		-768.4		1099	36	1179765	102	
18	2	1.7	22 %	22	917.6		-1344.4		1970	33	3873463	175	
$\Sigma Y$	828.94	$\Sigma X$	-153.24	$\Sigma(X-\bar{X})^2=$	3895.7	$\Sigma(X-\bar{X})(Y-\bar{Y})=$	-1701.4	$\Sigma(Y-\bar{Y})^2=$	10403	$\Sigma(Y-\bar{Y})^2=$	11422160	$\Sigma(Y-\bar{Y})^2=$	743
$\bar{Y}=\Sigma Y/Nr=$	46.05222222	$\bar{X}=\Sigma X/Nr=$	-8.513326461					SST=	10403	SSE=	11422160	SSR=	743
Now: $\bar{Y}=b(0)+b(1)X$								Coefficient of Determination	$r^2=$	0.071	(SSR/SST)		
and	$b(1)=$	$\Sigma(X-\bar{X})(Y-\bar{Y}) / \Sigma(X-\bar{X})^2$						Correlation Coefficient	$r=$	0.267			
		$= -0.4367239$											
and	$b(0)=$	$\bar{Y}-b(1)(\bar{X})$											
		$= 42.3342492$											



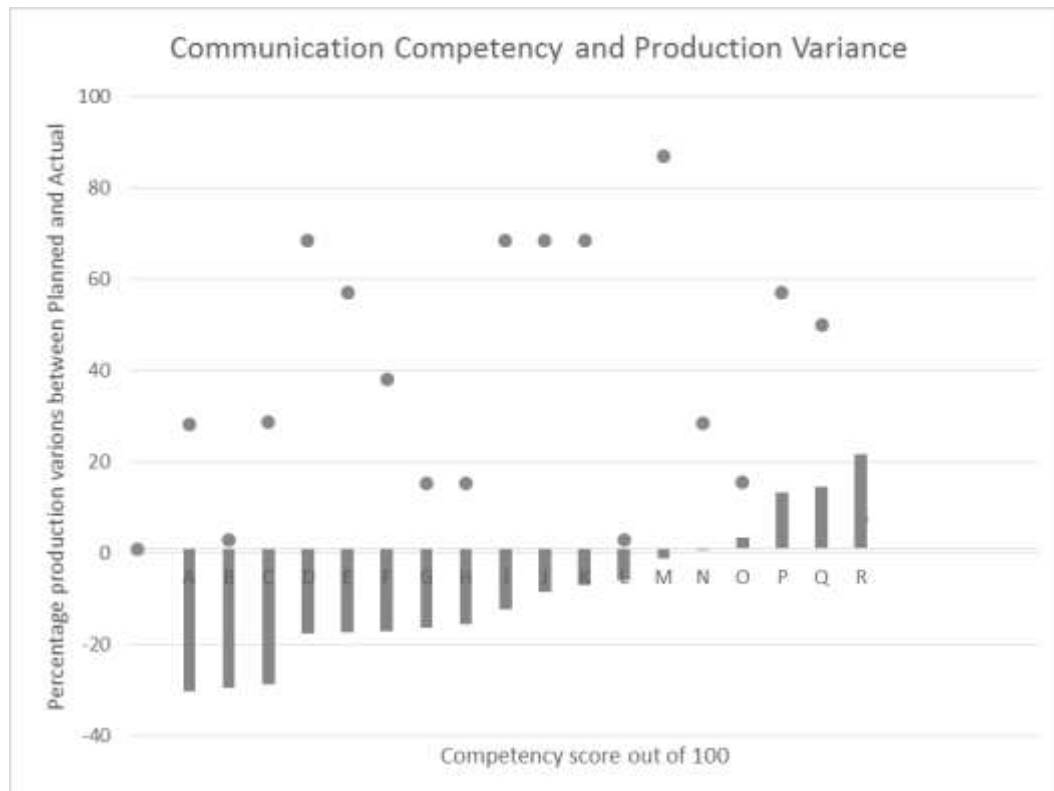
## Appendix E: Regression analysis calculations - continued

Competency:													
Approach to Expenditure (Raw scores represented in Y)													
Trend projection method for forecasting													
Respondent	Competency score	factor	# Variance % to Business plan		(X- $\bar{X}$ ) <sup>2</sup>	(X- $\bar{X}$ )(Y- $\bar{Y}$ )		(Y- $\bar{Y}$ ) <sup>2</sup>	$\bar{Y}$	(Y- $\bar{Y}$ ) <sup>2</sup>		( $\bar{Y}$ - $\bar{Y}$ ) <sup>2</sup>	
1	2	2.2	-30 %	-30	470.3	833.9		1479	49	2180086		65	
2	41	41.0	-29 %	-29	438.6	-6.6		0	48	1670		61	
3	41	40.7	-29 %	-29	409.5	-1.5		0	48	1658		57	
4	33	33.2	-18 %	-18	81.8	67.8		56	44	529		11	
5	41	40.7	-17 %	-17	76.0	-0.8		0	44	1658		11	
6	83	83.1	-17 %	-17	73.5	-363.9		1801	44	2950643		10	
7	83	83.1	-16 %	-16	61.6	-333.0		1799	44	2944884		9	
8	41	40.9	-16 %	-16	49.8	-2.0		0	43	1669		7	
9	41	40.9	-12 %	-12	14.4	-1.0		0	42	1668		2	
10	83	83.3	-8 %	-8	0.0	5.0		1823	41	3026270		0	
11	41	40.7	-7 %	-7	2.3	0.1		0	40	1658		0	
12	41	40.8	-6 %	-6	6.4	0.4		0	40	1662		1	
13	12	12.2	-1 %	-1	55.3	-211.7		811	38	638676		8	
14	78	77.6	1 %	1	83.0	336.5		1365	37	1657463		12	
15	0	0.2	3 %	3	140.9	-480.3		1637	36	2680248		20	
16	41	40.9	13 %	13	477.4	5.4		0	32	1667		66	
17	6	6.0	15 %	15	537.2	-803.4		1202	32	1429472		75	
18	24	24.2	22 %	22	917.6	-497.8		270	29	60448		128	
$\Sigma Y$	731.59	$\Sigma X$	-153.24	$\Sigma(X-\bar{X})^2=$	3895.7	$\Sigma(X-\bar{X})(Y-\bar{Y})=$	-1453.1	$\Sigma(Y-\bar{Y})^2=$	12243	$\Sigma(Y-\bar{Y})^2=$	17582029	$\Sigma(\bar{Y}-\bar{Y})^2=$	542
$\bar{Y}=\Sigma Y/Nr=$	40.64388889	$\bar{X}=\Sigma X/Nr=$	-8.513326461					SST=	12243	SSE=	17582029	SSR=	542
Now: $\bar{Y}=b(0)+b(1)X$								Coefficient of Determination	$r^2=$	0.044	(SSR/SST)		
and	$b(1)=\frac{\Sigma(X-\bar{X})(Y-\bar{Y})}{\Sigma(X-\bar{X})^2}$							Correlation Coefficient	$r=$	0.210			
	$= -0.3729892$												
and	$b(0)=\bar{Y}-b(1)(\bar{X})$												
	$= 37.4685103$												



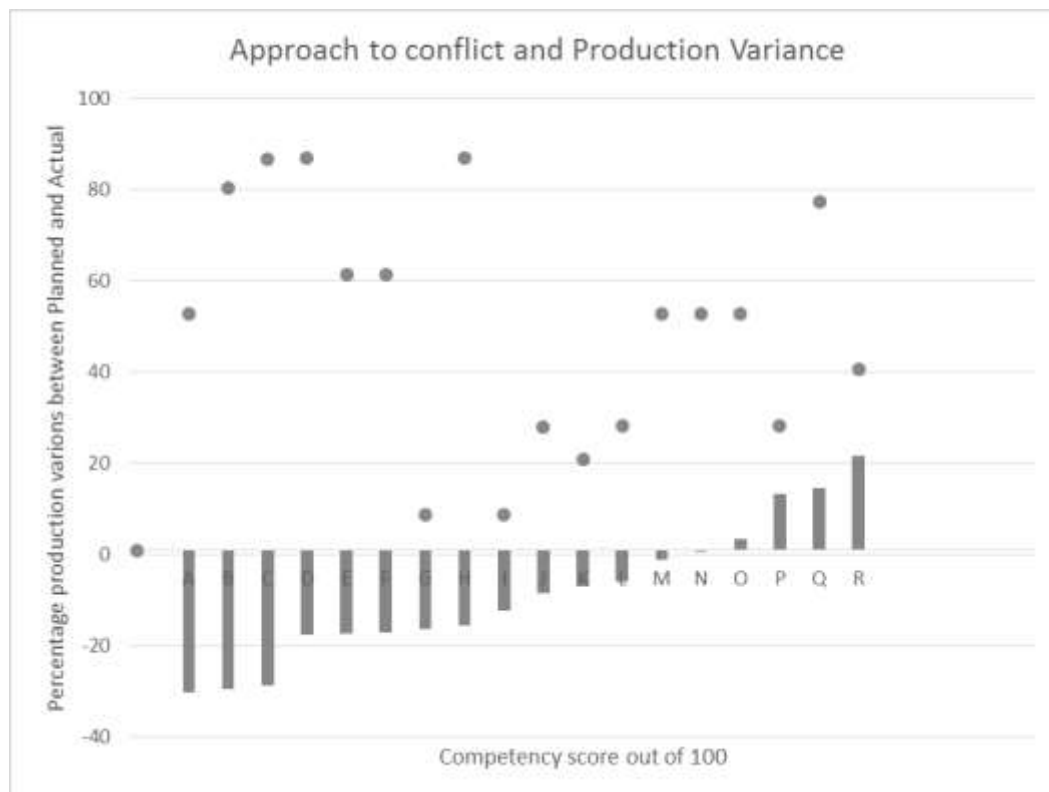
## Appendix E: Regression analysis calculations - continued

