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Valuation of Plant & Equipment by the Industrial Development Corporation in South Africa (IDC)

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Valuation of Plant & Equipment by the Industrial Development Corporation in South Africa (IDC)

Tinotonga Chadyiwa

A research report submitted to the Faculty of Commerce, Law and Management, University of the Witwatersrand, in partial fulfilment of the requirements for the degree of Master of Business Administration

Johannesburg, 2012

ABSTRACT

This research was primarily aimed at identifying and reviewing the use of depreciation factors when undertaking valuation of plant and machinery assets, particularly those under security. This will guide the changes that the Industrial Development Corporation (IDC) should implement in dealing with the uncertainties which arise when valuing plant and equipment and in improving security from current and prospective operational clients. The research will Identify possible losses from liquidation of current and prospective operational clients and propose suitable valuation procedure for equipment to be secured.

The researcher conducted a case study survey from the IDC's operational strategic business units (SBUs) employees. The data for the research was collected using a questionnaire in a structured survey format and examining current records on trends with regards to the propositions. For each of the SBUs, copies of well-structured questionnaires were given to an account manager. The study also sampled valuation reports prepared by valuers at IDC. The contents of valuation reports were examined and compared with data recovered by IDC after a client default.

The researcher noted that recoveries from physical collateral generally lagged behind expected recoveries as reported in valuation reports. There were, however, mixed responses on the certainty and uncertainty of valuation figures reported. The key findings were that there was a need to re-look at the factors considered in the valuation practice.

The recognition of appraisal depreciation considers the progressive decline in value as operational use and changes to the technical and economic environment diminish the worth of an asset. The expected asset retirement profile with its influence on life characteristics, in addition to the applied operation and maintenance policies, influences the rate of asset depreciation. These factors play a critical role in making sound estimates as far as valuation is concerned.

DECLARATION

I, Tinotonga Chadyiwa, declare that this research report is my own work except as indicated in the references and acknowledgements. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in this or any other university.

Tinotonga Chadyiwa

Signed at ……

On the …….. day of …… 2012

DEDICATION

This thesis would be incomplete without a mention of the support given to me by my parents since the beginning of my studies. They have been a great source of motivation and inspiration.

Finally, this thesis is dedicated to all those who believe in the richness of learning.

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1 INTRODUCTION

1.1 Purpose of the study

The purpose of this research is to carry out an analysis of the valuation of plant and machinery practices at the Industrial Development Corporation of South Africa (IDC). This study examines aspects of plant and machinery valuation processes on the method of determining the depreciation of plant and machinery assets to be placed under a security loan agreement. In addition this study will give some information and guidelines on the valuation of plant and machinery under liquidation. This will aid the investigation of possible recovery in the case of bankrupt clients. The analysis and assessment is intended to help IDC to implement measures to improve its security on clients requiring funding as well as in the event of liquidation. The implementation process with respect to funding securitisation will make it more conducive for IDC's investment to achieve a long-term balance.

1.2 Context of the study

The plant and machinery valuation is a multi-disciplinary subject involving law, economics, accountancy, insurance, planning, environmental science, industry processing/engineering etc. over and above techniques of valuation (Budhbhatti, 2002). Budhbhatti (2002) also emphasises that the valuer must possess team leadership skills and must be able to weigh appropriately all information collected from various sources. Therefore it is important for the valuer to understand fundamental principles of plant and machinery valuation practices as well as personnel management and business skills.

Plant, machinery and equipment are analysed with regards to the amount a lender might realise should the loan go into default (McClurg, 2002).

In the event of a default, McClurg (2002) indicated that assets are surrendered to the lender and sold gradually on the used equipment market. The author also indicated that some manufacturing facilities, however, cannot be broken up and sold gradually because the cost of dismantling the assets exceeds the amount they might realise on the open market. In this case special purpose plants commonly known as process plants may be sold on a piecemeal basis but for an amount substantially lower than their potential value.

Machinery and equipment are an important part of an asset intensive business, but are usually less important for high technology businesses where much of the value lies in intangible assets (Alico, 1989). Nonetheless, there is contention as to the actual value of such items. Alico (1989) gave an indication that a seller may state that the equipment is worth R8 million but the liquidation may only be R6 million. Monday (2009) also reiterated that the major difference between machinery and equipment and other tangible assets is based on the element of installation. Both Alico (1989) and Monday (2009) indicated that for many assets the installation costs are higher than the machine cost itself. These authors then concluded that these situations in the market transactions of used machinery may or may not represent the subject machine's value to the business enterprise.

The demand for distress funding from the IDC to address the moderation in gross domestic product (GDP) growth in the country, the current rise in corporate liquidations and the recessionary conditions being experienced is likely to remain strong (in at least the short to medium term) (IDC, 2010). The repercussion for IDC's Evaluations Department is the increased number of valuations and collateralisation advices for the clients, where data is regularly less ordered, and timing is paramount. As John (2009) indicated, a model needs to be put across while completing appraisals to improve on forced sale values. He also pointed out that liquidation appraiser models from used market values can be adjusted by applying a percentage change to derive an appropriate liquidation value.

IDC has also noted that recoveries from physical collateral seems to generally lag behind expected recoveries (IDC Evaluations Department, 2010). The IDC's Evaluations Department noted that the disparity between expected and actual recoveries might be due to over-optimism and/or wrong assumptions in calculation of the security cover for the approval of funds.

Valuation of plant and machinery is a subject that needs special skills and expertise. However, in South Africa there are no specific or standard guidelines in order to assist the valuer on plant and machinery valuation (Sahray, 2009). Valuation reports are required to professionally comply with international standards as set by the International Valuation Standards Committee (IVSC). Based on this, this study is expected to be able to give awareness and guidelines to the new practitioners in the plant and machinery valuation for the purposes of collateral. Besides that, this research will also be expected to be able to give some guidelines and procedure on plant and machinery valuation processes, indirectly generate knowledge and give exposure to the valuers in valuing plant and machinery.

The Industrial Development Corporation of South Africa (IDC) is a self-financing, national development finance institution (DFI). It was established in 1940 to promote economic growth and industrial development in South Africa (IDC SA, 2010). It operates in a broad spectrum of industries with specialised knowledge and experience. It is able to offer valid and appropriate financial assistance to a wide variety of individuals and companies. The company has thirteen operational SBUs, focusing on providing finance to the resources, industrial, utilities and services industries

The IDC's Evaluations Department is responsible for the valuation of plant and equipment assets with the primary task of ensuring accuracy, reasonableness and consistency across the corporation in the methodologies applied to and outcomes of physical asset valuations. This is done for the purposes of:

- Validating and independently reviewing and determining appropriate asset values for the purpose of determining purchase prices, authenticating shareholders' contributions, verifying security cover for new and existing loans and establishing reserve prices at disposal, etc.
- Determining fair and forced sale values for credit approval purposes and providing expert advice, for instance during negotiations on mergers and acquisitions where assets weighting is crucial.
- Setting fair values to advise on disposal by private sale, formal/informal tender or public auction sales.
- Setting reserve prices at disposal through the determination of attainable liquidation values.
- To forecast total and remaining economic life of equipment.
- To determine market values for specialized assets taking into account functional and economic factors, physical obsolescence, etc.

1.3 Problem statement

1.3.1 Main problem

The purpose of this research is to identify and review the use of depreciation factors when undertaking a valuation of plant and machinery assets, particularly those under security. This will allow identification of the changes that the IDC should implement to deal with the uncertainties which arise when valuing plant and equipment and how to improve security from prospective and current operational clients. It will also identify possible causes of liquidation from prospective and current operational clients and propose a suitable valuation procedure for equipment to be liquidated.

1.3.2 Sub-problems

The first sub-problem is to identify and review the current use of depreciation factors when undertaking a valuation of plant and machinery assets, particularly those under security.

The second sub-problem is to assess the appropriateness of the current depreciation factors for securitisation.

The third sub-problem is to propose a suitable or alternative process of determining the depreciation factors of plant and machinery assets valuation, particularly those under security and those under liquidation.

1.4 Significance of the study

The study fills a gap in that there is currently little that has been done in related research addressing the magnitude of the loss due to companies liquidating while holding a plant and machinery security bond. There is no research that has been carried out at IDC in this regard. The diversity of capital assets funding in all industrial sectors that IDC funds supports the need for this research. The study will also propose an alternative method of valuing equipment in direct response to actual or perceived problems as seen by IDC. This research will also address general practice in the valuation field and provide a background on assessing external valuations done on behalf of IDC clients. This research will discuss the plant and machinery valuation process and can be used as a manual for IDC's practice.

1.5 Delimitations of the study

Limitation of this research will be on the principle used for plant and machinery valuation for market value purposes. This research will discuss only the plant and machinery valuation process and the methods used to determine the depreciation

of a plant and machinery. The report will not include the valuation practice for assets classified under buildings and property. It will also not include the valuation for insurance purposes. To a better understanding, this research will focus on IDC practice as a case study in achieving research objectives.

1.6 Definition of terms

Some of the relevant terms used in this study are defined below as follows

- **Plant and machinery valuation** can be defined as the practice of developing an opinion of the value of plant or machinery and opinion of value usually refers to the market value (Budhbhatti, 2002). In addition it can be defined as an opinion of an expert who assesses the value of an asset. The expert's assessment depends on the purpose for which the evaluation is sought and his/her honest judgment.
- **Plant**: is the assemblage of assets that are inextricably combined with each other and may include specialised non-permanent buildings, machinery and equipment (e.g. power plant, water treatment plant, clean-in-place plant etc.) (Budhbhatti, 2002; The Machinery & Technical Specialties Committee of the American Society of Appraisers, 2010). Plant definitions are dealt with further in Table 1 below. (t's not below, mention page number)
- **Machinery** is defined as individual machinery or a collection of machines using or applying mechanical power and having several parts, each with a definite function and together performing a certain kind of work, (such as; creasing machine, knitting machine, moulding machine etc.) (Budhbhatti, 2002).
- **Equipment** is defined as ancillary assets that are used to assist the operation of the enterprise or entity (E.g. computers, photocopiers, compressors, welders, electric scales etc.) (Budhbhatti, 2002).
- More definitions which will be referred to in this research are in **Appendix A**

1.7 Assumptions

The following assumptions have been made regarding the study:

- The sample will be able to share information on the experiences within the industries in different SBUs.
- The respondent sample will reflect the general experiences of the employees in the environments in which they work. Non-representative views will skew the results of the study and reduce its validity.
- The respondents of the research will provide a representative view of the business population within the company.
- Respondents will provide information openly and honestly.
- The total number of respondents will be sufficient to gain adequate data that would be representative of the broader population.

2 LITERATURE REVIEW

2.1 Introduction

A comprehensive literature review has been conducted to explain the following elements. The first element will be the framework of plant and machinery valuation which will include the definitions, purpose and significance of valuation. The second element will discuss the methods of valuation of Plant and Machinery, equipment life expectancy, theory of depreciation and method of depreciation and application of the appropriate methods to quantify the valuation results. Bases of valuation and the purposes of valuation will also be discussed in this section.

The South African industrial sector is fast growing (Chang, 2010) and this situation leads to the increasing need for appropriate plant and machinery valuations. This is especially required by financial institutions to measure their exposure from funded clients. However, there are no intensive and aggressive efforts being done to generate knowledge and exposure to the valuers on the subject matter (Sahray, 2009). Sahray (2009) indicated that the valuation process of plant and machinery involves a lot of work and calls for plant valuers with high expertise. The identification of factors of depreciation for plant and machinery is too subjective and thus requires thorough analysis (L. Miles, 1998). Derry (1993) outlines the three principal types of valuation of plant and machinery as insurance, financial transactions and open market. He also discusses the techniques appropriate to each and possible future development in the field and echoes that the demand for plant valuation services is increasing and suitably qualified students need to be persuaded to opt for what is probably the least known discipline within the valuation profession.

Inappropriate use of valuation methods to determine the depreciation of plant and machinery value, particularly those under security, is mainly driven by failure to define the premise of value that needs to be established (Seow, 2009). Seow (2009) also added that when plant and machinery assets under liquidation are to be appraised, there are a number of factors that come into play and will require determining and measuring, so that the depreciation factor can be adjusted to reflect a reasonable estimate. As a matter of fact, economies are not generally in a steady state in the sense that they do not follow a path characterised by a constant growth rate, therefore the rate of build-up depends on the sequence of prices, which interact along the way with the actual dynamics of productivity and saving rate (Paganetto, 2005). Paganetto (2005) added that asset valuation comes to the fore as an argument of the investment function in a complex way - asset valuation does not express fundamental values but reflects coordinated difficulties.

2.2 Definition and interpretation of plant and machinery

There is no statutory definition of plant. The definitions for plant and machinery have been defined in mechanical and valuation literature. These definitions are shown in Table 1 (page 10).

Table 1: Plant and machinery definitions

Source	Definition
(Dictionary, 2004)	"the machinery or equipment used in industrial or manufacturing process" or "any fixture, implants, machinery and apparatus used in carrying on any industrial process", meanwhile "Machine" can be interpreted as "an apparatus with several moving parts and design to perform a particular task, it may be driven by electricity, gas, steam, etc. or by human power", on the other hand, machine also can be interpreted as "an apparatus for applying mechanical power consisting of interrelated part with separate function, used in performance of some kind of work; a mechanical apparatus or contrivance; a mechanism etc.
(American Society of Appraisers, 1980, 2005)	Limited the term to all fixed assets other than land and buildings" in additional they also noted that where a certain structure such as dry docks, jetties, silos, unit construction, cold storage, etc. may be viewed by an owner as plant and machinery, conversely there are items within the building such as electrical cabling, switchgear overhead cranes and gantries, air conditioning plant, boiler, central heating plant, fire protection installations, light fittings, etc. which may be included in the owner's land and buildings asset register.
(Alico, 1989)	Plant and machinery can be considered as those tangible items that are not permanently affixed to the real estate and can be moved, or anything except intangibles, which are not realty and/or permanently attached to the realty. He also notes that "it does not include the land, land improvement, or building and heating element which are attached to and made part of structure" and "specific items considered as real estate by the appraisal could include acoustical ceilings, recessed fluorescent lights, wall panelling, wall-to-wall carpeting, chain link fencing, metal awnings, and stock racks on exterior walls".
(Budhbhatti, 2002)	The terms of Plant and Machinery are used to refer to installation and support facilities for manufacturing in an industry designed to perform a specific predetermined function, whether used singly or in combination with other items to enhance the productivity or operating facilities, and include all devices in fixed or moveable form, other than real estate, deployed in manufacturing, processing or assembling of product from the stage of raw material to finished goods.
(Monday, 2008)	Defined machinery as physical facilities and equipment which can be built into the plant and may have direct relationship to the value of the whole property can be considered as plant and machinery. In other words all the supporting facilities or equipment that has direct relationship to the main property are considered as plant and machinery. Plant and equipment is used to describe tangible assets that are long term in nature and are acquired for use in operations. These assets generally include such items as machinery, furniture, and vehicles. Other terms for this category of assets include plant assets and fixed assets. Items of plant and equipment are generally distinguished from current assets because fixed assets are not easily converted into cash.

2.3 Purpose and basis of plant and machinery valuation

The objective of valuation is to establish the value for a client's assets. Therefore, the valuer or appraiser must be aware of the intended use of the valuation so that the value analysis by them must use appropriate theoretical and practical approaches to come up with a valid and accurate conclusion (Alico, 1989; Budhbhatti, 2002; Derry, 1993). The purpose of valuation has to be analysed so that the proper, accurate method can be utilised.