Respondent	Competency score	factor	# Variance % to Business plan										
	Y	1	X		$(X-\bar{X})^2$		$(X-\bar{X})(Y-\bar{Y})$		$(Y-\bar{Y})^2$	$\bar{Y}$	$(Y-\bar{Y})^2$		$(\bar{Y}-\bar{Y})^2$
1	28	28.3	-30 %	-30	470.3		240.1		123	36	8885		13
2	3	2.8	-29 %	-29	438.6		765.7		1337	36	1779275		13
3	29	28.9	-29 %	-29	409.5		212.7		110	36	6661		12
4	69	68.6	-18 %	-18	81.8		-264.0		851	38	612850		2
5	57	57.1	-17 %	-17	76.0		-154.4		314	38	65800		2
6	38	38.0	-17 %	-17	73.5		11.5		2	38	1313		2
7	15	15.4	-16 %	-16	61.6		188.4		576	38	313805		2
8	15	15.4	-16 %	-16	49.8		169.5		577	38	314904		1
9	69	68.6	-12 %	-12	14.4		-110.8		854	39	616450		0
10	68	68.5	-8 %	-8	0.0		3.4		847	39	606588		0
11	69	68.6	-7 %	-7	2.3		44.5		851	40	612850		0
12	3	2.9	-6 %	-6	6.4		-92.5		1334	40	1771379		0
13	87	87.1	-1 %	-1	55.3		354.3		2272	41	4775418		2
14	29	28.6	1 %	1	83.0		-98.1		116	41	7640		2
15	15	15.5	3 %	3	140.9		-283.6		571	41	308353		4
16	57	57.1	13 %	13	477.4		387.6		315	43	66331		14
17	50	50.1	15 %	15	537.2		249.4		116	43	4305		15
18	7	7.5	22 %	22	917.6		-966.0		1017	44	1019197		26
$\Sigma Y$	708.86	$\Sigma X$	-153.24	$\Sigma(X-\bar{X})^2=$	3895.7	$\Sigma(X-\bar{X})(Y-\bar{Y})=$	657.8	$\Sigma(Y-\bar{Y})^2=$	12182	$\Sigma(Y-\bar{Y})^2=$	12892006	$\Sigma(\bar{Y}-\bar{Y})^2=$	111
$\bar{Y}=\Sigma Y/Nr=$	39.38111111	$\bar{X}=\Sigma X/Nr=$	-8.513326461					SST=	12182	SSE=	12892006	SSR=	111
Now:	$\hat{Y}=b(0)+b(1)X$							Coefficient of Determination	$r^2=$	0.009	(SSR/SST)		
and	$b(1)=\frac{\Sigma(X-\bar{X})(Y-\bar{Y})}{\Sigma(X-\bar{X})^2}$							Correlation Coefficient	$r=$	0.095			
	$= 0.1688396$												
and	$b(0)=\bar{Y}-b(1)(\bar{X})$												
	$= 40.8184976$												



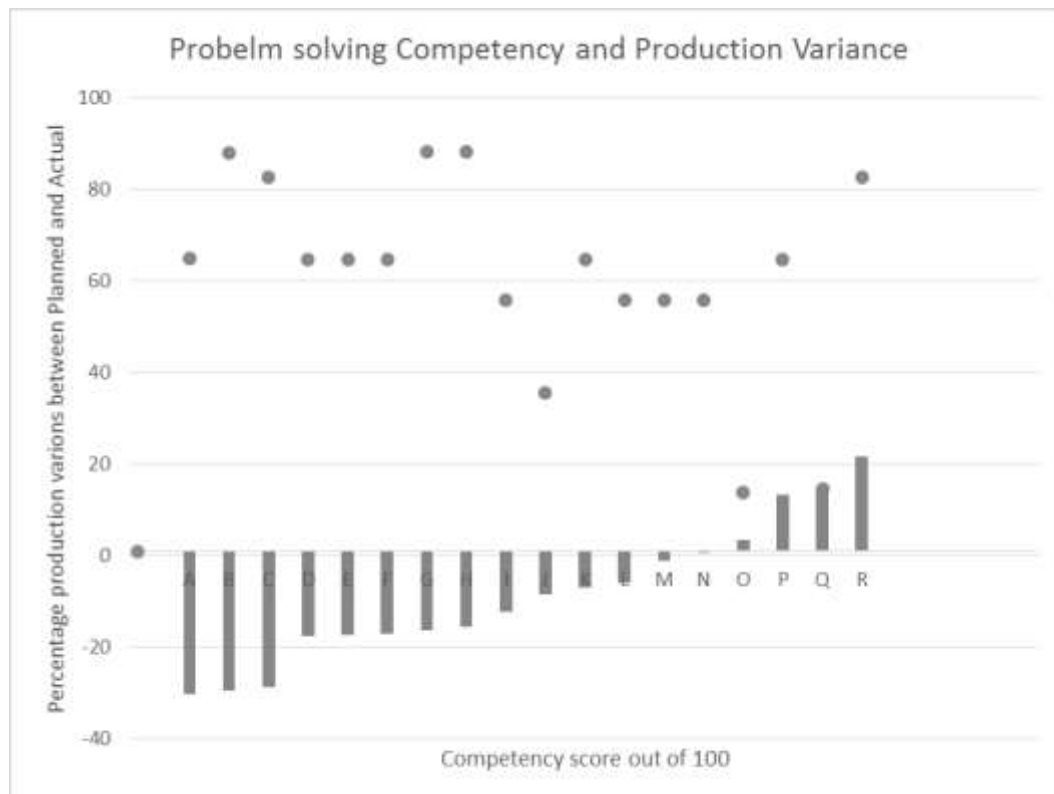
## Appendix E: Regression analysis calculations - continued

Competency:													
Approach to Conflict (Raw scores represented in Y)													
Trend projection method for forecasting													
Respondent	Competency score	factor	# Variance % to Business plan										
	Y	1	X		(X- $\bar{X}$ ) <sup>2</sup>		(X- $\bar{X}$ )(Y- $\bar{Y}$ )		(Y- $\bar{Y}$ ) <sup>2</sup>	$\bar{Y}$	(Y- $\bar{Y}$ ) <sup>2</sup>	(Y- $\bar{Y}$ ) <sup>2</sup>	
1	53	52.7	-30 %	-30	470.3		-38.9		3	61	2449	111	
2	80	80.4	-29 %	-29	438.6		-618.1		871	61	625111	104	
3	87	86.8	-29 %	-29	409.5		-725.7		1286	61	1438653	97	
4	87	87.0	-18 %	-18	81.8		-326.5		1303	55	1478069	19	
5	61	61.4	-17 %	-17	76.0		-91.7		111	55	2432	18	
6	62	61.6	-17 %	-17	73.5		-91.3		114	55	2697	17	
7	9	8.7	-16 %	-16	61.6		331.5		1783	55	3148334	15	
8	87	87.0	-16 %	-16	49.8		-254.9		1303	54	1479801	12	
9	9	8.7	-12 %	-12	14.4		159.9		1779	53	3133199	3	
10	28	28.0	-8 %	-8	0.0		-2.7		526	51	247622	0	
11	21	20.9	-7 %	-7	2.3		-45.8		902	50	775593	1	
12	28	28.2	-6 %	-6	6.4		-57.4		515	50	236614	2	
13	53	52.9	-1 %	-1	55.3		14.8		4	47	2395	13	
14	53	52.8	1 %	1	83.0		17.5		4	46	2415	20	
15	53	52.9	3 %	3	140.9		23.3		4	45	2403	33	
16	28	28.2	13 %	13	477.4		-496.1		516	40	237517	113	
17	77	77.4	15 %	15	537.2		614.8		704	40	391972	127	
18	41	40.7	22 %	22	917.6		-309.2		104	36	4026	217	
$\Sigma Y$	916.49	$\Sigma X$	-153.24	$\Sigma(X-\bar{X})^2=$	3895.7	$\Sigma(X-\bar{X})(Y-\bar{Y})=$	-1896.6	$\Sigma(Y-\bar{Y})^2=$	11830	$\Sigma(Y-\bar{Y})^2=$	13211302	$\Sigma(Y-\bar{Y})^2=$	923
$\bar{Y}=\Sigma Y/Nr=$	50.91611111	$\bar{X}=\Sigma X/Nr=$	-8.513326461					SST=	11830	SSE=	13211302	SSR=	923
Now: $\bar{Y}=b(0)+b(1)X$								Coefficient of Determination	$r^2=$	0.078	(SSR/SST)		
and	$b(1)=\Sigma(X-\bar{X})(Y-\bar{Y})/\Sigma(X-\bar{X})^2$							Correlation Coefficient	$r=$	0.279			
	= -0.4868457												
and	$b(0)=\bar{Y}-b(1)(\bar{X})$												
	= 46.7714344												



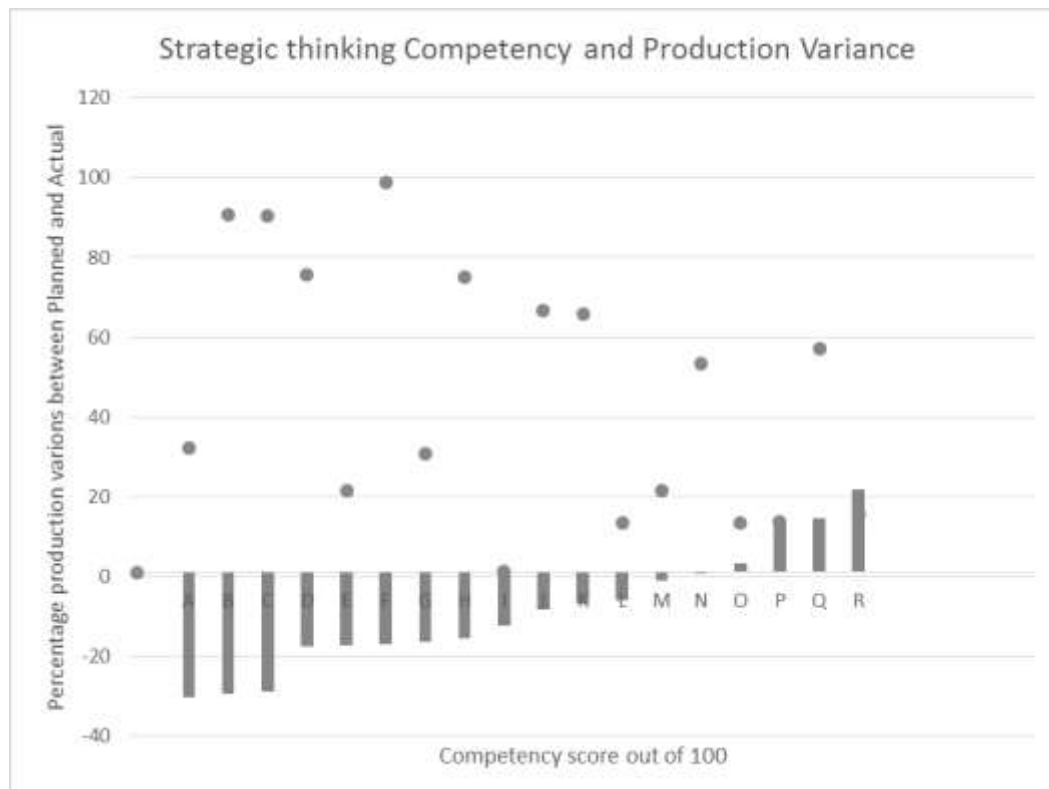
## Appendix E: Regression analysis calculations - continued

Competency:													
Approach to Method on Problem Solvi (Raw scores represented in Y)													
Trend projection method for forecasting													
Respondent	Competency score	factor	# Variance % to Business plan										
	Y	1	X		(X- $\bar{X}$ ) <sup>2</sup>		(X- $\bar{X}$ )(Y- $\bar{Y}$ )		(Y- $\bar{Y}$ ) <sup>2</sup>	$\bar{Y}$	(Y- $\bar{Y}$ ) <sup>2</sup>	(Y- $\bar{Y}$ ) <sup>2</sup>	
1	65	65.0	-30 %	-30	470.3		-76.6		12	76	2759	205	
2	88	88.1	-29 %	-29	438.6		-558.8		712	75	389017	192	
3	83	82.7	-29 %	-29	409.5		-429.2		450	75	134849	179	
4	65	64.8	-18 %	-18	81.8		-30.0		11	67	2889	36	
5	65	64.7	-17 %	-17	76.0		-28.2		10	67	2943	33	
6	65	64.8	-17 %	-17	73.5		-29.0		11	67	2853	32	
7	88	88.2	-16 %	-16	61.6		-210.0		716	67	393608	27	
8	88	88.3	-16 %	-16	49.8		-189.8		723	66	402240	22	
9	56	55.9	-12 %	-12	14.4		21.1		31	64	619	6	
10	36	35.7	-8 %	-8	0.0		-3.0		664	61	394854	0	
11	65	64.7	-7 %	-7	2.3		4.9		10	60	2943	1	
12	56	55.9	-6 %	-6	6.4		-14.1		31	60	631	3	
13	56	55.9	-1 %	-1	55.3		-41.2		31	57	637	24	
14	56	55.9	1 %	1	83.0		-51.1		31	55	595	36	
15	14	13.7	3 %	3	140.9		-566.7		2279	54	5131741	62	
16	65	64.8	13 %	13	477.4		72.6		11	47	2889	209	
17	14	14.5	15 %	15	537.2		-1089.1		2208	46	4811608	235	
18	83	82.7	22 %	22	917.6		643.1		451	41	135458	401	
$\Sigma Y$	1106.27	$\Sigma X$	-153.24	$\Sigma(X-\bar{X})^2=$	3895.7	$\Sigma(X-\bar{X})(Y-\bar{Y})=$	-2575.0	$\Sigma(Y-\bar{Y})^2=$	8393	$\Sigma(Y-\bar{Y})^2=$	11813134	$\Sigma(\bar{Y}-Y)^2=$	1702
$\bar{Y}=\Sigma Y/Nr=$	61.45944444	$\bar{X}=\Sigma X/Nr=$	-8.513326461					SST=	8393	SSE=	11813134	SSR=	1702
Now:	$\bar{Y}=b(0)+b(1)X$							Coefficient of Determination	$r^2=$	0.203	(SSR/SST)		
and	$b(1)=\frac{\Sigma(X-\bar{X})(Y-\bar{Y})}{\Sigma(X-\bar{X})^2}$							Correlation Coefficient	$r=$	0.450			
	$= -0.6609862$												
and	$b(0)=\bar{Y}-b(1)(\bar{X})$												
	$= 55.8322533$												



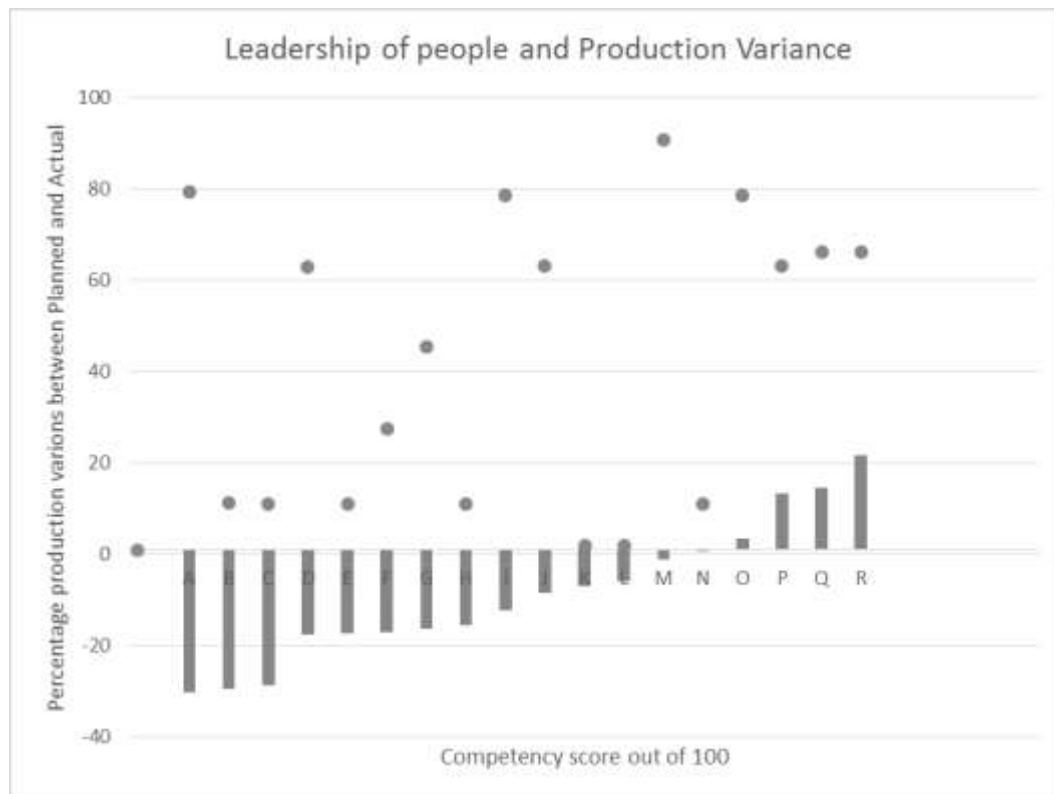
## Appendix E: Regression analysis calculations - continued

Competency: Managerial/Strategic Thinking (Raw scores represented in Y)													
Trend projection method for forecasting													
Respondent	Competency score	factor	# Variance % to Business plan		(X- $\bar{X}$ ) <sup>2</sup>	(X- $\bar{X}$ )(Y- $\bar{Y}$ )	(Y- $\bar{Y}$ ) <sup>2</sup>	$\bar{Y}$	(Y- $\bar{Y}$ ) <sup>2</sup>		(Y- $\bar{Y}$ ) <sup>2</sup>		
1	32	32.2	-30 %	-30	470.3	310.8	205	68	30000		468		
2	91	90.7	-29 %	-29	438.6	-924.9	1950	67	3457393		437		
3	90	90.4	-29 %	-29	409.5	-888.1	1926	67	3370541		408		
4	76	75.8	-18 %	-18	81.8	-264.7	856	56	608970		81		
5	22	21.6	-17 %	-17	76.0	217.0	620	55	357532		76		
6	99	98.8	-17 %	-17	73.5	-448.6	2737	55	6961758		73		
7	31	30.9	-16 %	-16	61.6	122.3	243	54	44878		61		
8	75	75.1	-16 %	-16	49.8	-202.3	821	54	555995		50		
9	1	1.2	-12 %	-12	14.4	171.8	2053	50	4210156		14		
10	67	66.6	-8 %	-8	0.0	2.4	403	46	113309		0		
11	66	65.8	-7 %	-7	2.3	29.5	374	45	94977		2		
12	13	13.4	-6 %	-6	6.4	-83.8	1094	44	1168373		6		
13	21	21.4	-1 %	-1	55.3	-186.2	628	39	367345		55		
14	53	53.4	1 %	1	83.0	63.2	48	37	28		83		
15	13	13.4	3 %	3	140.9	-393.3	1098	35	1175649		140		
16	14	13.6	13 %	13	477.4	-718.4	1081	25	1139601		475		
17	57	57.1	15 %	15	537.2	246.1	113	23	3098		535		
18	15	15.5	22 %	22	917.6	-939.1	961	16	894054		913		
$\Sigma Y$	836.83	$\Sigma X$	-153.24	$\Sigma(X-\bar{X})^2=$	3895.7	$\Sigma(X-\bar{X})(Y-\bar{Y})=$	-3886.3	$\Sigma(Y-\bar{Y})^2=$	17211	$\Sigma(Y-\bar{Y})^2=$	24553657	$\Sigma(\bar{Y}-\bar{Y})^2=$	3877
$\bar{Y}=\Sigma Y/Nr=$	46.49055556	$\bar{X}=\Sigma X/Nr=$	-8.513326461					SST=	17211	SSE=	24553657	SSR=	3877
Now: $\bar{Y}=b(0)+b(1)X$								Coefficient of Determination	$r^2=$	0.225 (SSR/SST)			
and	$b(1)=$	$\Sigma(X-\bar{X})(Y-\bar{Y}) / \Sigma(X-\bar{X})^2$						Correlation Coefficient	$r=$	0.475			
		$= -0.9975700$											
and	$b(0)=$	$\bar{Y}-b(1)(\bar{X})$											
		$= 37.9979164$											