The authors reiterated that the purpose is essential to establish the asset report content, the limiting condition, or any other parameters which will lead to a proper value analysis. A statement of any purpose is considered as a declaration by the valuer or appraiser as the objective in preparing a valuation report. There are various purposes for which a valuer or appraiser might be required to value plant and machinery (Fitoussi and Gaffard, 2005; Monday, 2009). These include sales/purchase, mortgage, merger and security.

Valuation of plant and machinery requires a considerable amount of serious work, experience, expertise and it may require a number of different bases depending on the particular circumstances to determine the scope of the valuation assignment and advise the client on the appropriate basis or bases of value to suit their needs (Musa and Škoda, 2009).

Valuation experts in general are fond of saying that valuations are more art than science (Gunderson, 2009). Gunderson (2009) went on to illustrate models to develop expected liquidation values under various scenarios to reduce risk and improve the accuracy of lending rates.

There are a number of bases of valuation, including insurance value, existing use value, open market value, force sale value, fair market value, orderly liquidation value and forced liquidation value (John, 2009). The definitions are given in Appendix A.

2.4 Valuation Approaches

There are three generally recognised approaches to the determination of value (Ahn, 2006; American Society of Appraisers, 2005; Machinery and Committee, 2005; L. Miles, 1996), namely:

- The sales comparison method,
- The cost method, and
- The income method.

The three traditional approaches to valuations can be utilised when appraising machinery and equipment. According to the authors, the cost approach and market approach are applied in the valuation of individual items of machinery and equipment and the income approach is applied in the valuation of group properties including machinery and equipment and other business assets. Through a series of calculations, the income approach determines the amount of supportable for the group of machinery and equipment (McClurg, 2002). He added that this amount of supportable is compared to the fair market value-in-place indicated by other approaches. He went on to illustrate that when using the cost approach, the appraiser first determines the proper level of current cost and then measures the future value of subject items by deducting the amount of three elements of depreciations from the current cost of subject assets.

2.4.1 The Sales Comparison Approach / Market Approach

The sales comparison approach is the best method in determining the value. This approach is generally considered the most reliable if adequate comparable sales exist. The appraiser adjusts the prices that have been paid for assets comparable to the asset being appraised, equating the comparable to the subject (Machinery and Committee, 2005).This method also examines the price or price per unit area of similar plant and machinery being sold in the market place (Ahn, 2006). Hence, the sales of properties similar to the subject are analysed and the sales price

adjusted to account for the difference of the comparable and the subject to determine the value of the subject asset.

However, because of inadequate comparable sales and inefficiency in data collection, the comparison method cannot always be relied on for the plant and machinery valuation (Barry and Duncan, 2005). In future, the market needs for the plant and machinery valuation could reach a higher level, as Barry and Duncan (2005) indicated. Plant and machinery valuation can be very complex and specialised in nature. Due to little and insufficient market evidence, the comparison method will not be reliable, hence the use of the cost method will be critical (Sahray, 2009).

2.4.2 Cost Method

In the cost approach theory, the value of a plant and machinery is estimated as the value of new plant and machinery minus the depreciation value of the plant and machinery plus other relevant costs (labour, transportation, and other costs) (Ellsworth, 2009a). The appraiser adjusts the new replacement cost of the asset being appraised for the loss in value caused by physical deterioration, functional obsolescence and economic obsolescence (Machinery and Committee, 2005). The author further indicated that this technique is often referred to as abbreviation RCNLD (reproduction cost new less depreciation or replacement cost new less depreciation), reproduction referring to reproducing an exact replica. Replacement cost refers to the cost of plant and machinery or other support machinery which has the same utility, workmanship and materials. In practice, appraisers use replacement cost and then deduct a factor for any functional disutility associated with the age of the subject equipment.

The cost approach rests mainly on the principle of substitution, whereby the prudent buyer will not pay more for an asset than the cost of acquiring a substitute asset of equivalent property (Budhbhatti, 2002). Thus a willing buyer for a plant and machinery will pay no more than the price of the plant and machinery of comparable utility.

The cost approach estimate value using the economic principle of substitution: a buyer will pay no more for an asset than the cost to obtain an asset of equal utility, whether by purchase or by construction.

The cost approach method is commonly used for the valuation of specialised assets that are rarely, if ever, sold in the market, except by way of sale of the business or entity of which it is part, due to uniqueness arising from its specialised nature and design, its configuration, size, location or other characteristic.

When replacement cost and depreciation are derived from the market, depreciated replacement cost (DRC) is regarded as an acceptable indication of market value.

2.4.3 The income method

For valuation of plant and machinery generating income for the business, the use of the investment/income approach is widely accepted (Ellsworth, 2009a; Fitoussi and Gaffard, 2005). The authors added that this approach is used for process plant or machinery that generates income from rents or leases and when neither the market comparison approach nor cost approach can provide an adequate and accurate analysis of value.

This approach is frequently used to value a group of assets or an individual machinery unit that is utilised in aggregate to generate an income stream. This collection of assets, along with intangible and working capital assets, is frequently referred to as a business enterprise or going concern (American Society of Appraisers, 2005).

The income approach in its simplest form is the estimation of present worth of future benefit accruing to the owner of the plant and machinery or to specific interests or rights one enjoys in the property (Budhbhatti, 2002). It is perhaps the best method to value the plant and machinery because it is considered the best measurement of total depreciation of all assets and bears reflection of the rationale behind all decisions (Rahayu, 2006).

Simply, this method estimates the value of a property along the lines of revenue potential, therefore the income that can be generated either from rental income or re-sale value. However, as this approach can be considered as the most desirable method due to valuation of going concerns business enterprise considering the aggregate overview of the contribution of each asset, working capital, fixed or intangible asset is as a whole not applicable to individual machinery and equipment (Budhbhatti, 2002)

2.5 Depreciation

Depreciation is an important factor in the widely used cost method (Budhbhatti, 2002; Ellsworth, 2009b). The authors defined depreciation as a loss in value of the plant and machinery due to various causes or factors generally identified as physical deterioration, functional, technological and economical obsolescence. According to the authors, there are three types of depreciation which are summarised below.

2.5.1 Physical Deterioration

Assets experience physical deterioration as a consequence of wear and tear, deterioration of individual equipment components, action of the elements and use in service (American Society of Appraisers, 2009; Ellsworth, 2009b). Physical deterioration is evidenced by observed conditions, such as worn equipment components, metal fatigue, and corrosion. Physical deterioration represents the decline from physical factors that reduce an asset's capabilities (Fallon, 1975). Both Ellsworth (2009b) and Fallon (1975) agreed that the maintenance policies and procedures applied to an asset are an important consideration when establishing physical deterioration, since a comprehensive maintenance program slows the physical deterioration process, while an inadequate maintenance program hastens physical deterioration. With operational use, remaining life decreases and an asset's value relative to its replacement cost declines with

increasing age as a result of the asset operating less efficiently and requiring more maintenance than it did when it was first placed in service (Fitoussi & Gaffard, 2005).

2.5.2 Functional Obsolescence

Functional obsolescence is caused by internal asset characteristics, such as inefficient layout and improvements in construction techniques along with functional inadequacies or super adequacies (American Society of Appraisers, 2009). Functional obsolescence and a corresponding diminish in value are characterised by factors that lead to excess operating costs (Remsha, 2009). Remsha (2009) and American Society of Appraisers (2009) indicated that functional obsolescence is identified by comparing the cost for a substitute asset that is both functionally equivalent and efficient with the cost of assembling a facsimile of the subject asset. Any additional functional obsolescence attributable to excess operating costs for the subject asset is quantified by identifying the actual annual amount of excess operating expense for the subject asset relative to the substitute asset over its remaining useful life (American Society of Appraisers, 2005). An example of this functional obsolescence is an older cooling unit relative to a newer more energy efficient cooling unit with the same capacity.

2.5.3 Economic Obsolescence

Unlike physical deterioration and functional obsolescence, economic obsolescence is caused by factors external to the asset (Marston, 1953). Ellsworth (2009a) also agreed with Marston (1953) in that economic obsolescence is consequently referred to as external obsolescence, since it is beyond the control of the asset owner. The authors further explained that common causes of economic obsolescence include supply or demand changes for raw materials or asset output, legislative enactments requiring stricter environmental standards, and changes in general economic conditions. Reductions in asset value

attributable to economic obsolescence are usually beyond the ability of the asset owner to influence (Fallon, 1975). The measurement of economic obsolescence is achieved through an analysis of the present value of the detriment associated with the external factors influencing asset value (Ellsworth, 2009a).

2.6 Equipment Life Expectancy

The analytical process associated with understanding the potential influences acting on the equipment asset is an important element in developing the consumption pattern of the imbedded capabilities (American Society of Appraisers, 2005). According to the author, equipment depreciation patterns reflect the influence of factors such as physical characteristics, historic utilisation rates, applied maintenance programs and asset life expectancy. Regardless of the depreciation method selected to describe equipment behaviour, the depreciation method should adequately reflect the economic pattern of decline associated with the equipment asset (Ellsworth, 2009a).

The Weibull distribution is a mathematical distribution widely used to describe the equipment life expectancy and to depict survival characteristics for a variety of populations. For valuation applications, the Weibull distribution is defined as a two-parameter distribution described by the following mathematical relationship (American Society of Appraisers, 2005; Ellsworth, 2009a; Pinder III *et al*., 1978):

$$S(t) = 1 - \exp(-(t/a)^b), \quad t \geq 0,$$

where

S(t) = Survival percentage at age t

t = Age or length of the customer account relationship

exp = Exponential function

a = Scale parameter

b = Shape parameter

The Weibull distribution is a generalisation of the exponential distribution with the ability to portray the depreciation over life of the equipment. The figure below illustrates how the depreciation is calculated under the life expectancy method.

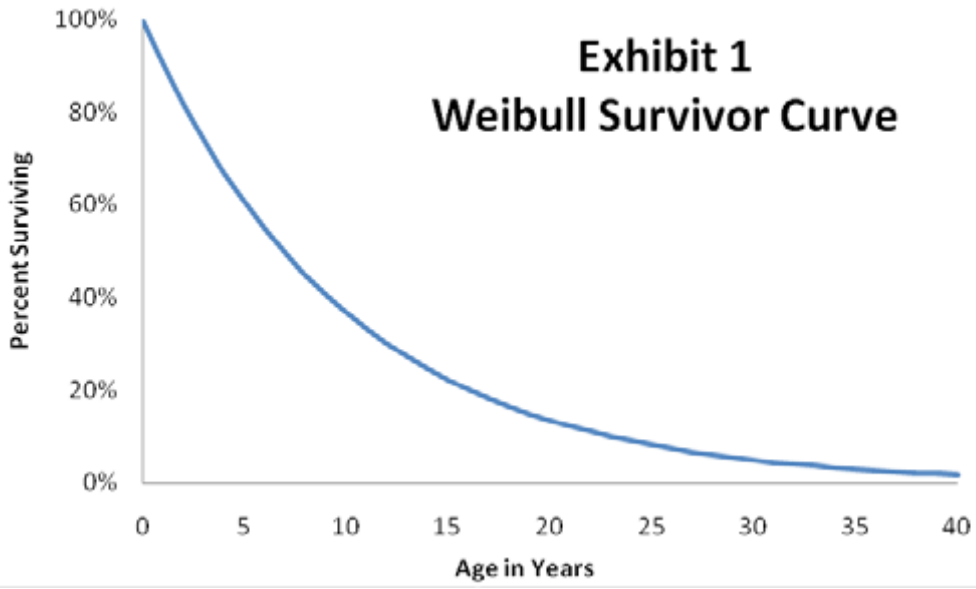


Figure 1: Weibull survivor curve (Ellsworth, 2009a).

Iowa-type survivor curves employ a nomenclature that involves average life and retirement behaviour pattern to designate individual survivor curves. The Iowa-type survivor curves are grouped into four families L, S, R, and O based on the position of the modal frequency relative to average life. The L curves have the modal frequency to the left of the average life, the S curves have the modal frequency at the average life and the R curves have the modal frequency to the right of average life. The O curves have the position of the modal frequency at the origin (Ellsworth, 2009a; L. Miles, 1998; L. H. Miles, 2009).

The Iowa-type survivor curves are further identified by a number that indicates the width of the dispersion pattern, with a low number indicating a wide dispersion pattern and a relatively low frequency of modal retirements. Similarly, a high number indicates a narrow dispersion pattern and a relatively high frequency of

modal retirements. A revised version of Iowa Engineering Experiment Station Bulletin 125, Statistical Analysis of Industrial Property Retirements, was published in 1967 and describes the four survivor curve family types for estimating life characteristics.

The survivor curve depicts the relationship between the percent of the equipment population surviving and asset age. Exhibit 2 illustrates the survivorship profile for an asset population following an Iowa L2 survivor curve with a ten-year life.

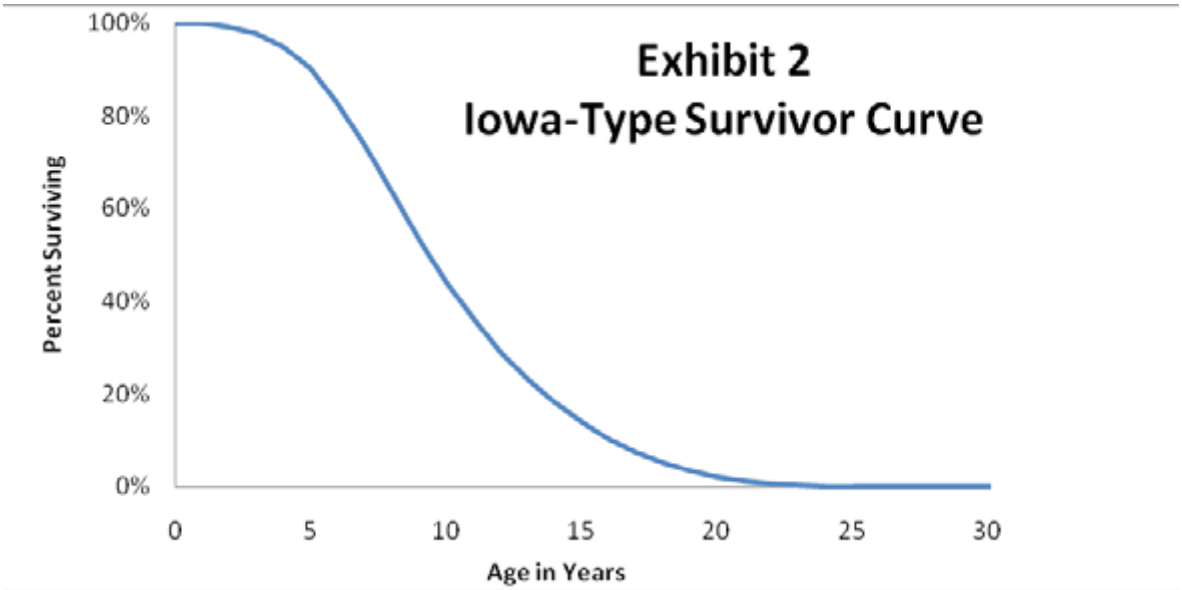


Figure 2: Iowa –type survivor curve (Ellsworth, 2009a).

The development of a complete survivor curve from equipment population retirement characteristics yields estimates of the life characteristics including average life, remaining life and probable life. Average life is the length of time over which an equipment asset is expected to remain in service and is calculated as the area under the survivor curve. Remaining life is the period of time from the chronological age of the equipment to its projected retirement date. Remaining life is calculated as the area under the survivor curve to the right of the equipment age divided by the percent surviving from the survivor curve at that age. Probable

life is the time period from the placed-in-service date to the expected retirement date for the equipment asset and is calculated as the sum of equipment age and its remaining life.

Exhibit 3 graphically presents both the ten-year Iowa L2 survivor curve and its associated probable life curve.

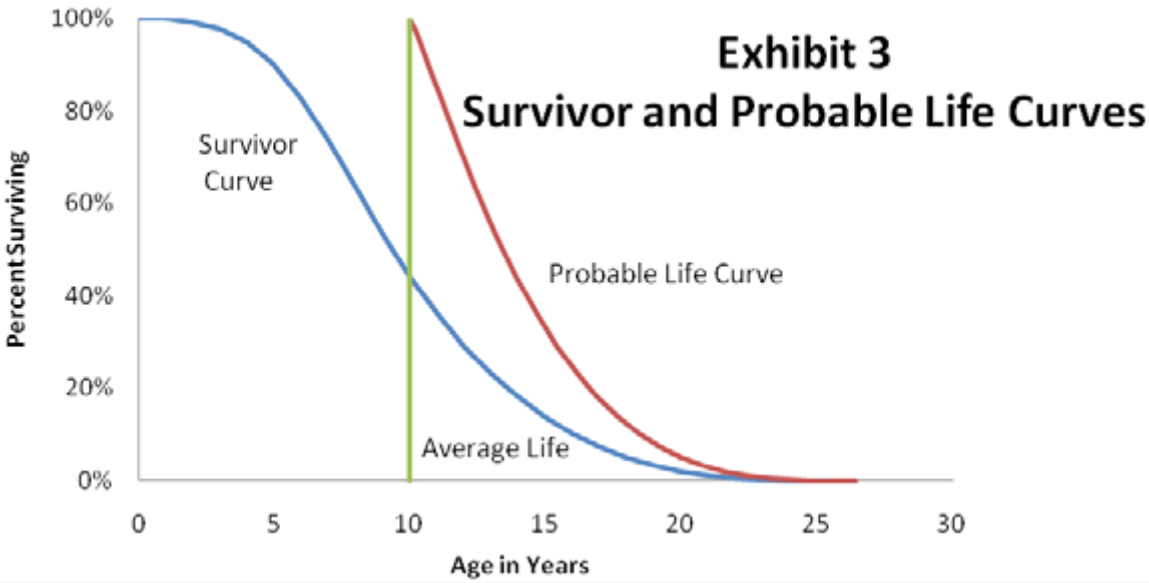


Figure 3: Survivor and probable life curves (Ellsworth, 2009a).

The life expectancy concepts identified previously are illustrated numerically for an equipment population following the retirement pattern of an Iowa L2 curve with a ten-year life. If the observed chronological age for an equipment asset is ten years, then its remaining life and probable life can be estimated from the survivor curve. In the case of an equipment asset with an observed age of ten years, its remaining life is calculated as the area under the survivor curve to the right of ten years divided by the percent surviving at ten years, which is equal to four years. Consequently, the probable life for an equipment asset following a ten-year Iowa L2 survivor curve pattern that has a chronological age of ten years is fourteen years (the age of ten years plus the remaining life of four years).

Exhibit 4 illustrates the previously discussed life expectancy concepts and presents the survivor curve, probable life curve, chronological age and remaining life for an equipment population with a ten-year life following an Iowa L2 survivor curve.

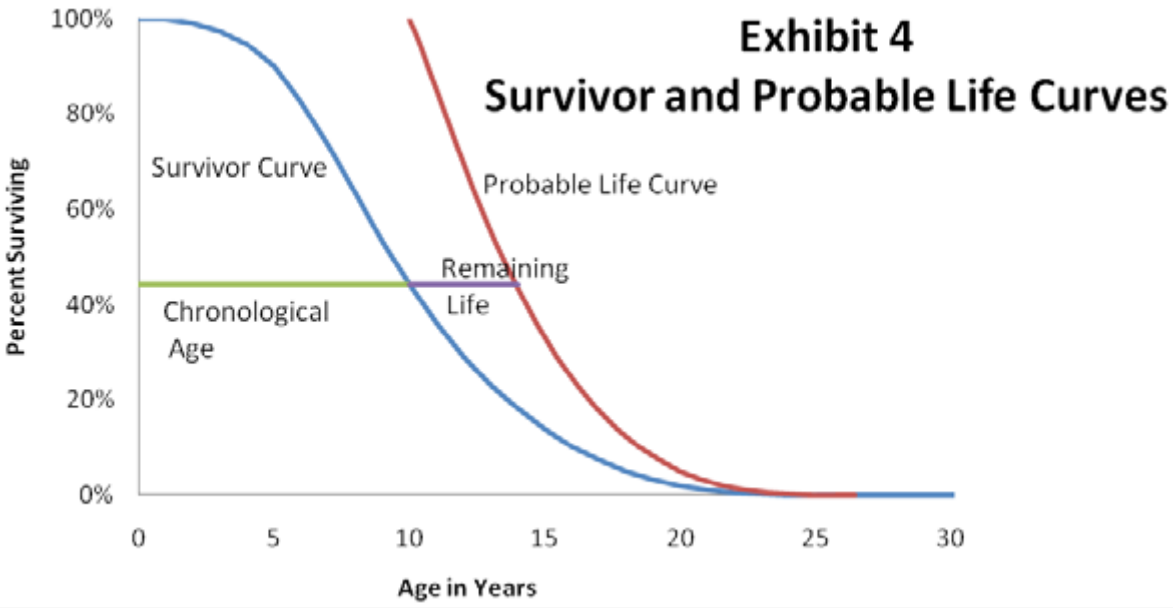


Figure 4: Survivor and probable life curves (Ellsworth, 2009a).

With knowledge of the survivor curve characteristics associated with the equipment, the probable life and remaining life curves can be developed to estimate the percent good profile for the equipment.

2.7 Methods of Depreciation

Depreciation methods recognize the diminished economic attractiveness as operational use and environmental exposure take their toll on an asset (Derry, 1993; Ellsworth, 2009a). Derry (1993) went on to explain that depreciation methods seek to describe the decline experienced by equipment assets during

their operational lifetime. Various depreciation methods have been used historically to describe the decline pattern followed by equipment assets.

Ellsworth (2009a) also argued that depreciation represents the progressive decline experienced by equipment assets after being placed in service as operational use and exposure to the environment diminish their attractiveness relative to a new asset. He said that the challenge in estimating depreciation is to develop methods that adequately describe the decline in economic attractiveness experienced by equipment assets as they are operated for their intended purpose. Depreciation recognizes the inability of equipment assets to perform as effectively relative to when they were originally placed in service (American Society of Appraisers, 2009).

Equipment depreciates and the decline pattern is influenced by many factors which include the physical characteristics, historic utilisation rates, applied maintenance programs and life expectancy (Derry, 1993). Ellsworth (2009) in his articles echoed Derry (1993)'s explanation that historically, various depreciation methods have been used to describe the behaviour of economic decline associated with equipment assets. Budhbhatti (2002) indicated that there are two methods of depreciation available to valuers, that is, the reducing balance depreciation and straight line depreciation. He also mentioned that there are many variations to these historical methods.

The selection of a particular depreciation method influences the depreciation profile for the equipment asset with a corresponding effect on the magnitude of the depreciation pattern and the resultant value estimate (Budhbhatti, 2002; Derry, 1993).

Depreciation methods describe the reduction in value through operational use and exposure to the elements that reduce the economic attractiveness of equipment assets (Lonergan, 2009). He also added that the application of depreciation methods considers factors such as life expectancy, physical condition, future service capabilities and other judgments in developing estimates of depreciation.

Depreciation methods vary from simple methods that place emphasis on life expectancy as the primary focus for estimating depreciation to more complicated methods that combine life expectancy and economic attributes in addressing depreciation patterns (Monday, 2009). They also measure the decline in value inherent in the equipment asset as operational use consumes its available services (Lonergan, 2009).

2.7.1 Age/Life Method

Age/life is the commonly used method of quantifying physical deterioration as it addresses that physical condition due to wear and tear is proportioned to use rather than age (L. H. Miles, 2009). L. H. Miles (2009) added that normal useful life differs from economic life and is the period of time over which an item may reasonably be expected to physically perform the function for which it was designed, given standard preventative maintenance. The economic useful life is defined as the time period that a new equipment may be profitably used for the purpose which it was intended (Daley, 2009). This method establishes the arithmetic life cycle of the assets at the appraisal date (L. Miles, 1998; L. H. Miles, 2009). An example that Miles (2009) gave shows that an asset may have a normal physical life of ten years and chronologically be eight years old. If an inspection of an eight-year-old item, with a normal physical life of ten years, indicates that it has not suffered the normal amount of physical deterioration, its remaining useful life could be greater than the calculated two years remaining of normal useful life. Conversely, the asset may have suffered an excessive amount of deterioration in which there is no remaining life after eight years.

Another method explained by Miles (2009) is Age/Life to Core Method which utilises physical life as the appropriate measurement. An asset's physical life can continue forever if the operator continues to invest the parts and labour to rebuild or renew it. This may not be true for the asset's economic life, however. The way to account for this is to set the physical life to be no lower than its core. The core is defined as the time at which the piece must be rebuilt or repaired to be able to

continue using it. In other words, the asset does not become scrap but instead can be made to operate through an investment of parts and labour (If an asset is scrap and cannot be rebuilt, the physical life is 100% gone.). The calculations would be based upon the typical normal useful physical life between core periods (L. H. Miles, 2009).

A 20-year physical normal useful life could be as expressed in the graph shown in Figure 5 on page 5. If one assumes that the machine is used normally, there would be a constant physical depreciation over the 20 years to a point in which it would be idled or scrapped (Ellsworth, 2009a). The loss due to factors associated with functional or economic obsolescence may indicate whether a partial or total rebuild is economically possible. In this figure, Ellsworth (2009a) illustrated the stepped functional line to indicate new technology changes at various points in time. The economic obsolescence measurements are indicating a trend from outside forces. As one can see demonstrated in this graph, a measurement could be made of each factor at any point in time for calculating the value. The graph considers one piece of equipment rather than the industry and therefore relates to a specific item.

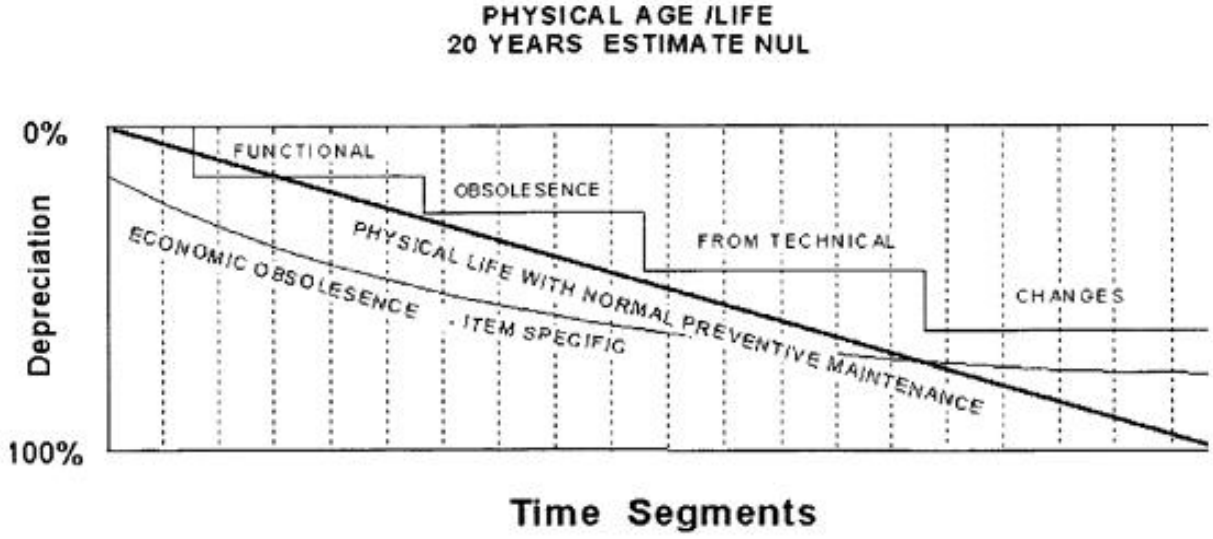


Figure 5: Physical age/life*.*

1.1.1 0-100% Method

This method is the appraiser's estimate of physical deterioration by percentage without a calculation. This is the least favoured method for quantifying the physical deterioration by the cost approach (Ellsworth, 2009a; Seow, 2009). Both authors indicated that there are times in which it is the only available option. They went on to say that sometimes an appraiser is extremely familiar with certain types of equipment and can reasonably estimate a reasonable deterioration from appearance and/or other investigation such as discussions with maintenance personnel and users of this equipment.

2.7.2 Straight Line Method

The most widely used method for estimating depreciation is the straight line method that considers the asset age and average life expectancy as the basis for developing a depreciation estimate (Ellsworth, 2009a; Monday, 2009; Stickney *et al.*). The popularity of the straight line depreciation as a method to describe the decline pattern for equipment assets arises from its ease of application and the inherent simplicity from a conceptual explanation perspective as authors explained.

In its simplest form, the straight line method uses the chronological age of the equipment asset and the average life expectancy as the basis for estimating depreciation (Ellsworth, 2009a). Depreciation can be estimated according to the following relationship:

DEPR = CA/AL,

where,

DEPR = Depreciation

CA = Chronological age

AL = Average life

Alternatively, the complement of depreciation or its percent good can be calculated to estimate the remaining services for an equipment asset. To estimate the percent good, chronological age and average life expectancy are again used to develop the estimate for the equipment asset. Percent good is estimated as follows:

PRG = (AL-CA) /AL,

where,

PRG = Percent good

CA = Chronological age

AL = Average life

To illustrate the valuation concepts discussed concerning the straight line method, assume that an estimate of depreciation and percent good is desired for an item of equipment with a replacement cost of R500, 000. The equipment is 15 years old with an average life expectancy of 20 years. Depreciation is calculated as the chronological age divided by the average life (15/20), indicating that the item of equipment is 75 percent depreciated. Similarly, percent good is calculated as the difference between average life and chronological age divided by the average life ((20-15)/20) or 25 percent remaining. Consequently, with the straight line method of depreciation for the equipment is R375, 000 (R500, 000 x 0.75) and the percent good is R125, 000 (R50, 000 x 0.25)

2.7.3 Life Expectancy Method

The life expectancy method for estimating depreciation recognises the variability of life expectancy with increasing equipment age and uses probable life rather

than average life as the basis for developing a depreciation estimate (Ellsworth, 2009a). Similar to the straight line method, the life expectancy method uses the chronological age of the equipment asset and probable life expectancy as the basis for estimating depreciation or percent good. With the life expectancy method, depreciation is estimated as follows:

DEPR = CA/PL,

where,

DEPR = Depreciation

CA = Chronological age

PL = Probable life

Similarly, with the life expectancy method, chronological age and probable life expectancy are used to estimate the percent good for the equipment asset. Percent good with the life expectancy is estimated as follows:

PRG = (PL-CA) /PL,

where,

PRG = Percent good

CA = Chronological age

PL = Probable life

Continuing the example used for the straight line and using life expectancy concepts, a 15-year-old item of equipment following a 20-year life Iowa L2 survivor curve has a probable life of 24.1 years and a replacement cost of R500, 000. Depreciation is estimated as the chronological age divided by the probable life (15/24.1) indicating that the item of equipment is 63 percent depreciated. With

the life expectancy method, percent good is calculated as the difference between the average life and chronological age divided by the average life ((24.1-15)/24.1) or 37 percent remaining. Consequently, the depreciation for the equipment is estimated to be R315, 000 (R500, 000 x 0.63) and the percent good R185, 000 (R500, 000 x 0.37).