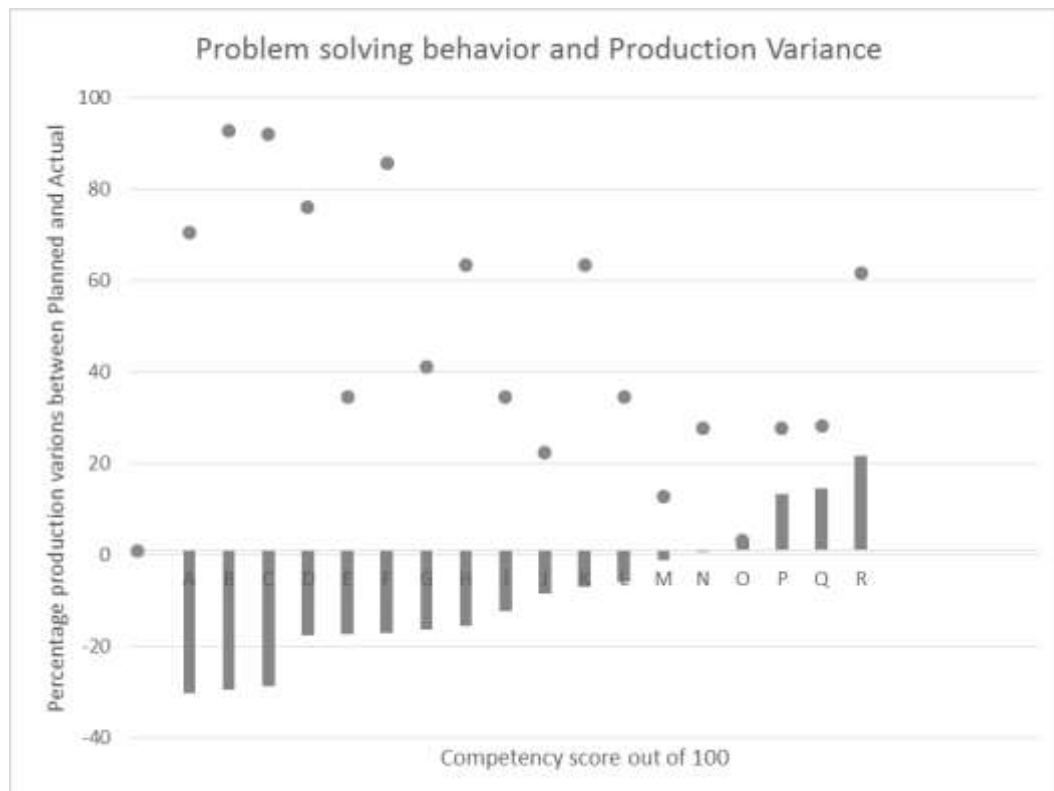
## Appendix E: Regression analysis calculations - continued

Competency:													
Leadership of people (Raw scores represented in Y)													
Trend projection method for forecasting													
Respondent	Competency score	factor	# Variance % to Business plan										
	Y	1	X		$(X-\bar{X})^2$		$(X-\bar{X})(Y-\bar{Y})$		$(Y-\bar{Y})^2$	$\bar{Y}$	$(Y-\bar{Y})^2$	$(\bar{Y}-\bar{Y})^2$	
1	80	79.5	-30 %	-30	470.3		-782.4		1302	28	1493715	247	
2	11	11.3	-29 %	-29	438.6		672.7		1032	28	1041330	231	
3	11	11.1	-29 %	-29	409.5		655.1		1048	29	1075014	215	
4	63	63.1	-18 %	-18	81.8		-177.8		386	37	104576	43	
5	11	11.0	-17 %	-17	76.0		282.5		1050	37	1080477	40	
6	27	27.4	-17 %	-17	73.5		137.6		258	37	53019	39	
7	46	45.6	-16 %	-16	61.6		-17.1		5	38	1670	32	
8	11	10.9	-16 %	-16	49.8		229.5		1057	38	1094226	26	
9	79	78.7	-12 %	-12	14.4		-133.8		1246	41	1362546	8	
10	63	63.3	-8 %	-8	0.0		2.3		396	44	110905	0	
11	2	1.9	-7 %	-7	2.3		-63.4		1726	45	2971397	1	
12	2	1.9	-6 %	-6	6.4		-105.2		1725	45	2968499	3	
13	91	90.8	-1 %	-1	55.3		352.2		2245	49	4639497	29	
14	11	10.9	1 %	1	83.0		-296.2		1058	50	1095607	44	
15	79	78.7	3 %	3	140.9		418.7		1244	52	1357678	74	
16	63	63.1	13 %	13	477.4		430.2		388	59	105321	251	
17	66	66.2	15 %	15	537.2		528.2		519	60	205312	282	
18	66	66.2	22 %	22	917.6		690.9		520	65	206121	482	
$\Sigma Y$	781.76	$\Sigma X$	-153.24	$\Sigma(X-\bar{X})^2=$	3895.7	$\Sigma(X-\bar{X})(Y-\bar{Y})=$	2824.1	$\Sigma(Y-\bar{Y})^2=$	17204	$\Sigma(Y-\bar{Y})^2=$	20966909	$\Sigma(\bar{Y}-\bar{Y})^2=$	2047
$\bar{Y}=\Sigma Y/N=$	43.43111111	$\bar{X}=\Sigma X/N=$	-8.513326461					SST=	17204	SSE=	20966909	SSR=	2047
Now: $\hat{Y}=b(0)+b(1)X$								Coefficient of Determination	$r^2=$	0.119	(SSR/SST)		
								Correlation Coefficient	$r=$	0.345			
and	$b(1)=$	$\Sigma(X-\bar{X})(Y-\bar{Y}) / \Sigma(X-\bar{X})^2$											
		$= 0.7249117$											
and	$b(0)=$	$\bar{Y}-b(1)(\bar{X})$											
		$= 49.6025214$											



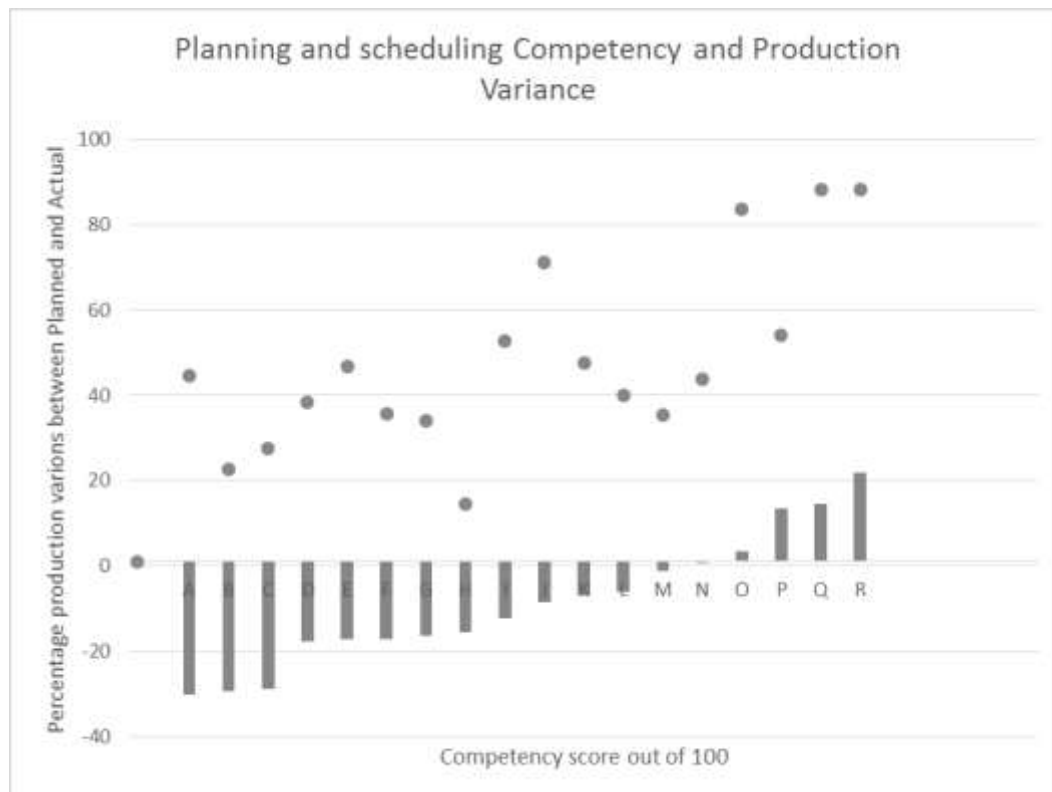
## Appendix E: Regression analysis calculations - continued