2.7.4 **Economic Consumption Method**

This method for estimating depreciation combines the variability of life expectancy as equipment age increases with present value theory. The economic consumption method also uses probable life rather than average life as the basis for developing the depreciation estimate. Similar to the life expectancy method, the economic consumption method uses the chronological age of the equipment asset and probable life expectancy, but also includes present value concepts as part of the depreciation estimation process. The economic consumption method uses percent good to recognize the remaining capabilities available from the equipment relative to its total capabilities, while depreciation represents the consumed capabilities of the equipment asset.

Percent good with the economic consumption method is estimated through the application of the following relationship:

PRG = (1+r)^PL – (1+r)^CA/((1+r)^PL-1),

where,

PRG = Percent good

CA = Chronological age

PL = Probable life

r = rate of return/residual percentage value

Revisiting the example used for the straight line and using life expectancy concepts, a 15-year-old item of equipment following a 20-year life Iowa L2 survivor curve has a probable life of 24.1 years and a replacement cost of R500, 000. The rate of return requirement is estimated as 5 percent for the equipment asset. Percent good represents the difference between total capabilities available from the equipment less the consumed equipment capabilities divided by the total capabilities available from the equipment so that the percent good is estimated to be R260,000 (R500,000 x 0.52)

The economic consumption method is an attractive theoretical basis to estimate depreciation, because it identifies equipment value decline as the consumption of available equipment capabilities in the context of the present value of a future annuity (Ellsworth, 2009a; L. Miles, 1998).

Further modification of future capabilities may be recognized through the application of a service adjustment to reflect the decline in quality and reliability of the remaining equipment capabilities. Depreciation is thus quantified through the analysis of the consumption of available capabilities that occurs as the equipment performs its intended purpose and its available capabilities are consumed through operational use during its lifetime. Depreciation measures the reduction in value as the productive capabilities of equipment assets are consumed through operational use during its lifetime. Depreciation methods facilitate the description of the behaviour patterns followed by equipment assets and are used to estimate the expected depreciation profile associated with an equipment asset. The selection of a particular depreciation method can influence the results of the valuation analysis and consequently the selection process should be approached with care before applying a depreciation method to estimate equipment value.

2.7.5 Declining Balance Method

Declining balance is an accelerated depreciation method. Some accountants recognise that depreciation may be greatest in the early years of an asset's life

and correspondingly less in the later years (Hardin *et al.,* 1999). This is because some assets are most efficient when new and therefore contribute more and better services in the early years of useful life. The trend towards adoption of accelerated methods of depreciation is also explained by the increasingly rapid pace of technological change which makes obsolescence more important than physical deterioration. Also significant in the decision to use an accelerated method of depreciation is the prospect of reducing the current year's income tax burden by recognising a relatively large amount of depreciation expense. Another argument for allocating a comparatively large share of the cost of a depreciable asset to the early years of use is that repair expenses tend to increase as assets grow older (Hardin, et al., 1999). A method of depreciation which provides heavy depreciation charges in the first year and lessens depreciation charges in each subsequent year will tend to offset the rising trend of repair expenses. The combined expense of depreciation and repairs may be more uniform from year to year under an accelerated method of depreciation than when the straight-line method is followed. In the declining balance method the normal rate of depreciation is increased and applied to the declining balance (net book value) of the asset (Hardin *et al*., 1999).

For example, assume an asset is acquired at a cost of R500, 000 and has an estimated useful life of ten years. The normal rate of depreciation under the straight-line method would be 10 per cent. To depreciate the asset by the declining-balance method the normal rate is increased, say by 50 per cent, to 15 per cent and applied to the cost. Depreciation expense in the first year would then amount to R75, 000. In the second year, the depreciation expense would drop to R63, 750, computed at 15 per cent of the remaining book value of R425, 000. In the third year depreciation would be R54, 000 and so on. At the end of the tenth year, accumulated depreciation totals 410, 000 and the book value of the asset is R90, 000.

Assuming that the asset is retired from use at the end of the tenth year, the undepreciated cost of R90, 000 will be written off the books at the time of

disposal. Any difference between the proceeds from sale and the book value will be recorded as either a gain or loss on the disposal of the asset. If the asset is used beyond the estimated life of ten years, depreciation will be continued at the 15 percent rate on the undepreciated cost. When the declining-balance method is used, the cost of a depreciable asset will never be entirely written off as long as the asset continues in use.

Theoretically, the rate of depreciation applicable under the declining balance method is calculated as:

dr = 1 – nSqrt(S/C),

where C is the initial cost price;

S is the scrap or salvage value; and

n is the number of years of expected life.

However, in practice the depreciation rate is obtained by applying a factor to the straight-line rate (Colditz *et al*., 1988). In Australia a depreciation rate exceeding the straight-line rate by 50 percent is applied to the net book value of the asset under the declining balance method, while in the United States double the straight-line rate is used (Barton, 1984). This method is known as the double declining balance method.

Finally, it should be noted that depreciation, in the case of declining balance, is taken on the cost of the asset, not cost less the scrap value, as in the straight-line method. If depreciation is calculated on cost less the scrap value the balance will not be reduced to the required amount.

2.7.6 Sum-of-the years'-digits method

Sum-of-the-years'-digits is another method of accelerated depreciation. The depreciation rate to be used is a fraction, of which the numerator is the remaining

years of useful life and the denominator is the sum of the years of useful life (Hardin *et al*., 1999). For example, consider an asset with an initial cost of R500 000, an estimated life of four years and an estimated salvage value of R50 000. Since the asset has an estimated life of four years, the denominator of the fraction will be 10 (1 + 2 + 3 + 4 = 10). For the first year, the depreciation will be 4/10 x R500 000 or R200000. For the second year, the depreciation will be 3/10 x R500 000 or R150 000. For the third year, the depreciation will be 2/10 x R500, 000 or R100, 000 and in the fourth year, 1/10 x R500 000 or R50 000.

Numerous depreciation methods have been developed to describe the decline experienced by equipment assets as operational use and exposure to the elements diminishes their economic attractiveness when compared with a new asset (John, 2009).

2.8 Conclusion of Literature Review

The predominant issues emerging from the literature is that valuation of plant and machinery is a complex process that still requires substantial research to understand clearly and generate desired knowledge. Also emerging is the strong linkage between engineering and financial, marketing and overall general knowledge base requirements in terms of market trends.

The process of appraising plant and machinery assets involves a lot of work and thus requires plant and machinery valuers with high skills and expertise. Market comparison method has been considered as the most appropriate method. However, because of inadequate comparable sales and inefficient data collection, the application of the market comparison method is difficult, and the cost method is more reliable. Depreciation is one of the critical elements that exists in plant and machinery valuation regardless of the type and nature of the plant and machinery. The identification of the factor of depreciation for plant or machinery is normally too subjective and thus requires thorough analysis. The study revealed that the depreciation of plant and machinery is influenced by the physical deterioration,

functional obsolescence, economic obsolescence and external factors of obsolescence. Therefore, the ultimate objective of this research is to resolve the issue of inappropriate use of valuation methods to determine the depreciation of plant and machinery assets, particularly those under security and to propose a suitable process of valuation.

This study attempts to evaluate some aspects of plant and machinery valuation processes to determine the depreciation with a special reference to the valuation of equipment under IDC's terms of reference. Over and above that, this study also attempts to resolve the issues of inappropriate use of valuation methods for equipment under security and propose the most suitable process. It is a hope that this study will give some information and guidelines in the valuation of plant and machinery.

In the attempt to resolve the issues, the following propositions are postulated and tested:

2.8.1 Proposition 1:

How does the current approach of calculating depreciation improve security from prospective and current operational clients?

2.8.2 Proposition 2:

Is the current depreciation approach appropriate for the valuation of plant and equipment capital assets that are under security?

2.8.3 Proposition 3:

What will the suitable process be?

3 RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the methodology and techniques employed in order to conduct the research. The choice of both qualitative and quantitative research methods are discussed and justified followed by a review of the research design and research instruments used. Aspects relating to the selection of the research population or respondents, as well as the data collection and analysis procedure are discussed.

3.2 Research Methodology / Paradigm

This study establishes the extent to which the valuation of plant and machinery practice can be improved in light of the security of funding institutions and addresses the magnitude of IDC loss/gain due to financed companies liquidating. In addition, the study establishes the valuation practice in general for the purposes of security and in the event of liquidation. Therefore, to provide the ability to measure the propositions, the study uses both quantitative and qualitative research methods. The topic of plant and machinery valuations still requires substantial study, as gleaned from literature, especially when it entails trying to assess what would constitute an accurate valuation report. Creswell (2009) advocates quantitative research approaches for measuring the perceptions, attitudes and behaviours.

Case study research consists of detailed investigation, often with data collected over a period of time, of phenomena, within the context (Hartley, 2004). The aim is to provide an analysis of the context and processes which illuminates the theoretical issues being studied. The phenomena is not isolated from its context but is of interest precisely because the aim is to understand how behaviour and/or processes are influenced by and influence context (Hartley, 2004).

3.3 Research Design

Research design is the approach to the central research problem (Leedy & Ormrod, 2001). According to the author this provides the overall structure for the procedures that the researcher follows, the data the researcher collects and the data analysis the researcher conducts. Simply put, researcher design is planning. The research design is a plan for the study, providing the overall framework for collecting the data detailed steps in the study and guidelines for systematic gathering.

(Corbin & Strauss, 1990) define research design as the consideration and creation of means of obtaining reliable, objective and valid data. The authors further indicate that the research design is a plan that will be applied during the investigation in order to answer the research questions and aims to ensure that answers to questions are accurate. In this study the research plan was based on a case study, namely Industrial Development Corporation of South Africa.

In order to achieve the objectives set for the study, the researcher has conducted a case study survey from IDC Account Managers in 12 operational SBUs. For each of the SBUs, copies of well-structured questionnaires were provided to account managers of the SBUs. The study also sampled valuation reports prepared by valuers at IDC. The contents of valuation reports were examined and compared with what IDC recovered after a client default. The valuation reports were for security purposes and were those prepared between January, 2010 and December, 2011. The valuation reports were analysed from the Workout and Restructuring Department, where the effects of recovery are noticed when a funded client is under distress.

Table 2: Comparison of qualitative and quantitative research methods (Onwuegbuzie & Collins, 2007).

Qualitative method	Quantitative method
• Uses observation and words as data • Has a goal of exploration and discovery • Asks "how" and "why?" • Uses data collected through interviews and observation • Is case-oriented • Does not have generalisability as a goal • Uses sampling that is purposive, convenience, snowball, or quota • Use a small sample size	• Uses numerical data • Has a goal of verification or proof • Asks "how many?" • Use data collected through surveys and calculations. • Is population-oriented • Has generalisability as a goal • Uses probability sampling • Use a large sample size

The above therefore seeks to justify both quantitative and qualitative research approach chosen for the research.

3.4 Population and Sample

3.4.1 Population

According to Unrau, Krysik and Grenell (1997), the population is the entire set or universe of people, objects or events of concern to a research study, from which a sample is drawn. The population is the IDC operational SBUs in this research and the sample will comprise a number of managers and business analysts as in Table 3 at IDC because they are currently engaged in the process of due

diligence and the fact that these are the clients for the valuation department. These respondents within the population could only be those who have been in industry and with sufficient knowledge of the requirements of plant and machinery valuation. The reason for choosing IDC as the case study is the fact that all industrial units are represented; hence the diversity of the plant and machinery assets encountered is embraced. Therefore, the research gauges the usefulness of the Valuations Department as a support service at IDC with regards to valuation for security. This will aid in suggestions to cater for security valuations to improve on the business security. The IDC population adds some degree of control and homogeneity to the sampling procedure (Urban 2008).

3.4.2 Sample and Sampling method

The sample of the research was drawn from the IDC in Sandton. The sample respondents will be account managers and business analysts of the operational business units. Table 3 provides a break-down of the research sample.

Table 3: Research sample (Own compilation)

Respondent Categories	**Total**
Senior Account Managers	22
Account Managers	21
Senior Business Analysts	3
Business analysts	2
Risk Managers	1
Project Managers	1
TOTAL	**50**

A non-random (non-probability) sampling method (Onwuegbuzie & Collins, 2007) was applied to the research. The reason for this chosen method was the match

between respondent characteristics and research objectives. The goal is not to generalise a population but to obtain insights into the research objectives. The selected individuals are considered because they are expected to have better and greater knowledge of both the content and quality of valuation report and be able to state, in an informed way, whether they are satisfied or not with the content. Other methods of sampling were duly considered, but, however, they did not best meet the requirements of the research and were therefore considered less appropriate.

Sample size for non-probability sampling varies, and therefore it should rather be dictated by the research objectives; which size will provide useful and credible results (Saunders *et al.,* 2009). Taking this into cognisance, a sample size of 50 respondents was deemed sufficient for the research; this is 80% of the identified population at IDC.

3.5 Procedure for data collection

The data for the research was collected using a questionnaire in a structured survey format and current records on trends with regards to the proposition. The questionnaire provided the researcher with geographical reach, protection of the respondent's anonymity. Newman and McNeil (1998) further state the disadvantages as low response rates, varying question interpretation and inability to trace incomplete questionnaires back to the respondents.

Respondents were approached via the IDC email database. The main reasons for these methods were to maximise response rates as well as increase the ease and convenience for collecting the data. The questions on the actual instrument were measured on a five-point Likert scale. The final questionnaire is provided in Appendix C.

3.6 Data analysis and interpretation

The technique that was applied to analyse the data is triangulation. This is because there is need to verify the validity of the information being collected since the clients' perceptions should also be tied up on the usefulness of the valuation report. Triangulation is broadly defined as the combination of methodologies in the study of the same phenomenon (Jick, 1979). This analytical approach seeks to definitively answer a pre-formed hypothesis and to strengthen interpretations and improve decisions based on the available evidence. Triangulation does not infer causality, but offers a rational explanation or interpretation of the data at hand (Heath, 2001). Data was gathered concurrently and the researcher was able to compare both forms of data to search for congruent findings (Onwuegbuzie & Collins, 2007).

There are many advantages to triangulation. Firstly, triangulation can make use of pre-existing data sources (Scandura & Williams, 2000). This allows for rapid understanding of the situation and facilitates timely, appropriate decisions in health crises.

Secondly, by examining information collected by different methods, by different persons and in different populations, findings can substantiate each other and reduce the effect of both systematic bias and random error present in a single study (Heath, 2001).

Triangulation can also combine information from quantitative and qualitative studies, incorporate prevention and care program data and make use of expert judgment. Triangulation provides a method to evaluate interventions and assess population-level outcomes. Appropriately used, triangulation might enhance the completeness and confirmation of data in research findings of qualitative research. The use of both quantitative and qualitative strategies in the same study is a viable option to obtain complementary findings and to strengthen research results (Thurmond, 2001).

As indicated previously, the purpose of this study is to carry out an analysis of the valuation of plant and machinery practices at the Industrial Development Corporation of South Africa (IDC). This study attempts to propose aspects of plant and machinery valuation processes on the method to determine the depreciation of plant and machinery assets to be placed under a security loan agreement. In addition this study will give some information and guidelines on the valuation of plant and machinery under liquidation. This aims to investigate possible recovery in the event of bankrupt clients. The analysis and assessment is intended to help IDC to implement measures to its security on clients requiring funding as well as in the event of liquidation. The implementation process with respect to funding securitisation will make it more conducive for IDC's investment to achieve a long term balance. The purpose of the study was achieved through the use of the case study method. A case study can be defined as an extension examination of a single phenomenon of interest, an example of phenomenology methodology. It is an account of problem situations and events in a real or imagined organisation. A case study approach implies a single unit of analysis such as a single company or a group of employees, an event, a process or even an individual. It involves gathering detailed information about the unit of analysis, often over a long period, with a view to obtain in-depth knowledge (Hussey & Hussey, 1997).

The case study method used in this research was mainly based on the work of Yin (2003). The author highlights four key stages that need to be followed in the development of case studies: designing the case study; conducting the case study; analysing the case study evidence and developing conclusions and recommendations. Furthermore, Yin (2003) states that the case study can be utilised for four applications: to explain complex causal links to real life interventions; to describe real life context in which intervention has occurred; to describe the intervention; and to explore the situation in which the intervention being evaluated has no clear set of outcomes. The method employed in this research is therefore based on Yin's four reasons for developing case studies, to:

- Explain the role and objectives of the Evaluations Department at IDC with regards to plant and machinery valuations.
- Describe the IDC valuation practice and its process.
- Describe how valuations add value as an intervention in curbing IDC loss.
- Explore whether IDC is effectively achieving its intended objectives.

3.7 Validity and Reliability

When choosing a research methodology it is important to consider the validity of the approach. In qualitative research the term verification is used instead of validity and is described as the accuracy, meaningfulness and credibility of the research project as a whole (Creswell 1998). In order to ensure the trustworthiness of the research, the researcher will describe how he has established the validity and reliability of the research, which are the equivalent quantitative research terms for internal validity, external validity and reliability (Creswell 1998). The credibility of a study reflects the extent to which the research design and the data collected have enabled the researcher to construct valuable and appropriate conclusions concerning the phenomenon being studied (Leedy and Ormrod 2001).

Any possible researcher bias has been recorded in the research methodology section of this report. The researcher commented on, biases and prejudices that may have shaped the interpretation and approach to the study, thereby assisting in the credibility of the research (Creswell 1998).

3.7.1 Internal Validity

Internal validity refers to the ability to which the research is able to measure what it is intended to (Saunders *et al*., 2009). For this research it refers to the ability the questionnaire will possess to measure the strengths of the skills, motivations and intentions variables. Kalof *et al* (2008) explained it as the ability of drawing appropriate conclusions for the research from data collected. The higher the degree of internal validity, the more the questionnaire measures what it is supposed to. Saunders *et al.* (2009) also recommends that high degrees of content validity and construct validity be achieved in questionnaire design. Content validity refers to the extent to which the questionnaire provides adequate coverage of the investigative questions. Careful delineation of the research topic should be conducted through reviewing literature, which should be captured in the questionnaire to maximise content validity (Kalof *et al.*, 2008; Saunders *et al*., 2009).

The questionnaire for the research was designed to measure clients' perception of the quality of valuation reports depending on the value derived from the information reported. The perception is mainly derived from the usefulness of the report. This maximises the internal, content and construct validity of the research.

However, the validity also largely depends on the truthfulness of the responses and because behaviours, attitudes and intentions are measured, the assumption is that the respondents are honest and truthful in their inputs as professionals.

The researcher established internal validity in the study by interviewing groups of people who have different perspectives of the phenomenon under investigation. The account managers are directly involved in the decision-making process based on the valuation reports submitted. The researcher sought the convergence of the perceptions and experiences of the individuals interviewed from each of the business units.

Triangulation includes not only the comparison of different data sources, but also the use of different data gathering techniques and methods to investigate the same phenomenon, and this is in line with the research objectives.

3.7.2 External Validity

External validity refers to the ability to generalise findings from a specific setting and small group to a broad range of settings and people (Newman and McNeil, 1998). The higher the degree of external validity, the more the research findings can be generalised to many situations and groups of people. The researcher made use of in-depth, detailed description, which includes a description of the participants and the setting of the study. This enables readers to transfer the information within this research report to other settings, which will thereby determine whether the conclusions of the study are transferable because of the shared characteristics.

3.7.3 Reliability

Reliability is about consistency, meaning that the information provided by the research instrument does not vary as a result of characteristics of the instrument itself (Neuman, 1994; Kalof *et al*., 2008). More specifically relating to questionnaire design, Saunders *et al*. (2009) stress the robustness of the questionnaire, that is, whether or not the questionnaire will produce consistent results at different times under different circumstances. To ensure maximised reliability, only one and the same questionnaire has been managed amongst the research sample. The Likert scale incorporated into the questionnaire increased the consistency level of measurement.

Dependability is comparable to reliability in that it is “the consistency with which a measuring instrument yields a certain result when the entity being measured hasn’t changed” (Leedy and Ormrod, 2005:29). The personal biases and perceptions of both the researcher and participants may influence the

interpretation of the data (Leedy and Ormrod 2001). To increase the reliability of the overall study, the aim of the study and topic of discussion were clearly communicated to the participants at the beginning of each questionnaire.

4 PRESENTATION OF RESULTS

4.1 Introduction

This chapter presents the case study results on the issues considered with the objective of identifying and reviewing the use of depreciation factors when undertaking a valuation of plant and machinery assets, particularly those under security. This will then enable the IDC to determine the changes they should implement to deal with the uncertainties which arise when valuing plant and equipment and how to improve security from prospective and current operational clients. A further objective was to identify possible causes of liquidation from prospective and current operational clients and propose a suitable valuation procedure for equipment to be liquidated.

4.2 Case study overview: The IDC practice of plant and machinery valuations

Before analysing the results of the study, it is useful to look at the case of IDC on how the valuation is done in order to set the scene for the analysis process. This section will briefly discuss on the procedure and process involved from the inspection to the preparation of report. Both the process and procedure of valuation are based on the observation and interview with the professional valuers at IDC.

4.2.1 Inspection of Plant and Machinery

Inspection of plant and machinery is an organized examination for the purpose of evaluating a plant or machinery condition, or a formal evaluation exercise of machinery and equipment. In general, valuation of plant and machinery requires

the preparation of an inventory in the form of a schedule. However, the extended details are upon the valuer's judgment after due consideration of client's instruction.

The process of valuation and sequences of work include:

- Understanding the purpose of valuation.
- Collection of required documents and information.
- Site Inspection and collection of field data.
- Analysing the information and field data collected.
- Assessment of the value of the asset (s) based on facts, market rates and experience.
- Produce a valuation report detailing the facts and assessment made, and issue a certificate of valuation.
- Proper guidance to the client.

4.2.2 Methodology and Data Analysis at IDC

The valuation process is a systematic process used to provide an estimated value of the plant and machinery to clients. After all the related information has been gathered and market research conducted, then the appropriate analytical technique is applied to conclude a report. In an effort to determine open market and forced sale values for the subject equipment, the Evaluations Department make enquiries to various suppliers and analyse the market information contained in the database. Both the cost approach and the market comparable methods are applied where possible to arrive at market values. The use of investment method is rarely applied.

The cost approach method is where the use of depreciation is of paramount importance. Failure to judge the depreciation will result in under- or over-valuation of assets, resulting in IDC failing to recover from default clients.

The double-declining method (also known as reducing-balance) is the only depreciation method being used for all these purposes under the cost approach.

The study attempts to fill that gap on the method being used to determine the depreciation of plant and machinery assets to be placed under a security loan agreement. Although the reducing balance method is popular and recommended for market values on specialised plant and machinery, it is important to look at IDC's markets which involve assets under security. Under the reducing-balance/double-declining method, the depreciation factor is calculated using the formula below:

DEPR = (Residual Factor) ^ CA/PL,
where,
DEPR = Depreciation
CA = Chronological age
PL = Probable life (economic life)

4.3 Data collection process

Having explained the contextual issues surrounding the case study, the data collection process was done based on the process explained in Chapter 3, Section 3.5.

4.4 Valuation of plant and machinery revisited

It is also important to revisit the objectives of valuation of plant and machinery at the IDC, as this provides a yardstick against which the findings of the study on the current approach of calculating depreciation to improve security will be measured in comparison to the proposed suitable process of valuation. From the questionnaire submitted through survey monkey to the users of the valuation reports, it was evident that there was an understanding of the objectives, which were mensioned under the context of the study in the first chapter:

The following graph (Figure 6) shows how respondents responded. This showed a true reflection in terms of who often requested valuation to be done on their behalf. Senior business analysts, Business Analysts, Project Managers and Risk Managers rarely request for valuations and this is reflected on their response willingness.

4.5 Demographic profile of respondents

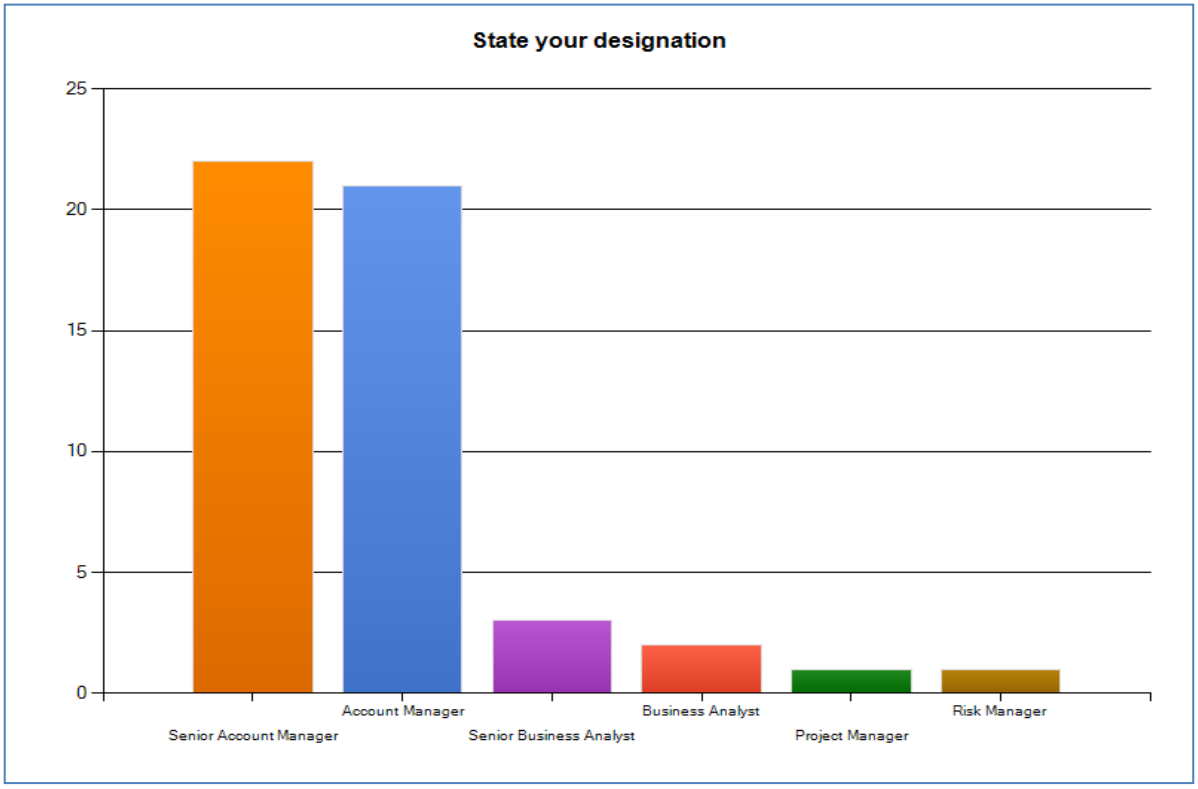


Figure 6: Demographic profile of respondents (Own Compilation)

Table 4: Summary of qualitative results.

	Not Satisfactory	Partially Satisfactory	Neutral	Satisfactory	Highly Satisfactory	Average Rating
Suitability of the specific plant and equipment for a loan at the amount and on terms proposed	0%	6%	14%	**76%**	4%	3.78
Physical description of the equipment	4%	0%	14%	**68%**	14%	3.88
Valuation method used	4%	10%	16%	**59%**	10%	3.61
Degree of uncertainty of valuation figures (if you feel there is a high degree of uncertainty then its not satisfactory)	20%	6%	32%	**40%**	2%	2.98
Valuation figures higher than expected (if values too high that expected then its not satisfactory, if values within reason then highly satisfied	12%	16%	24%	**34%**	14%	3.22
Valuation figures lower than expected (if too low than expected then its not satisfactory, if within reason then its highly satisfactory	10%	10%	**38%**	30%	12%	3.24
The provision of sufficient general information on comparables and proper explanation of the report	8%	12%	24%	**48%**	8%	3.36

4.6 Results pertaining to Proposition 1 and Proposition 2

The extent of satisfaction with plant and equipment valuation reports was measured under the following subheadings:.

4.6.1 Suitability of the specific plant and equipment for a loan at the amount and on terms proposed

Most respondents were satisfied with the recorded specific plant and equipment list of assets to be included as part of security. However, there were a few respondents who were partially not satisfied because they noted that some equipment may be highly specialised and might not be easily disposed of in the event of a default by the client. The distribution of the response is shown in the figure below

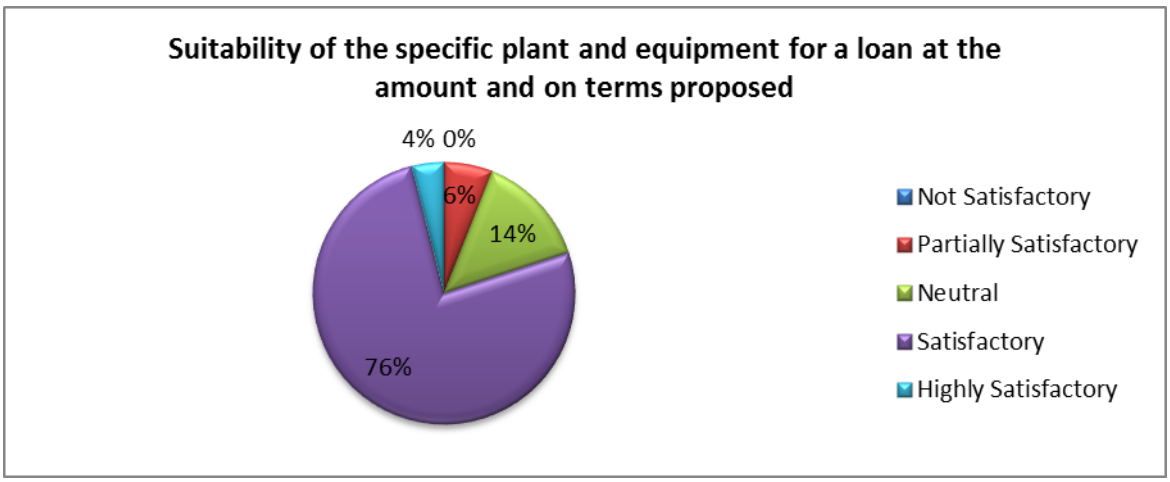


Figure 7: Respondents results

4.6.2 Physical description of the equipment

With respect to this question there was an indication that most of the description was satisfactory. This was an important question to understand if the reports are read in full and the proper description is put in legal agreements. In the event of a default and when liquidating it is important to have the proper description of plant and machinery assets so that they will be easily be identified as secured.