Competency:													
Problem Solving Behaviour (Raw scores represented in Y)													
Trend projection method for forecasting													
Respondent	Competency score	factor	# Variance % to Business plan		(X- $\bar{X}$ ) <sup>2</sup>	(X- $\bar{X}$ )(Y- $\bar{Y}$ )		(Y- $\bar{Y}$ ) <sup>2</sup>	$\bar{Y}$	(Y- $\bar{Y}$ ) <sup>2</sup>		( $\bar{Y}$ - $\bar{Y}$ ) <sup>2</sup>	
	Y	1	X										
1	71	70.6	-30 %	-30	470.3	-478.6		487	72	173509		564	
2	93	92.8	-29 %	-29	438.6	-926.4		1956	71	3473158		526	
3	92	92.2	-29 %	-29	409.5	-884.5		1911	71	3306692		491	
4	76	76.1	-18 %	-18	81.8	-249.1		758	58	465004		98	
5	35	34.6	-17 %	-17	76.0	121.2		193	58	25141		91	
6	86	85.8	-17 %	-17	73.5	-319.9		1392	58	1706391		88	
7	41	41.1	-16 %	-16	61.6	57.9		54	57	177		74	
8	64	63.6	-16 %	-16	49.8	-106.4		227	56	26748		60	
9	35	34.6	-12 %	-12	14.4	52.7		193	53	25141		17	
10	22	22.3	-8 %	-8	0.0	-3.1		686	48	440269		0	
11	63	63.5	-7 %	-7	2.3	22.8		224	47	25807		3	
12	35	34.7	-6 %	-6	6.4	-35.0		191	46	24418		8	
13	13	12.8	-1 %	-1	55.3	-265.5		1276	40	1595268		66	
14	28	27.8	1 %	1	83.0	-188.3		428	39	159821		100	
15	3	3.1	3 %	3	140.9	-538.9		2061	36	4235113		169	
16	28	27.7	13 %	13	477.4	-455.5		435	25	165654		573	
17	28	28.4	15 %	15	537.2	-467.0		406	23	142588		645	
18	62	61.6	22 %	22	917.6	396.3		171	15	11994		1101	
$\Sigma Y$	873.34	$\Sigma X$	-153.24	$\Sigma(X-\bar{X})^2=$	3895.7	$\Sigma(X-\bar{X})(Y-\bar{Y})=$	-4267.4	$\Sigma(Y-\bar{Y})^2=$	13049	$\Sigma(Y-\bar{Y})^2=$	16002893	$\Sigma(\bar{Y}-\bar{Y})^2=$	4675
$\bar{Y}=\Sigma Y/Nr=$	48.51888889	$\bar{X}=\Sigma X/Nr=$	-8.513326461					SST=	13049	SSE=	16002893	SSR=	4675
Now: $\hat{Y}=b(0)+b(1)X$								Coefficient of Determination	$r^2=$	0.358 (SSR/SST)			
and	$b(1)=\Sigma(X-\bar{X})(Y-\bar{Y})/\Sigma(X-\bar{X})^2$							Correlation Coefficient	$r=$	0.599			
	= -1.0954116												
and	$b(0)=\bar{Y}-b(1)\bar{X}$												
	= 39.1932926												



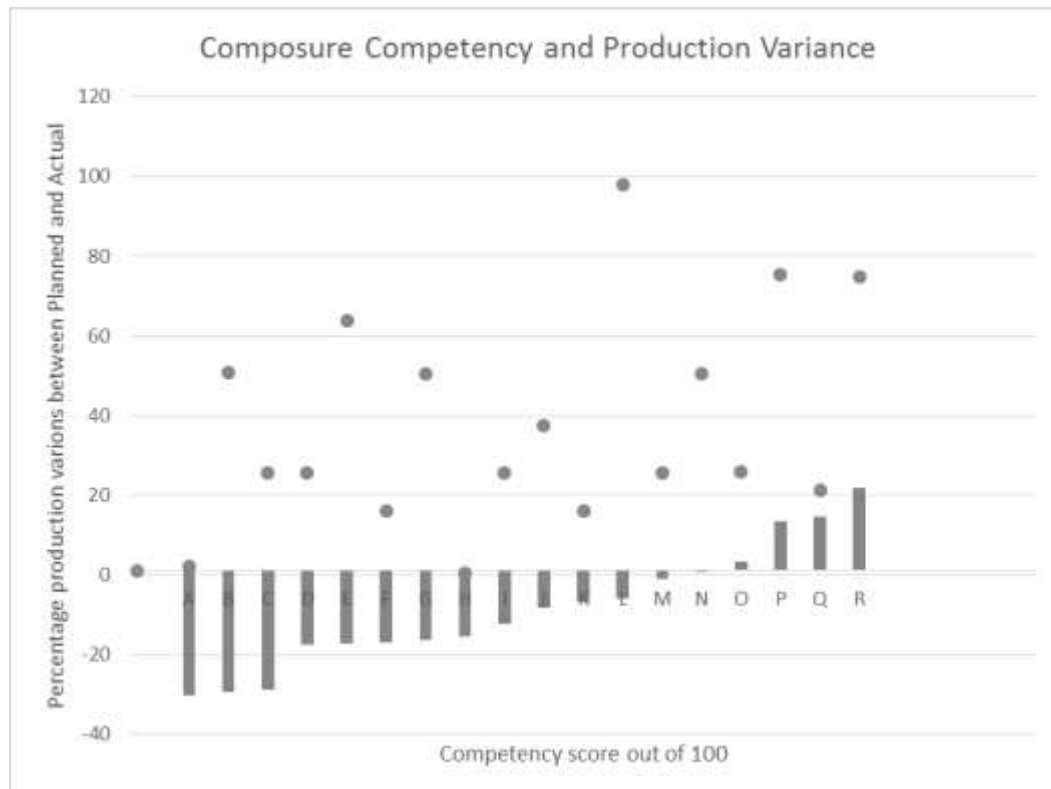
## Appendix E: Regression analysis calculations - continued

Competency:													
Planning and scheduling (Raw scores represented in Y)													
Trend projection method for forecasting													
Respondent	Competency score	factor	# Variance % to Business plan		(X- $\bar{X}$ ) <sup>2</sup>	(X- $\bar{X}$ )(Y- $\bar{Y}$ )		(Y- $\bar{Y}$ ) <sup>2</sup>	$\bar{Y}$	(Y- $\bar{Y}$ ) <sup>2</sup>		(Y- $\bar{Y}$ ) <sup>2</sup>	
	Y	1	X										
1	45	44.7	-30 %	-30	470.3	78.2		13	25	1002		522	
2	23	22.8	-29 %	-29	438.6	533.8		650	26	392889		487	
3	27	27.5	-29 %	-29	409.5	421.3		433	27	164752		454	
4	38	38.4	-18 %	-18	81.8	89.1		97	39	3427		91	
5	47	46.8	-17 %	-17	76.0	13.0		2	39	1987		84	
6	36	35.7	-17 %	-17	73.5	107.8		158	39	15003		82	
7	34	33.9	-16 %	-16	61.6	112.6		206	40	29554		68	
8	15	14.5	-16 %	-16	49.8	238.4		1140	41	1267235		55	
9	53	52.7	-12 %	-12	14.4	-16.7		19	44	1114		16	
10	71	71.0	-8 %	-8	0.0	2.7		517	48	199107		0	
11	48	47.7	-7 %	-7	2.3	-0.9		0	50	2239		3	
12	40	40.0	-6 %	-6	6.4	-21.0		69	51	823		7	
13	36	35.5	-1 %	-1	55.3	-95.0		163	56	16322		61	
14	44	43.8	1 %	1	83.0	-41.1		20	58	550		92	
15	84	83.5	3 %	3	140.9	418.1		1241	61	1338982		156	
16	54	54.2	13 %	13	477.4	129.2		35	71	370		530	
17	88	88.2	15 %	15	537.2	925.3		1594	73	2266916		596	
18	88	88.2	22 %	22	917.6	1209.0		1593	80	2264543		1018	
$\Sigma Y$	868.99	$\Sigma X$	-153.24	$\Sigma(X-\bar{X})^2=$	3895.7	$\Sigma(X-\bar{X})(Y-\bar{Y})=$	4104.0	$\Sigma(Y-\bar{Y})^2=$	7951	$\Sigma(Y-\bar{Y})^2=$	7966816	$\Sigma(Y-\bar{Y})^2=$	4323
$\bar{Y}=\Sigma Y/Nr=$	48.27722222	$\bar{X}=\Sigma X/Nr=$	-8.513326461					SST=	7951	SSE=	7966816	SSR=	4323
Now: $\hat{Y}=b(0)+b(1)X$								Coefficient of Determination		$r^2=$	0.544 (SSR/SST)		
								Correlation Coefficient		$r=$	0.737		
and	$b(1)=\frac{\Sigma(X-\bar{X})(Y-\bar{Y})}{\Sigma(X-\bar{X})^2}$												
	$= 1.0534554$												
and	$b(0)=\bar{Y}-b(1)(\bar{X})$												
	$= 57.2456323$												