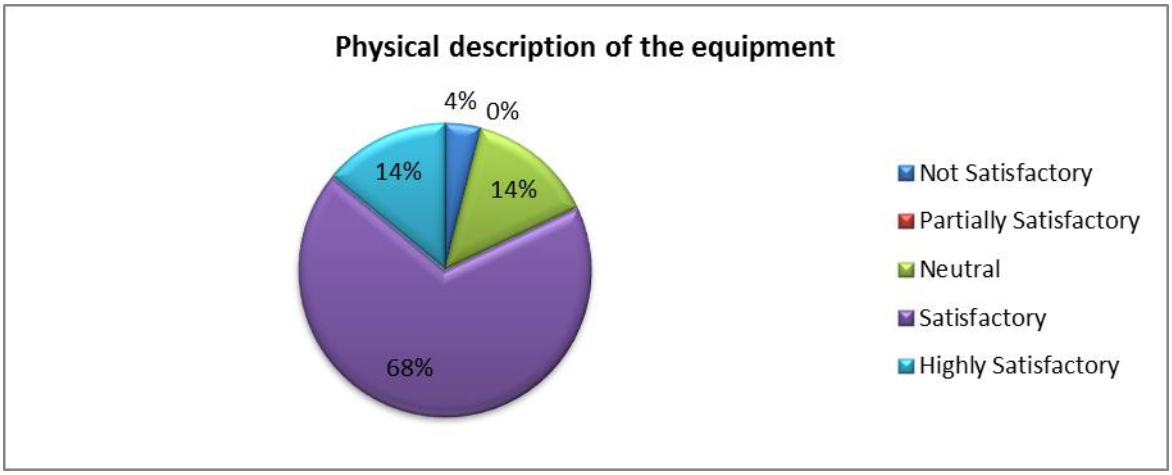


Figure 8: Respondents results

4.6.3 Valuation method used

All valuation reports have a section which identifies the methodology used for a specific job. It was also important to gauge the view of the participants with respect to their exposure and make comments on the methods as it has an impact on the security values. Some responses on the open question below provided a lot of insights. However the majority showed a higher degree of satisfaction

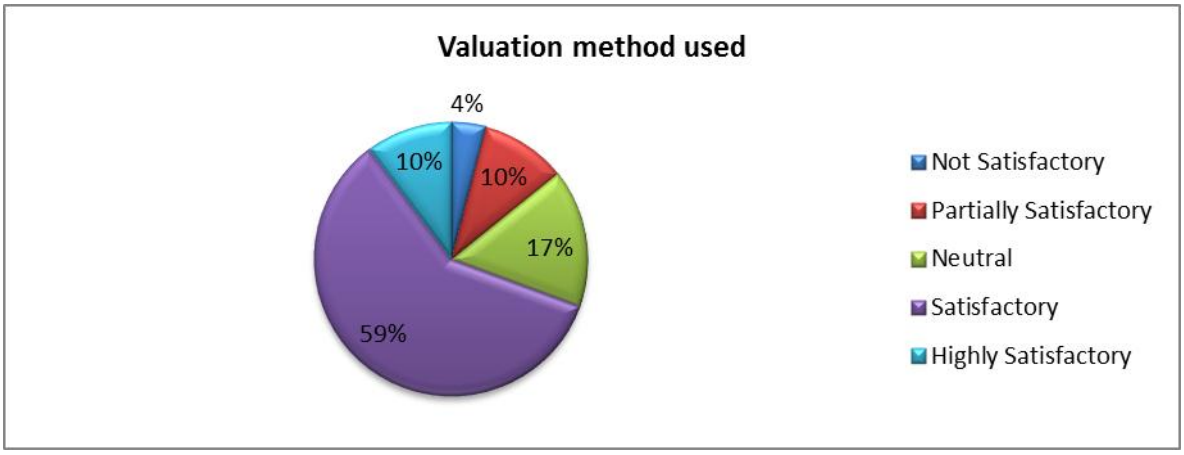


Figure 9: Respondents results (Own Compilation)

4.6.4 Degree of uncertainty of valuation figures

The degree of uncertainty was also important in that it sets the tone on the valuation figures that the IDC provides before liquidation is carried out. Currently the valuers are not involved in the liquidation process but they provide valuation. The author wanted to get the level of uncertainty that the participants face in the liquidation transactions (Figure 10).

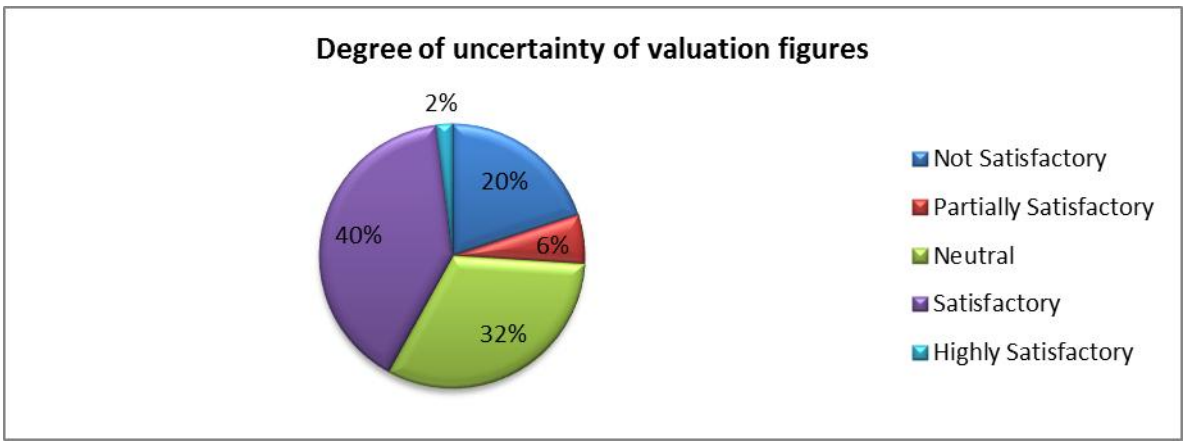


Figure 10: Respondents results (Own Compilation)

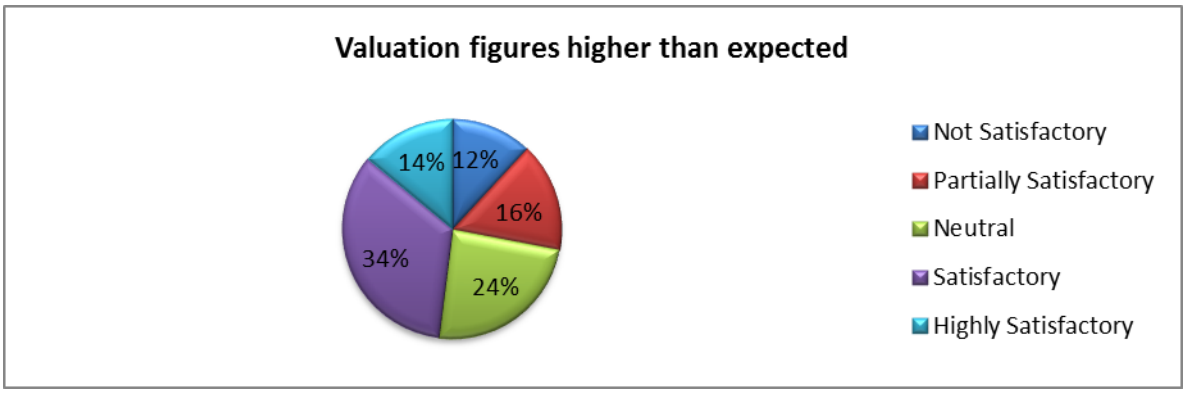


Figure 11: Respondents results (Own Compilation)

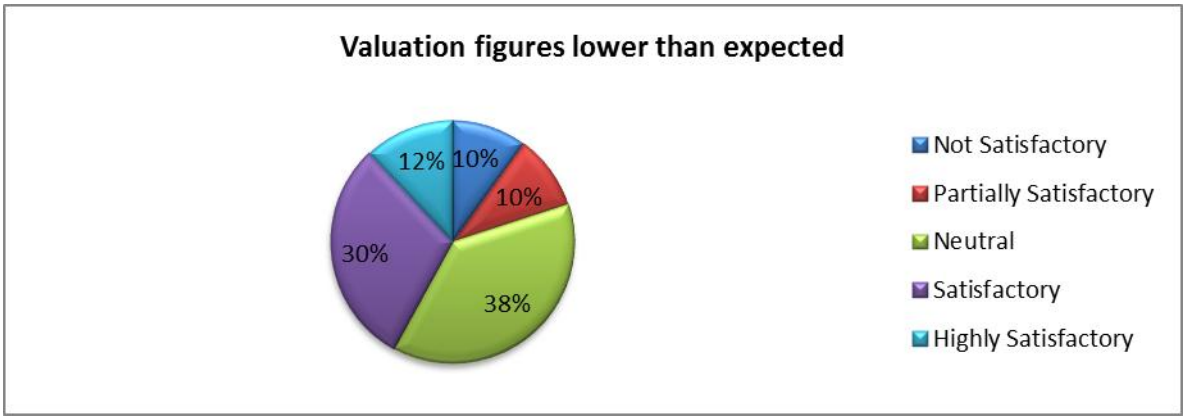


Figure 12: Respondents results (Own Compilation)

4.6.5 The provision of sufficient general information on comparable and proper explanation of the report

This element adds to proper explanation of methodology and further explanations so that the recipient of the valuation report can understand the basis of valuation. This was not such an important factor with regards to analysis of depreciation in valuation practice. However, it assists in testing those reports done using depreciation and also in trying the see the gap between the actual market information comparable and the information reported on.

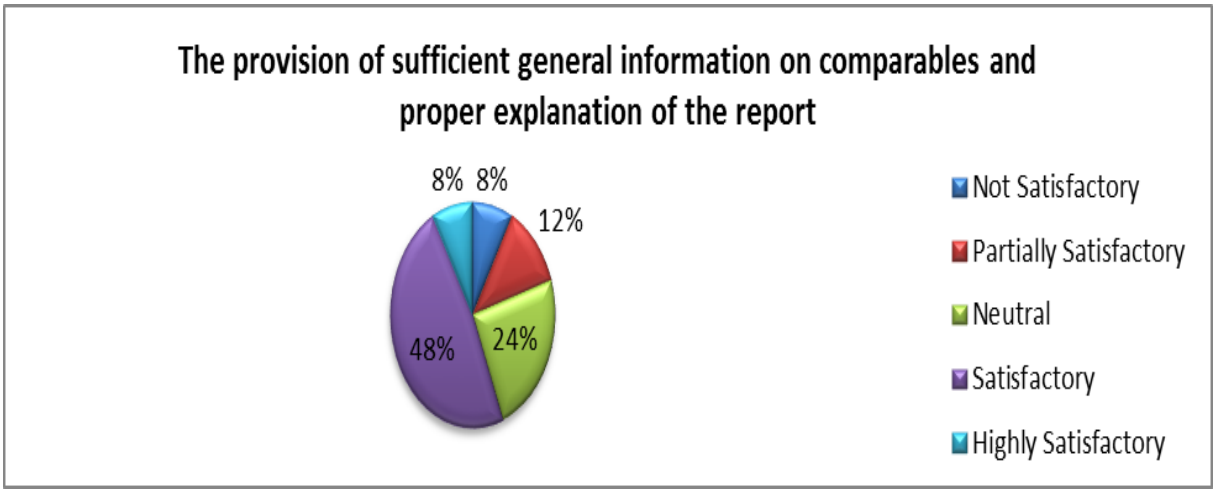


Figure 13: Respondents results (Own Compilation)

The following graph on page 55 shows how respondents responded to the questions posed:

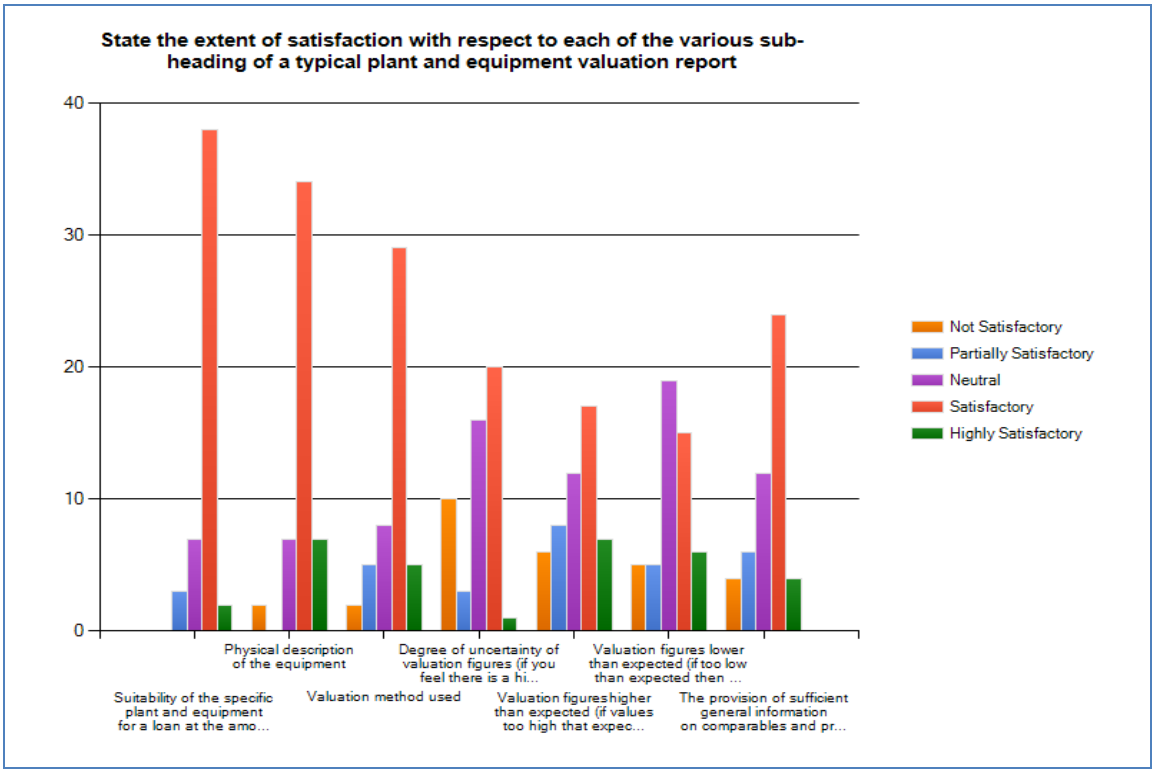


Figure 14: Consolidated respondents results (Own Compilation)

With almost three quarters of the respondents being satisfied, it's important to note that a sizable 25% were also not fully satisfied The open ended question raised some important points in explaining their position. A sizable number of respondents were neutral; mainly due to the fact that they may not have dealt with clients under liquidation hence could not quantify the degree of variation. Others were highly unsatisfied with the report mainly due to the fact that they had experienced a high degree of variation from what valuers report on and what they experience during liquidation. Some respondents were satisfied but the open ended responses indicated otherwise.

Below are some of the responses for the section on improvement on the quality of valuation reports, with a view of increasing their level of satisfaction.

- "engage industry experts on the value of equipment in the market and take that into consideration in your reports"

- “I am happy with the quality of the IDC valuation reports as they add value to our assessments.”

- “My take...It is sometimes a little difficult to rely on a desktop valuation of plant and equipment. It is understandable that there are resource (time and manpower amongst others) constraints in executing valuation process. That said (and unfortunately using extreme examples), the sub-prime crisis resulted from similar practices. Over-valuation or under-valuation of investments that can be resolved by a simple change in operations but hindered by complacence and over-adherence to instruction. 20 desktop reviews of R1, 5 million Rand investments count a great deal when looked at individually. Further, the skewed balance in focus on pre- and post-investment evaluations does not bode well for health checks on investments. At all times, evaluations need to be equally thorough, detailed and timeous to inform decisions on investment/interventions/exit & salvage. In the end, the question remains...how effective are we in our estimations of value. Are we valuing our assets properly?”

- “Forced Sale values are always overstated and do not take into account the historical experience and trends of realisable values.”

- “Use different methods to do valuation and then compare the values coming from different methods.”

- “Info comparables would be useful in order to make qualitative judgement when including value for security calculations. Sources of comparables would be welcome”

- “Not really qualified to do this. The proof is always at the end when things go wrong and the plant has to be sold in the open market”

- “The quality can be considered adequate. A bit more speed in conducting valuations would help.”

- “The current way of conducting the valuations are satisfactorily and helpful for business purposes.”

- “Valuations should not always follow a general approach but should cater for situational circumstances. Basing valuations purely on a replacement cost basis as is often done are erroneous.”

- “There is no comparison to market values. The values per the report and the values actually received differ significantly. The valuation team is not fully aware of industry happenings and the going rate of the machinery - industry expertise and not generalisation need to be achieved”

- “Valuation reports could be made shorter with concise explanations.”

- “Maybe educate the deal makers about principles used for valuation.”

- “Valuation report provided was at a satisfactory level.”

- “Valuation of plants needs to be done frequently as most of valuations are out-dated.”

- “More info around the comparable pricing will contextualise the findings.

    - use of descriptions so that the assets are easily identifiable; - provision of market replacement values for comparisons”

- “Sometimes the equipment is not in operation. I think you should determine the working condition of the equipment in order to adjust the value either downwards or upwards. What if the equipment has got technical problems that will eventually affect its operation when sold?”

- “It would be nice to have better explanations of the valuation methods and why IDC values are always different from that of the client or independent valuator. Who is more accurate?”

- “Also using the prices from the previous auction of similar assets”
- “The context and contents of reports must be explained and agreed with the relevant accounts manager prior to approval by the valuation's head.”
- “The valuation people should go and visit the client and look at the equipment. They should communicate directly with the client and not rely on the team leader. They should be able to explain to the client why there are variances between their valuation and the client valuation. I know that the report is confidential but it becomes difficult to explain to a client why our valuation amount is less than theirs and valuation department is not willing to explain to the client.”

4.7 Results pertaining to Proposition 3

The author also retrieved current records of the actual liquidation values attained versus the valuation report done prior to the liquidation. Coupled with the results pertaining to the first and second proposition, these records will assist the researcher in proposing a suitable process.

Table 5: Summary of quantitative results.

	Client Name	Date of Valuation	Date of Liquidation	Valuation Report Value' R	Liquidation Value' R	*% change (Variation)Valuation vs Liquidation*
1	A	Jun-09	Jul-09	3 000 000	2 000 000	33%
2	B	Jun-09	Jul-09	1 750 000	1 200 000	31%
3	C	Mar-11	Apr-11	5 300 000	3 200 000	40%
4	D	Jan-10	Feb-10	400 000	228 000	43%
5	E	Aug-10	Sep-10	1 800 000	1 100 000	39%
6	F	May-10	Jun-10	1 500 000	1 160 000	23%
7	G	Feb-11	Mar-11	220 000	181 630	17%
8	H	Mar-09	Apr-09	300 000	248 012	17%
9	I	Jan-10	Feb-10	3 600 000	2 900 000	19%
10	J	Dec-09	Jan-10	280 000	200 000	29%
11	K	Sep-10	Oct-10	390 000	246 000	37%
12	L	Jan-10	Feb-10	1 200 000	950 000	21%
13	M	Aug-10	Sep-10	21 000 000	6 000 000	71%
14	N	Mar-09	Apr-09	3 500 000	2 500 000	29%
15	O	Jan-10	Feb-10	2 900 000	1 800 000	38%

Figure 15: IDC data of valuation report values vs Liquidation values (Own compilation)

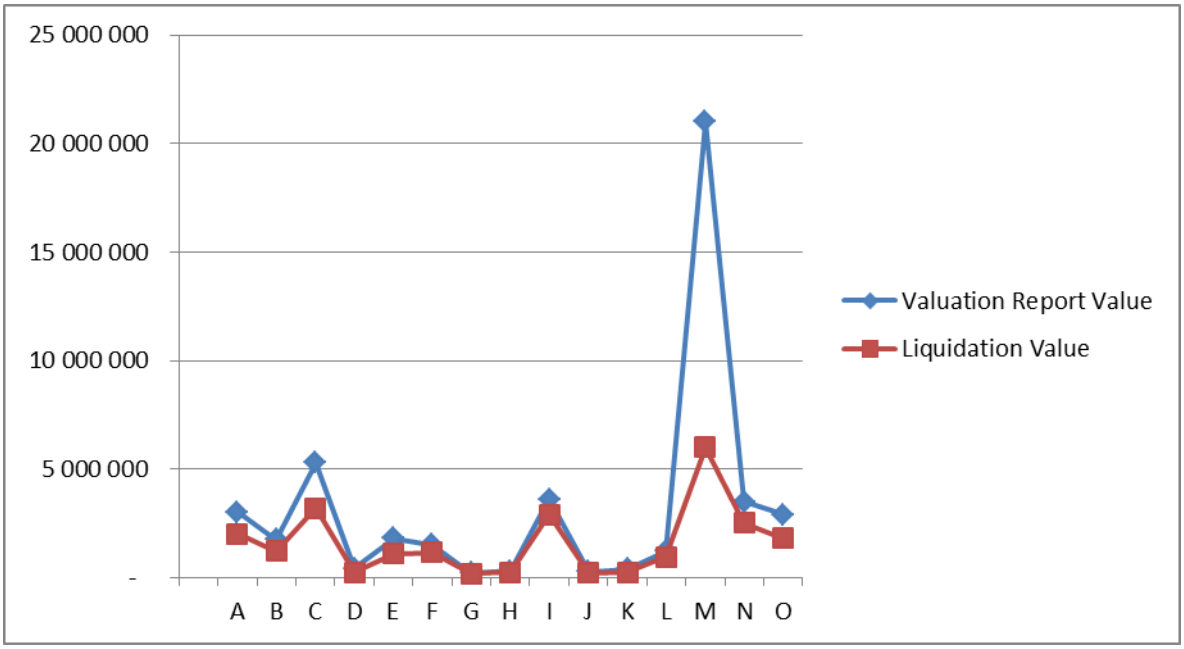


Figure 15: Graphical presentation of IDC data of valuation report values vs liquidation values (Own compilation)

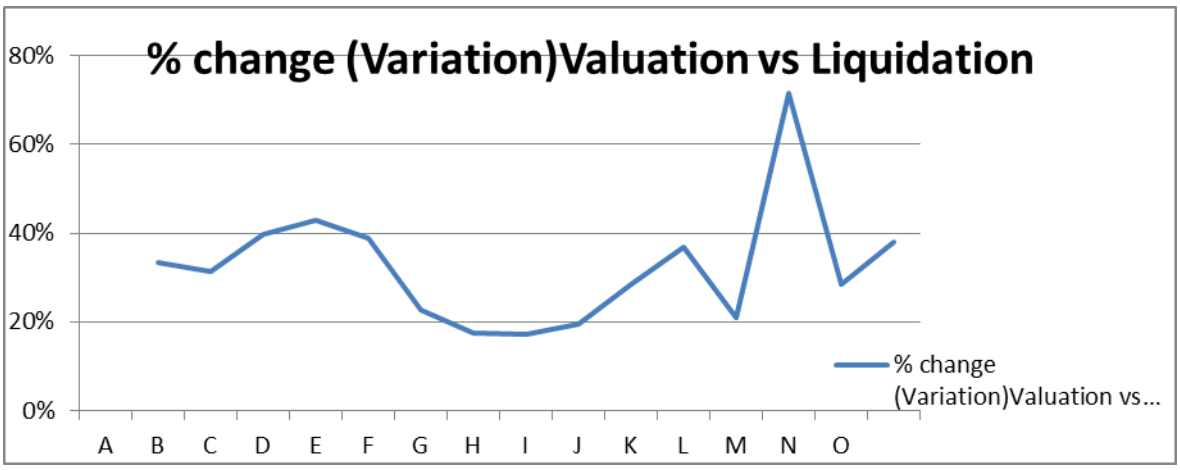


Figure 16: Graphical presentation of IDC data of % difference between valuation report values vs. liquidation values (Own compilation)

Figures 15 and 16 indicate the variation between the liquidation value acquired during disposal process and the actual valuation report prior to liquidation.

The research instrument used to collect data from IDC records, with client's names omitted for confidentiality reasons, depicted the results shown in Figure 15. There is a gap between the actual values and the liquidation values reported prior to disposal of the assets. This implies that IDC is losing out on security values advised by the Evaluations Department after valuation has been done.

The study attempts to fill this gap and address the magnitude of the loss due to companies liquidating while holding a plant and machinery security bond. This gap has also been qualitatively identified from the first part of the qualitative data gathering, and the quantitative approach has identified it.

4.8 Conclusions

The results of the study to carry out an analysis of the valuation of plant and machinery practices at the IDC have been presented and summarised. This study attempts to propose aspects of plant and machinery valuation processes on the method to determine the depreciation of plant and machinery assets to be placed

under a security loan agreement. The next chapter provides a detailed analysis and interpretation of these research findings.

5 DISCUSSION OF THE RESULTS

5.1 Introduction

In this section, the data gathered from the case study is structured and examined in depth. The intention is to demonstrate how this information relates to and addresses the research questions mentioned in chapter one. To recap, the fundamental objective of this research was to use the case study method to analyse the valuation of plant and machinery practices at the IDC and then to identify and review the current use of depreciation factors when undertaking a valuation of plant and machinery assets under security. This will enable the IDC to address the changes that should be implemented to deal with the uncertainties which arise when valuing plant and equipment and improve security from prospective and current operational clients. It will also identify possible causes of liquidation from prospective and current operational clients and propose a suitable valuation procedure for equipment to be liquidated.

5.2 Demographic profile of respondents

It appeared that mostly senior account managers and account managers expressed concern on how valuations are carried out. There is a true reflection in terms of the users of valuation reports. The other categories do not often request the services and for them this is a once-in-a-while assignment. The author also expected that some account managers would be neutral based on the fact that they have never experienced a liquidation process and the effects thereof in relation to security. A sizeable number of senior account managers and account managers were either not satisfied or partially satisfied; most of them responded to the open question and gave their constructive criticism. There are a large

proportion of neutral responses on the degree of uncertainty of valuation figures reported.

5.3 Discussion pertaining to Proposition 1

Based on the qualitative analysis from the results presented, most respondents do agree that the equipment is suitable to be included in the valuation report for security purposes as shown, however a small proportion was not satisfied with the physical description of the equipment and that small proportion again is not satisfied with the valuation method used. The reason for this assessment was to measure the degree of client satisfaction with the report so that the valuers' can ascertain this link to the valuation methodology. The valuation methodology will then filter to the depreciation component which is being investigated. 20% of the respondents indicated that the valuations figures are overstated or understated. Having looked at which 20% of the respondents constitute to that perception it was indicative that these are the clients who have competent knowledge of what they expected. This showed a great concern and again tied up to the open ended responds from the respondents. The reasons for these concern was also explained by the fact that valuations department needed to look at each class of equipment differently. The open ended question responses showed a high level of understanding by the respondents and indicated that there is need to relook at the methodology of valuation which is tied to the depreciation as it is the main component on all valuation procedures. They also indicated that desktop valuation can be the main reason for the discrepancies as depreciation can be under or overstated. Historical trends are also important in valuation of plant and machinery as they give a good indication on how depreciation behave on different classes of equipment.

Based on the quantitative analysis from the results obtained from valuation reports records and liquidation reports (see Table 5) there is clear discrepancy which calls for a revisit in the way depreciation is calculated.

From the discussion of the first proposition it showed that the current approach to the way depreciation is calculated is not fully addressing the issue of equipment under security. The method being used to quantify the depreciation is suitable to a greater extent for equipment that is not specialised but proper consideration is required to deal with some discrepancies that are encountered. By using the reducing-balance method, the value of the machine is declining gradually with the higher amount of the depreciation in the early life of an asset, which becomes lower in the subsequence years. Apart from that, this method also helps to even out the total amount charged as expenses for the use of the asset each year. However, while the current approach doesn't take into consideration the fact that this equipment is under security, it provides the possible fair market value of assets in operation that will not obviously translate to liquidation value. It provides IDC with a fair market value of possible recovery under fair conditions. The forced sale value calculated is a discounted fair market value to take into consideration the security that can be used. This is a proper method to arrive to a security value but the factor of discounting can be improved. There is clear indication that the current approach to depreciation can be re-looked at. To improve security there is a need to accelerate the reducing-balance method.

5.4 Discussion pertaining to Proposition 2

The second proposition of the analysis proposes that the depreciation can further be revised on a case by case basis depending on the type of equipment in question. This was drawn from conclusions by respondents on open ended question were they explained how the discrepancies in valuation figures can be solved. Having seen that more than 50% of respondents do not agree with the valuation figures or they are neutral about it there is clear indication that there is need to revisit the valuation methodology and this can be done by looking at the depreciation concept. These respondent figures also agree to the quantitative figures that are shown in Table 5 and the variation graph which shows a gap of 32% between the reported figures and the recovered actual values.

The impact of physical deterioration, functional obsolescence and economic obsolescence require further attention as this may skew the results. There are other factors that need to be considered when determining or quantifying the depreciation factors of equipment under security.

External factor of obsolescence can be defined as the loss of value to the plant and machinery caused by the external factor of the machine itself, such as demand and supply of the machine, investment factor, consumer behaviour, etc. On the other hand, the external factor of obsolescence can be defined as the loss of value to the plant and machinery caused by other factors but not from the machine itself. These external factors need to be carefully quantified so that the depreciation deduced will be more appropriate.

The percentage change in the variation of values shown on a sample of clients is on average 32%, which is substantial. The results show a trend in the variation of the reported value versus the actual recovered amount.

The qualitative analysis also indicated the gap as shown by the presentation of results in pie charts in the previous chapter. The open ended question captured this investigation as well. The clients were asked to identify ways of improving the quality of valuation reports with a view of increasing their level of satisfaction. Most respondents indicated that more research and engagement of specialist to a specific group of equipment.

The findings of the study revealed that the reported values are generally on the higher side than expected, more especially for the valuation done using the cost approach. This is because there are no comparables to the market. Either they are highly specialised or there are no previous sales of similar equipment. According to Ellsworth (2009a), the other factor attributing to this is the fact that the cost approach takes into consideration the age and estimated useful life of plant and equipment assets. All these factors are estimates hence the significant gap in values reported versus the recoveries. The IDC should strive to reduce the

gap to below 20% levels and this can be done by revisiting the estimated useful life and the subsequent depreciation factors used.

Furthermore a study carried out by Ellsworth (2009a) and Marston (1953) concluded that the economic obsolescence is consequently referred to as external obsolescence and it is beyond the control of the asset owner. Valuers would need to carry out a thorough analysis of those external factors and putting them into consideration.

On the basis of this, Monday (2009) concluded that depreciation methods vary from simple methods that place emphasis on life expectancy as the primary focus for estimating depreciation to more complicated methods that combine life expectancy and economic attributes in addressing depreciation patterns. Lonergan (2009) added that depreciation also measures the decline in value inherent in the equipment asset as operational use consumes its available services.

The above views agree with the findings of this study, which demonstrates that the variation and discrepancies of the valuation reports are due to the depreciation and all the variables in the depreciation factors.

The current depreciation approach is not appropriate for highly specialised equipment. For equipment that is not specialised and common in the marketplace it can be used and proper consideration be given to the discounting factor to come up with the forced sale value.

From the findings of this study, it became clear that the valuation practice at IDC is appropriate but will require some adjustments depending on the type of equipment. The findings of this study in this regard are corroborated by the qualitative response from the users of the valuation report.

5.5 Discussion pertaining to Proposition 3

The third proposition requires that the current process be modified to close the gap that is shown by the quantitative results. This gap is also shown in the qualitative analysis of results. There appears to be a systematic adjustment that can be made from the factors that affect depreciation. There is a requirement to double decline on the reducing-balance formula to take care of the uncertainties in the event of liquidation. The percentage change in variation based on the IDC recovered values is 32%. This shows a systematic gap of the recovered amount versus the figures reported by the Evaluations Department. There is need to factor in the 32% decrease on the reported valuation report on the forced sale value. Proper reviews of the particular assets need to be undertaken before a 30% adjustment is implemented. This should only be applied to specialised assets where the marketability of the facility is in question.