## Appendix E: Regression analysis calculations - continued

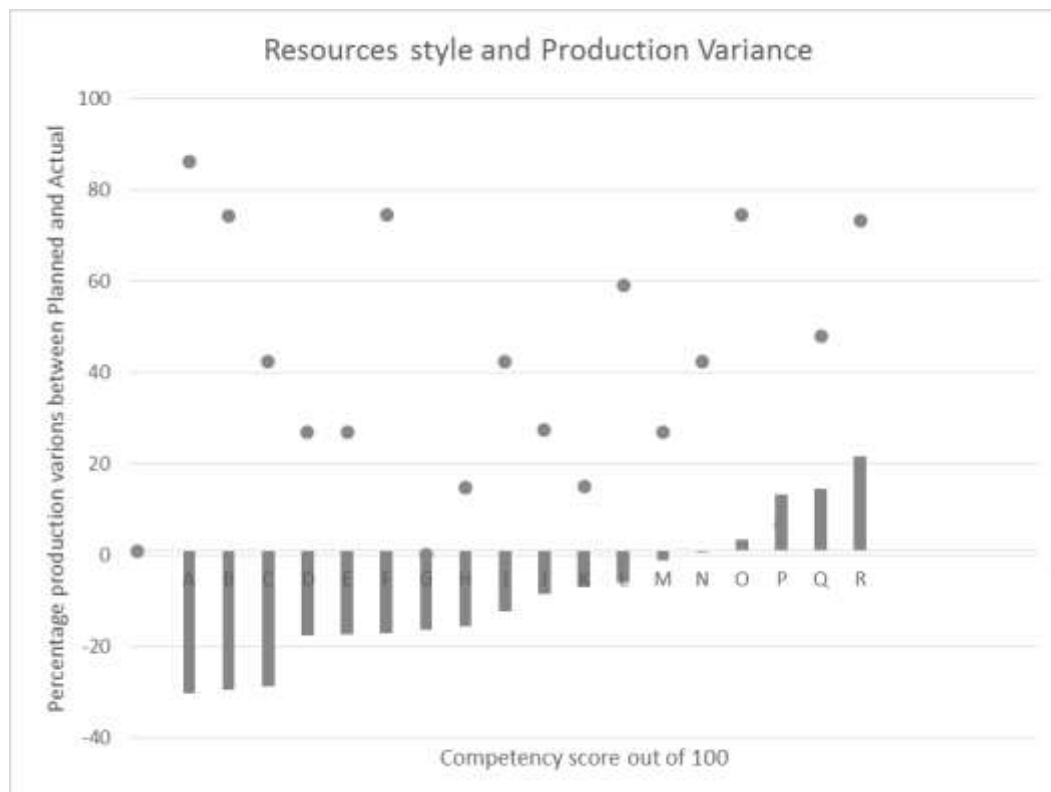
Competency:													
Need for composure (Raw scores represented in Y)													
Trend projection method for forecasting													
Respondent	Competency score	factor	# Variance % to Business plan		(X- $\bar{X}$ ) <sup>2</sup>	(X- $\bar{X}$ )(Y- $\bar{Y}$ )		(Y- $\bar{Y}$ ) <sup>2</sup>	$\bar{Y}$	(Y- $\bar{Y}$ ) <sup>2</sup>		( $\bar{Y}$ - $\bar{Y}$ ) <sup>2</sup>	
	Y	1	X										
1	2	2.2	-30 %	-30	470.3	778.2		1288	24	1652365		209	
2	51	50.7	-29 %	-29	438.6	-264.5		159	24	11827		195	
3	26	25.6	-29 %	-29	409.5	252.6		156	25	16969		182	
4	26	25.6	-18 %	-18	81.8	112.3		154	32	16500		36	
5	64	63.8	-17 %	-17	76.0	-224.3		662	32	357701		34	
6	16	16.0	-17 %	-17	73.5	188.8		485	32	219958		33	
7	50	50.4	-16 %	-16	61.6	-96.9		152	33	10412		27	
8	0	0.3	-16 %	-16	49.8	266.7		1427	33	2035030		22	
9	26	25.7	-12 %	-12	14.4	46.9		153	36	16236		6	
10	37	37.3	-8 %	-8	0.0	-0.1		1	38	1349		0	
11	16	15.9	-7 %	-7	2.3	-33.7		489	39	223785		1	
12	98	98.0	-6 %	-6	6.4	151.8		3592	40	12210929		3	
13	26	25.6	-1 %	-1	55.3	-92.4		155	43	16633		25	
14	50	50.5	1 %	1	83.0	113.2		154	44	10804		37	
15	26	25.7	3 %	3	140.9	-146.3		152	46	15910		63	
16	75	75.4	13 %	13	477.4	816.2		1396	53	1742692		212	
17	21	21.4	15 %	15	537.2	-387.1		279	54	66384		239	
18	75	74.9	22 %	22	917.6	1116.5		1358	58	1647382		408	
$\Sigma Y$	684.96	$\Sigma X$	-153.24	$\Sigma(X-\bar{X})^2=$	3895.7	$\Sigma(X-\bar{X})(Y-\bar{Y})=$	2597.8	$\Sigma(Y-\bar{Y})^2=$	12212	$\Sigma(Y-\bar{Y})^2=$	20272867	$\Sigma(\bar{Y}-\bar{Y})^2=$	1732
$\bar{Y}=\Sigma Y/Nr=$	38.05333333	$\bar{X}=\Sigma X/Nr=$	-8.513326461					SST=	12212	SSE=	20272867	SSR=	1732
Now: $\bar{Y}=b(0)+b(1)X$								Coefficient of Determination	$r^2=$	0.142	(SSR/SST)		
								Correlation Coefficient	$r=$	0.377			
and	$b(1)=$	$\Sigma(X-\bar{X})(Y-\bar{Y}) / \Sigma(X-\bar{X})^2$											
		$= 0.6668390$											
and	$b(0)=$	$\bar{Y}-b(1)(\bar{X})$											
		$= 43.7303517$											





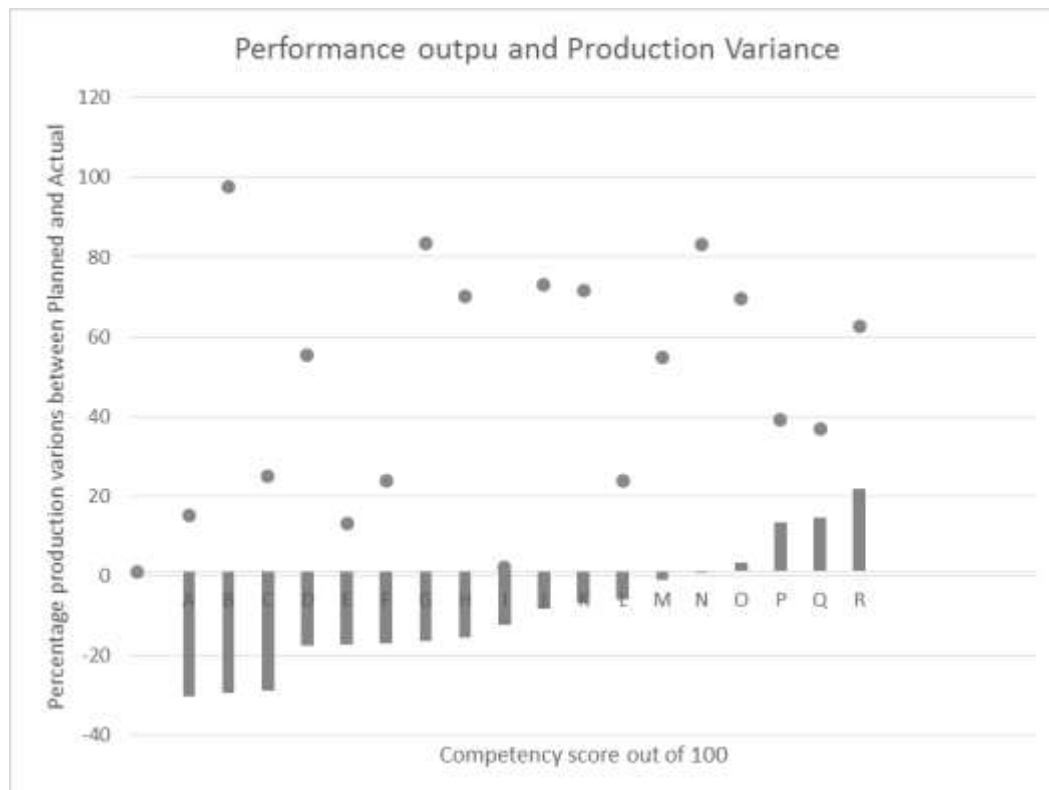
## Appendix E: Regression analysis calculations - continued

Competency:													
Resourcer Style (Raw scores represented in Y)													
Trend projection method for forecasting													
Respondent	Competency score	factor	# Variance % to Business plan										
	Y	1	X		(X- $\bar{X}$ ) <sup>2</sup>		(X- $\bar{X}$ )(Y- $\bar{Y}$ )		(Y- $\bar{Y}$ ) <sup>2</sup>	$\bar{Y}$	(Y- $\bar{Y}$ ) <sup>2</sup>	(Y- $\bar{Y}$ ) <sup>2</sup>	
1	86	86.3	-30 %	-30	470.3		-951.7		1926	45	3385148	9	
2	74	74.4	-29 %	-29	438.6		-671.2		1027	45	907523	8	
3	43	42.5	-29 %	-29	409.5		-3.4		0	45	1807	8	
4	27	27.0	-18 %	-18	81.8		139.5		238	44	44477	2	
5	27	26.9	-17 %	-17	76.0		134.6		238	44	44746	1	
6	75	74.6	-17 %	-17	73.5		-275.9		1035	44	923251	1	
7	0	0.1	-16 %	-16	61.6		332.1		1789	43	3201981	1	
8	15	14.8	-16 %	-16	49.8		194.5		759	43	553990	1	
9	42	42.3	-12 %	-12	14.4		0.2		0	43	1792	0	
10	27	27.4	-8 %	-8	0.0		-1.8		224	42	38596	0	
11	15	15.0	-7 %	-7	2.3		-41.8		751	42	542388	0	
12	59	59.3	-6 %	-6	6.4		42.8		286	42	51196	0	
13	27	26.9	-1 %	-1	55.3		-114.7		238	41	44611	1	
14	42	42.4	1 %	1	83.0		0.3		0	41	1798	2	
15	75	74.7	3 %	3	140.9		383.5		1044	41	939179	3	
16	7	6.8	13 %	13	477.4		-777.3		1265	39	1584031	9	
17	48	48.0	15 %	15	537.2		131.1		32	39	257	10	
18	73	73.3	22 %	22	917.6		938.1		959	38	784399	18	
$\Sigma Y$	762.7	$\Sigma X$	-153.24	$\Sigma(X-\bar{X})^2=$	3895.7	$\Sigma(X-\bar{X})(Y-\bar{Y})=$	-541.1	$\Sigma(Y-\bar{Y})^2=$	11813	$\Sigma(Y-\bar{Y})^2=$	13051168	$\Sigma(Y-\bar{Y})^2=$	75
$\bar{Y}=\Sigma Y/Nr=$	42.37222222	$\bar{X}=\Sigma X/Nr=$	-8.513326461					SST=	11813	SSE=	13051168	SSR=	75
Now: $\bar{Y}=b(0)+b(1)X$								Coefficient of Determination	$r^2=$	0.006	(SSR/SST)		
								Correlation Coefficient	$r=$	0.080			
and	$b(1)=$	$\Sigma(X-\bar{X})(Y-\bar{Y}) / \Sigma(X-\bar{X})^2$											
		$= -0.1388891$											
and	$b(0)=$	$\bar{Y}-b(1)(\bar{X})$											
		$= 41.1898143$											



## Appendix E: Regression analysis calculations - continued

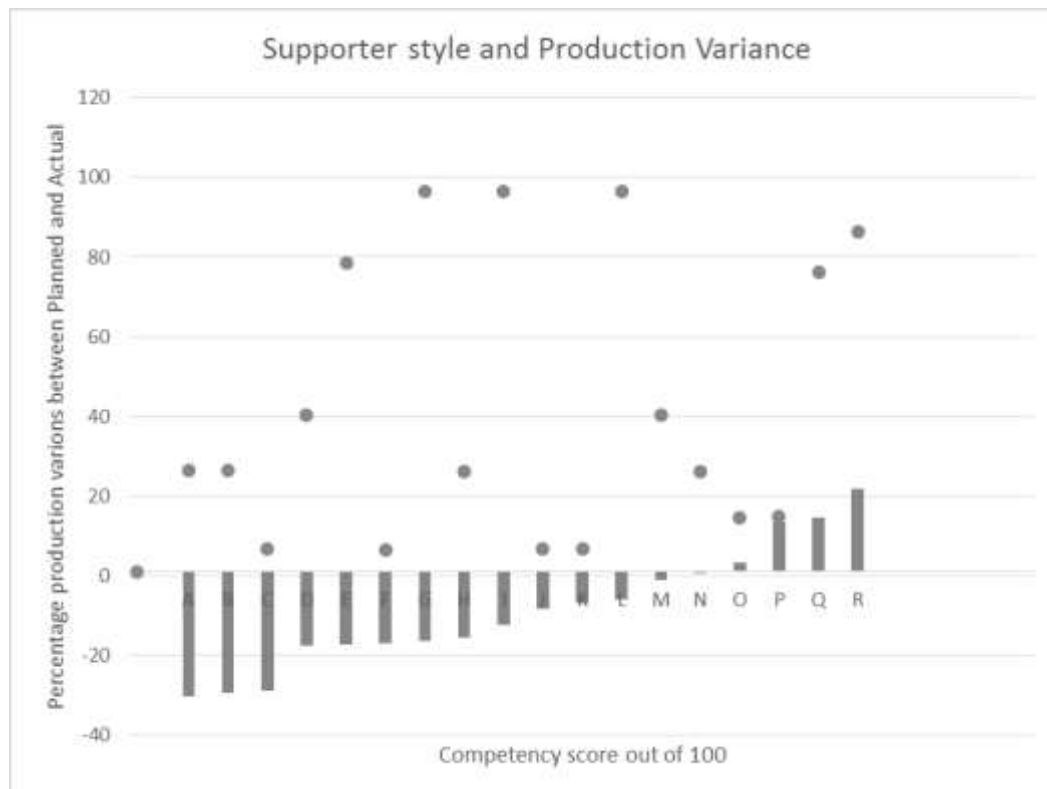
Competency:													
Performance output (Raw scores represented in Y)													
Trend projection method for forecasting													
Respondent	Competency score	factor	# Variance % to Business plan										
	Y	1	X		(X- $\bar{X}$ ) <sup>2</sup>		(X- $\bar{X}$ )(Y- $\bar{Y}$ )		(Y- $\bar{Y}$ ) <sup>2</sup>	$\bar{Y}$	(Y- $\bar{Y}$ ) <sup>2</sup>	( $\bar{Y}$ - $\bar{Y}$ ) <sup>2</sup>	
1	15	15.2	-30 %	-30	470.3		757.8		1221	45	1453975	26	
2	98	97.7	-29 %	-29	438.6		-996.5		2264	45	4691447	24	
3	25	25.1	-29 %	-29	409.5		505.7		625	45	359414	23	
4	56	55.5	-18 %	-18	81.8		-49.1		29	48	679	5	
5	13	13.2	-17 %	-17	76.0		321.6		1361	48	1816662	4	
6	24	23.9	-17 %	-17	73.5		224.2		684	48	435598	4	
7	84	83.6	-16 %	-16	61.6		-263.1		1123	48	1079877	3	
8	70	70.3	-16 %	-16	49.8		-142.3		406	48	112954	3	
9	2	2.2	-12 %	-12	14.4		181.7		2297	49	5268576	1	
10	73	73.0	-8 %	-8	0.0		2.7		526	50	205310	0	
11	72	71.7	-7 %	-7	2.3		32.9		466	50	155181	0	
12	24	23.9	-6 %	-6	6.4		-66.3		686	51	437713	0	
13	55	54.7	-1 %	-1	55.3		34.5		22	52	1104	3	
14	83	83.2	1 %	1	83.0		301.9		1099	52	1031312	5	
15	70	69.7	3 %	3	140.9		232.4		383	53	98357	8	
16	39	39.2	13 %	13	477.4		-237.3		118	55	6203	26	
17	37	37.0	15 %	15	537.2		-304.1		172	56	18285	30	
18	63	62.6	22 %	22	917.6		379.5		157	57	8897	51	
$\sum Y$	901.66	$\sum X$	-153.24	$\sum (X-\bar{X})^2 =$	3895.7	$\sum (X-\bar{X})(Y-\bar{Y}) =$	916.2	$\sum (Y-\bar{Y})^2 =$	13638	$\sum (Y-\bar{Y})^2 =$	17181544	$\sum (\bar{Y}-\bar{Y})^2 =$	215
$\bar{Y} = \sum Y / N =$	50.09222222	$\bar{X} = \sum X / N =$	-8.513326461					SST =	13638	SSE =	17181544	SSR =	215
Now: $\hat{Y} = b(0) + b(1)X$								Coefficient of Determination	$r^2 =$	0.016 (SSR/SST)			
								Correlation Coefficient	$r =$	0.126			
and	$b(1) = \frac{\sum (X-\bar{X})(Y-\bar{Y})}{\sum (X-\bar{X})^2}$												
	$= 0.2351792$												
and	$b(0) = \bar{Y} - b(1)(\bar{X})$												
	$= 52.0943797$												





## Appendix E: Regression analysis calculations - continued

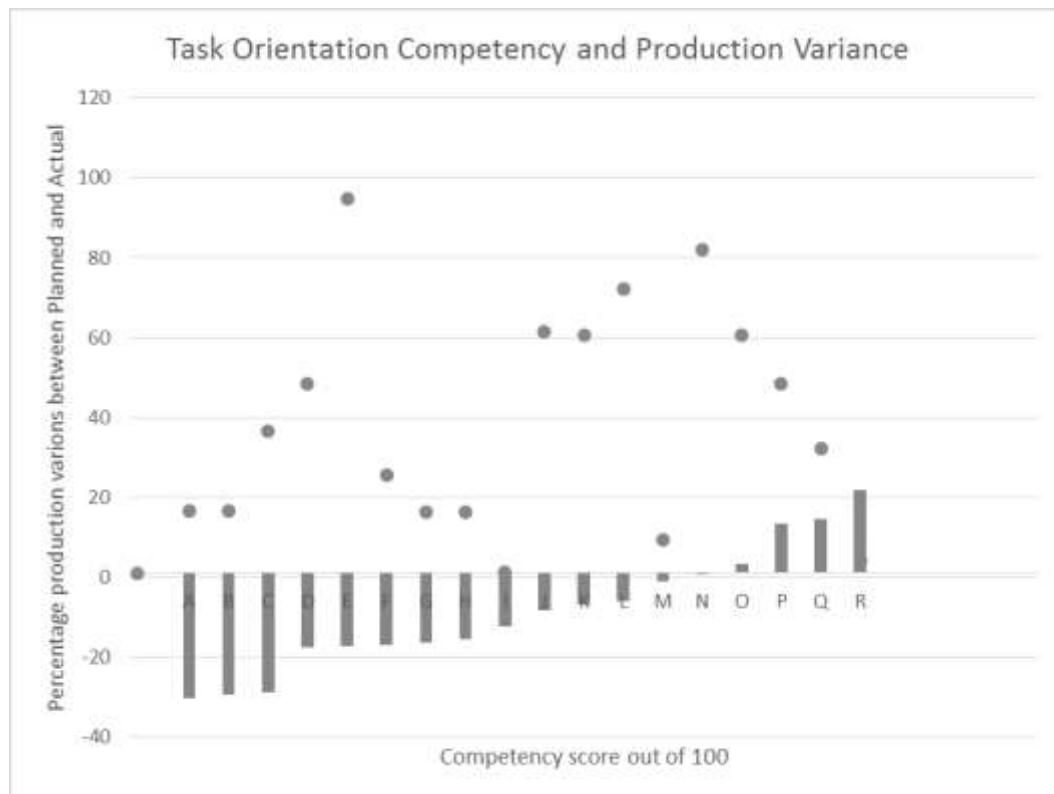
Competency:													
Supporter Style (Raw scores represented in Y)													
Trend projection method for forecasting													
Respondent	Competency score	factor	# Variance % to Business plan										
	Y	1	X		(X- $\bar{X}$ ) <sup>2</sup>		(X- $\bar{X}$ )(Y- $\bar{Y}$ )		(Y- $\bar{Y}$ ) <sup>2</sup>	$\bar{Y}$	(Y- $\bar{Y}$ ) <sup>2</sup>	(Y- $\bar{Y}$ ) <sup>2</sup>	
1	26	26.3	-30 %	-30	470.3		359.2		274	32	61515	125	
2	26	26.4	-29 %	-29	438.6		345.9		273	32	60673	117	
3	7	6.6	-29 %	-29	409.5		734.0		1316	32	1713913	109	
4	40	40.2	-18 %	-18	81.8		24.1		7	38	1099	22	
5	79	78.5	-17 %	-17	76.0		-310.5		1269	38	1416070	20	
6	6	6.5	-17 %	-17	73.5		312.3		1327	38	1742980	20	
7	96	96.4	-16 %	-16	61.6		-420.1		2863	39	7653489	16	
8	26	26.2	-16 %	-16	49.8		118.0		279	39	64092	13	
9	96	96.5	-12 %	-12	14.4		-203.0		2867	41	7676978	4	
10	7	6.8	-8 %	-8	0.0		-4.2		1305	43	1685207	0	
11	7	6.6	-7 %	-7	2.3		-55.3		1315	44	1711988	1	
12	96	96.4	-6 %	-6	6.4		135.5		2863	44	7653489	2	
13	40	40.4	-1 %	-1	55.3		-19.0		7	47	1144	15	
14	26	26.2	1 %	1	83.0		-152.2		279	48	64092	22	
15	15	14.6	3 %	3	140.9		-335.6		799	49	615884	38	
16	15	14.8	13 %	13	477.4		-613.6		789	54	598898	127	
17	76	76.3	15 %	15	537.2		773.8		1115	55	1078155	143	
18	87	86.5	22 %	22	917.6		1320.9		1901	59	3294163	244	
$\Sigma Y$	772.27	$\Sigma X$	-153.24	$\Sigma(X-\bar{X})^2=$	3895.7	$\Sigma(X-\bar{X})(Y-\bar{Y})=$	2010.1	$\Sigma(Y-\bar{Y})^2=$	20848	$\Sigma(Y-\bar{Y})^2=$	37093828	$\Sigma(Y-\bar{Y})^2=$	1037
$\bar{Y}=\Sigma Y/Nr=$	42.90388889	$\bar{X}=\Sigma X/Nr=$	-8.513326461					SST=	20848	SSE=	37093828	SSR=	1037
Now: $\hat{Y}=b(0)+b(1)X$								Coefficient of Determination	$r^2=$	0.050	(SSR/SST)		
								Correlation Coefficient	$r=$	0.223			
and	$b(1)=$	$\Sigma(X-\bar{X})(Y-\bar{Y}) / \Sigma(X-\bar{X})^2$											
		$= 0.5159787$											
and	$b(0)=$	$\bar{Y}-b(1)(\bar{X})$											
		$= 47.2965844$											





## Appendix E: Regression analysis calculations - continued

Competency:													
Task orientation (Raw scores represented in Y)													
Trend projection method for forecasting													
Respondent	Competency score	factor	# Variance % to Business plan		(X- $\bar{X}$ ) <sup>2</sup>	(X- $\bar{X}$ )(Y- $\bar{Y}$ )		(Y- $\bar{Y}$ ) <sup>2</sup>	$\bar{Y}$	(Y- $\bar{Y}$ ) <sup>2</sup>		( $\bar{Y}$ - $\bar{Y}$ ) <sup>2</sup>	
1	17	16.6	-30 %	-30	470.3	487.8		506	36	239527		10	
2	17	16.7	-29 %	-29	438.6	468.6		501	36	234170		9	
3	37	36.6	-29 %	-29	409.5	49.7		6	36	935		8	
4	48	48.3	-18 %	-18	81.8	-84.0		86	38	1436		2	
5	95	94.9	-17 %	-17	76.0	-486.5		3114	38	9117151		2	
6	26	25.6	-17 %	-17	73.5	115.5		182	38	24325		2	
7	16	16.3	-16 %	-16	61.6	178.6		518	38	251442		1	
8	16	16.4	-16 %	-16	49.8	159.7		512	38	245431		1	
9	1	1.2	-12 %	-12	14.4	143.5		1433	39	2049813		0	
10	61	61.3	-8 %	-8	0.0	2.6		496	39	188755		0	
11	61	60.6	-7 %	-7	2.3	32.9		465	39	163602		0	
12	72	72.1	-6 %	-6	6.4	83.7		1093	39	1041617		0	
13	9	9.3	-1 %	-1	55.3	-220.9		884	40	764190		1	
14	82	82.0	1 %	1	83.0	391.5		1848	40	3117929		2	
15	60	60.5	3 %	3	140.9	254.5		460	41	159214		3	
16	48	48.3	13 %	13	477.4	202.5		86	42	1409		10	
17	32	32.2	15 %	15	537.2	-160.0		48	42	241		11	
18	4	4.0	22 %	22	917.6	-1060.6		1226	43	1493119		19	
$\Sigma Y$	702.97	$\Sigma X$	-153.24	$\Sigma(X-\bar{X})^2=$	3895.7	$\Sigma(X-\bar{X})(Y-\bar{Y})=$	559.1	$\Sigma(Y-\bar{Y})^2=$	13461	$\Sigma(Y-\bar{Y})^2=$	19094306	$\Sigma(\bar{Y}-\bar{Y})^2=$	80
$\bar{Y}=\Sigma Y/N=$	39.05388889	$\bar{X}=\Sigma X/N=$	-8.513326461					SST=	13461	SSE=	19094306	SSR=	80
Now: $\bar{Y}=b(0)+b(1)X$								Coefficient of Determination	$r^2=$	0.006	(SSR/SST)		
								Correlation Coefficient	$r=$	0.077			
and	$b(1)=$	$\Sigma(X-\bar{X})(Y-\bar{Y}) / \Sigma(X-\bar{X})^2$											
		$= 0.1435115$											
and	$b(0)=$	$\bar{Y}-b(1)(\bar{X})$											
		$= 40.2756487$											



## Appendix E: Regression analysis calculations – continued

Competency:													
Operator Style (Raw scores represented in Y)													
Trend projection method for forecasting													
Respondent	Competency score	factor	# Variance % to Business plan		(X- $\bar{X}$ ) <sup>2</sup>	(X- $\bar{X}$ )(Y- $\bar{Y}$ )		(Y- $\bar{Y}$ ) <sup>2</sup>	$\bar{Y}$	(Y- $\bar{Y}$ ) <sup>2</sup>		(Y- $\bar{Y}$ ) <sup>2</sup>	
	Y	1	X										
1	45	45.4	-30 %	-30	470.3	69.4		10	39	1238		93	
2	32	32.1	-29 %	-29	438.6	346.8		274	39	58621		86	
3	21	20.8	-29 %	-29	409.5	562.7		773	40	566246		81	
4	61	60.5	-18 %	-18	81.8	-107.8		142	45	6656		16	
5	32	32.5	-17 %	-17	76.0	140.7		260	45	51968		15	
6	21	21.0	-17 %	-17	73.5	237.2		765	45	553571		14	
7	33	32.5	-16 %	-16	61.6	126.6		260	45	51666		12	
8	84	84.4	-16 %	-16	49.8	-252.5		1279	45	1426870		10	
9	97	96.8	-12 %	-12	14.4	-182.8		2325	47	4966164		3	
10	46	45.5	-8 %	-8	0.0	-0.4		10	49	1295		0	
11	84	84.2	-7 %	-7	2.3	54.3		1265	49	1395124		0	
12	1	0.7	-6 %	-6	6.4	-121.2		2292	50	5251407		1	
13	61	60.5	-1 %	-1	55.3	88.5		142	52	6619		11	
14	6	5.9	1 %	1	83.0	-388.8		1822	53	3299177		16	
15	46	46.4	3 %	3	140.9	-26.6		5	54	1711		28	
16	84	84.3	13 %	13	477.4	779.0		1271	58	1408426		94	
17	96	95.6	15 %	15	537.2	1088.2		2204	59	4447413		106	
18	26	26.0	22 %	22	917.6	-685.2		512	62	235797		181	
$\Sigma Y$	875.13	$\Sigma X$	-153.24	$\Sigma(X-\bar{X})^2=$	3895.7	$\Sigma(X-\bar{X})(Y-\bar{Y})=$	1728.0	$\Sigma(Y-\bar{Y})^2=$	15613	$\Sigma(Y-\bar{Y})^2=$	23729971	$\Sigma(\bar{Y}-\bar{Y})^2=$	766
$\bar{Y}=\Sigma Y/Nr=$	48.61833333	$\bar{X}=\Sigma X/Nr=$	-8.513326461					SST=	15613	SSE=	23729971	SSR=	766
Now: $\hat{Y}=b(0)+b(1)X$								Coefficient of Determination		$r^2=$	0.049 (SSR/SST)		
								Correlation Coefficient		$r=$	0.222		
and	$b(1)=\frac{\Sigma(X-\bar{X})(Y-\bar{Y})}{\Sigma(X-\bar{X})^2}$												
	$= 0.4435629$												
and	$b(0)=\bar{Y}-b(1)(\bar{X})$												
	$= 52.3945289$												