The valuation concepts discussed in the literature review and their analysis and impact on valuation methods to be used are illustrated in Table 4.

An assumption is made that an estimate of depreciation is desired for an item of equipment with a replacement cost of R500, 000. The equipment is 15 years old with an average life expectancy of 20 years.

The table below illustrates the effect of approach used to carry out the valuation of equipment. The same piece of equipment valued differently can produce different results. The premise of value needs to be spelled out correctly before an approach is chosen.

Table 6: Analysis and impact of depreciation methods.

Depreciation Method used	Age	Average Life Expectancy	Probable Life	Depreciation	Depreciated Value	Comments
Age/Life Method	15	20	-	-	-	There is an element of physical condition on the depreciation factor and this has to be determined on site
0-100% Method	15	20	-	-	-	There is an element of physical condition on the depreciation factor and this has to be determined on site
Straight Line Method	15	20	-	375 000	125 000	Adjustment on physical condition and age required. This can only be determined when proper state of the machinery is established.
Life Expectancy Method	15	20	24.1	311 000	189 000	Adjustment on physical condition and age required. This can only be determined when proper state of the machinery is established. The probable life is estimated using Iowa survivor curves
Economic Consumption Method	15	20	24.1	259 000	241 000	Adjustment on physical condition and age required. This can only be determined when proper state of the machinery is established. The probable life is estimated using Iowa survivor curves
Declining Balance Method	15	20	24.1	447 000	53 000	Adjustment on physical condition and age required. This can only be determined when proper state of the machinery is established
Sum-of-the years' digits method	15	20	-	464 000	36 000	Adjustment on physical condition and age required. This can only be determined when proper state of the machinery is established

Table 4 above clearly shows the effects of different valuation methods and how figures will differ if not properly applied. For security values and liquidation values IDC has been using the declining-balance method. The analysis of the results indicated that it is still 30% high of the actual figures recovered.

The first two depreciation methods can only be applied when the physical conditions have been assessed. All other methods can be used on a desktop valuation approach. However, the physical condition is still required to adjust on the probable life and life expectancy.

The researcher's proposal is that for highly specialised equipment where there are no similar assets in the market, sum-of-years' digits must be applied.

For specialised equipment, where there are few similar equipment in the market, then the accelerated declining-balance method should be used with a 30% factor to determine the required forced sale value for security.

5.6 Conclusion

The discussion of the results indicated that the IDC will need to implement more measures as discussed under proposition 3. This will enable IDC to reduce the gap on the expected recoveries versus the recorded collateral. The latter is the one that IDC valuers give advice on. The IDC's practice requires valuers to review and look at plant and machinery assets on a case by case basis as a different type of equipment may require a different approach from the one which is currently used for other categories. The fact that a significant proportion views the valuation results as satisfactory gives hope that the fewer discrepancies can be re-looked at and be improved.

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

This chapter attempts to provide a fair judgement of the research results as discussed in the previous chapter on how IDC valuation practice can be improved. From the case findings, it should also be clear as to whether the requirements of the valuation practice are achievable or not. Therefore, this chapter will present the conclusion of this research together with a few recommendations for future research in order to project a more advanced and better approach of plant and machinery valuation.

6.2 Conclusions of the study

Having analysed the results of the study in more detail, the researcher arrived at the following conclusions.

- As discussed previously, there are three general appraisal approaches to value: income, cost and market. The market approach to the appraised value of equipment for a loan is the most orthodox. Value under the market approach is determined by comparing the asset to similar assets that have been sold under circumstances consistent with the appraisal value concept ("comparable sales" or "comps."). The second best approach to value is cost. It should be used as a backup to the market approach or in circumstances where good comparables are not available. The income approach to value is rarely used in equipment appraisal assignments for lenders. It can be used under unusual circumstances where a clearly defined income stream can be documented so that capitalisation rates or present-value analyses can be applied.

- Within the cost method, there are three most commonly used factors of depreciation when valuing plant and machinery, namely physical deterioration, functional obsolescence, and economic obsolescence. The age of the equipment or machinery should be established with accuracy.
- From the analysis it is clear that the depreciation is not only influenced by the physical deterioration, functional obsolescence, and economic obsolescence but also influenced by the other external factors of obsolescence. Hence, the model for the depreciation is;

Total Depreciation = Physical Deterioration + Functional Obsolesce + Economic Obsolesces + External Factor of Obsolesces.

The external factors are not easily quantifiable; from our key findings there is a general lag from previous transactions at an average higher rate of 30%.

To provide some form of protection against adverse future market conditions, the researcher's proposal is that for highly specialised equipment where there are no similar assets in the market, sum of year digits must be applied as the method of depreciation.

For specialised equipment, where there are few similar equipment in the market, the accelerated declining-balance method should be used with a 30% factor to determine the required forced sale value for security.

6.3 Recommendations

The value of this research project lies in its ability to provide workable solutions to the problems reviewed by the results. Some major challenges revealed by the findings of the study included capacity constraints, in terms of equipment specialisation versus the knowledge valuers have or are perceived to have, lack of coordination on liquidation process, lack of liquidation and auctioning skills on the valuers' part, lack of depth in economic obsolescence determination, lack of

proper communication structures and confusion resulting from lack of clear communication between the valuers and the users of the valuation reports. These challenges have impacted negatively on the perceptions and facts of the valuation reports. The following measures are therefore recommended to address these challenges:

- The inconsistencies arising from the valuation reports versus the recovered amount call for urgent attention to improve the IDC recovery in the event of a default by a client who is undergoing liquidation. Some of these inconsistencies may be due to the fact that valuers are not involved in the actual sale. They must be involved in the liquidation and auctioning sessions so that their services may not be undermined by predictable cartel offers from possible buyers. The valuers should be able to see discrepancies and be able to argue on the discrepancies. This will help a long way in minimising the risk of overstating or understating the valuation figures.
- IDC appraisal team should try by all means to minimise desktop valuations as this will contribute to more anomalies being experienced. Desktop valuations do not take into consideration the condition of the machines and assumes that all machines deteriorate in the same manner at a particular age.
- IDC appraisal teams should present their appraisal reports to provide the client with a list of separate equipment values in descending order. This will allow the lender, IDC in this case, to focus on the most valued items of equipment for collateral.
- Also typically, equipment-appraisal reports consist of a lot of boilerplate narratives followed by a thick listing of equipment with detailed descriptions sorted by room or area. Most readers have trouble absorbing all this data. Appraisers should take time to summarise this with the client so that the IDC will easily re-shape this data to a more manageable form.

- The 80/20 rule holds true in many areas of business and it applies to secure lending as well. Lenders frequently find that approximately 80 percent of the total collateral value resides in only 20 percent of the equipment items. Accordingly, the lender needs to focus attention on these high-value items that can easily be identified from the descending-value sort described above.

Questions that the valuer should attempt to have answers to before deciding on the appropriate method include:

- Did the comparable sales research indicate that a broad active market for the equipment exists, or only a shallow market with very little sales activity?
- In regard to the high-value items: Did the valuer speak with the equipment manufacturers? Was there any indication that the manufacturers' new equipment will be technologically obsolete or seriously diminish the value of their older equipment?
- What about new planned equipment releases?
- Are these equipment items special-purpose or general-purpose? Can the equipment be sold to users that will operate the equipment in an industry different from the one your borrower is in?
- If the equipment is special-purpose, what are the industry prospects?
- If the equipment is special-purpose, will cash flow and collateral value diminish concurrently?
- What recommendations does the appraiser have regarding the liquidation of the equipment?
- How long will it take to liquidate this equipment?
  Will you prepare a liquidation sales and expense budget?

All the answers to those questions are important as this will lead to a proper depreciation approach being applied.

6.4 Suggestions for further research

With the experience gained in presenting this research and concerns about the market needs, there are a few suggestions for future research and these are:

- Identify and quantify the external factor of obsolescence in the cost method.
- Identify the different magnitude of depreciation in the total depreciation of plant and machinery.
- Identify the significant type of depreciation and obsolescence in the total depreciation for the cost method.

To conclude, the results of the study have shown that although a significant percentage of valuation report users were satisfied with the valuation practice of the IDC, there is need to revisit and re-look at the approach as addressed in some sections of the qualitative open question responses. The qualitative section of the research also showed us a gap which shows that there is a need to re-look at the depreciation factors being used among other items mentioned under Recommendations.

REFERENCES

Ahn, J. K. (2006). The Valuation Methods of Machinery and Equipment. *The Journal of Plant & Machinery Valuation, 15*(4), 25 - 37.

Alico, J. (1989). *American Society of Appraisers:Appraising Machinery and Equipment* (1st ed.). New York: McGraw-Hill.

American Society of Appraisers (1980). *Insurance Valuations: Definitions, Derivations and Appraisals*: American Society of Appraisers.

American Society of Appraisers (2005). *Valuing Machinery and Equipment: the Fundamentals of Appraising Machinery and Technical Assets*: American Society of Appraisers.

American Society of Appraisers (2009). The Machinery & Technical Specialist Journal. *26*(4), 26 - 40.

Barry, G., & Duncan, P. (2005). A vision for valuation. *Journal of Property Investment and Finance, 23*(2), 123-140.

Budhbhatti, K. (2002). *Valuation of Plant and Machinery: Theory and Practice*: Kirit Budhbhatti.

Chang, H. J. (2010). Evaluating the current industrial policy of South Africa. *Transformation*(36).

Corbin, J. M., & Strauss, A. (1990). Grounded theory research: Procedures, canons, and evaluative criteria. *Qualitative sociology, 13*(1), 3-21.

Daley, P. (2009). Calculating the Economic Useful Life and Forecasting Residual Values for IT Equipment. *The Journal of the International Machinery & Technical Specialties of the American Society of Appraisers, 26*(4).

Derry, C. (1993). Plant and Machinery Valuation. *Journal of Property Valuation and Investment, 9*(2), 152-158.

Dictionary, O. E. (2004). Oxford English dictionary online. *Mount Royal College Lib., Calgary, 14*.

Ellsworth, R. K. (2009a). Depreciation Methods in Theory and Practice. *The Journal of the International Machinery & Technical Specialties Committe of the American Society of Appraisers, 25*(4), 35 - 42.

Ellsworth, R. K. (2009b). Retirement Dispersion and Appraisal Depreciation. *The Journal of the International Machinery & Technical Specialties Committe of the American Society of Appraisers, 25*(2), 35 - 51.

Fallon, E. (1975). *The appraiser's handbook: A unique guide to appraising land, buildings, and machinery, with specialized information for industrial engineers* (Vol. 1): Exposition Press (Hicksville, NY).

Fitoussi, J. P., & Gaffard, J. L. (2005). Asset Valuation, Liquidity Issues, and Growth Regimes. *Finance markets, the new economy and growth*, 1.

Gunderson, B. (2009). Reducing Banker Lending Risk Inventory Valuations - More Science than Art. *The Journal of the International Machinery & Technical Specialties of the American Society of Appraisers, 26*(4).

Hardin, A., Ergas, H., & Small, J. (1999). *Economic depreciation in telecommunications cost models*.

Hartley, J. (2004). Case study research. *Essential guide to qualitative methods in organizational research*, 323-333.

Heath, L. (2001). Triangulation: methodology. *Elsevier Science Ltd.: Oxford, UK, 1*, 15901–15906.

Hussey, J., & Hussey, R. (1997). *Business research*: Macmillan.

IDC (2010). Industrial Development Corporation Annual Report. [Website].

IDC Evaluations Department (2010). Valuation Meeting

IDC SA (2010). http://www.idc.co.za/Operations Management Head Office.

Jick, T. D. (1979). Mixing qualitative and quantitative methods: Triangulation in action. *Administrative science quarterly, 24*(4), 602-611.

John, A. R. a. S. (2009). Valuation Modeling. *The Journal of the International Machinery & Technical Specialties of the American Society of Appraisers, Volume 26*(Issue 4).

Kalof, L., Dan, A., & Dietz, T. (2008). *Essentials of social research*: Open university press.

Leedy, P., & Ormrod, J. (2001). Practical Research. *Planning and Design, 7*.

Leslie H. Miles, J. (2009). What is Orderly Liquidation. *The Journal of the International Machinery & Technical Specialties of the American Society of Appraisers, 26*(4), 22 - 37.

Lonergan, W. (2009). The Valuation of In-Situ Plant and Machinery. *JASSA: The Finsia Journal of Applied Finance*(4), 31-35.

Machinery, A. S. o. A., & Committee, E. T. (2005). *Valuing Machinery and Equipment: the Fundamentals of Appraising Machinery and Technical Assets*: American Society of Appraisers.

Marston, A. R. W., and J. Hempstead (1953). Engineering Valuation and Depreciation.

McClurg, S. M. (2002). Valuing The Assets of a Special Purpose Process Plant for Securing a Loan. *Secured Lender, 58*(4), 24.

Miles, L. (1996). Fair Market Values and the Cost Approach. *Journal of Plant and Machinery Valuation Practice, 40*, 58-74.

Miles, L. (1998). Age/Life Analysis. *Journal of Plant and Machinery Valuation Practice, 42*, 41-52.

Miles, L. H. (2009). Physical Life Explained. *The M & TS Journal, 25*(4).

Monday, S. E. (2008). IAS 16 and the Revaluation Approach: Reporting Property, Plant and Equipment at Fair Value.

Monday, S. E. (2009). IAS 16 and the Revaluation Approach: Reporting Property, Plant and Equipment at Fair Value.

Musa, H., & Škoda, M. (2009). Revaluation and Impairment of Property, Plant and Equipment. *Studia Universitatis" Vasile Goldi " Arad-Seria tiin e Economice*(1-1), 109.

Newman, I., & McNeil, K. A. (1998). *Conducting survey research in the social sciences*: Univ Pr of Amer.

Onwuegbuzie, A. J., & Collins, K. M. T. (2007). A typology of mixed methods sampling designs in social science research. *The Qualitative Report, 12*(2), 281-316.

Paganetto, L. (2005). *Finance markets, the new economy and growth*: Ashgate Pub Co.

Pinder III, J. E., Wiener, J. G., & Smith, M. H. (1978). The Weibull distribution: a new method of summarizing survivorship data. *Ecology*, 175-179.

Remsha, M. J. (2009). Functional Obsolescence: Real Life Stories. *The Journal of the International Machinery & Technical Specialties of the American Society of Appraisers, 26*(4).

Sahray, K. (2009). Quantifying depreciation in plant and machinery valuation.

Saunders, M., Lewis, P., & Thornhill, A. (2009). *Research methods for business students*: Prentice Hall.

Scandura, T. A., & Williams, E. A. (2000). Research methodology in management: Current practices, trends, and implications for future research. *The Academy of Management Journal, 43*(6), 1248-1264.

Seow, I. S. (2009). The Role of Premise of Value in Plant and Machinery Valuation.

Stickney, C. P., Brown, P., Wahlen, J. M., Baginski, S. P., & Bradshaw, M. *Financial reporting, financial statement analysis, and valuation: a strategic perspective*: South-Western Pub.

The Machinery & Technical Specialties Committee of the American Society of Appraisers (2010). Definition of Value Relating to MTS Assets. [Journal]. *The Journal of the International Machinery & Technical Specialties of the American Society of Appraisers, 27*(4).

Thurmond, V. A. (2001). The Point of Triangulation. *Journal of Nursing Scholarship, 33*(3), 253-258.

APPENDIX A:

Definition of valuation terms (The Machinery & Technical Specialties Committee of the American Society of Appraisers, 2010)

Reproduction cost new	is the current cost of reproducing a new replica of a property with the same or closely similar materials (The Machinery & Technical Specialties Committee of the American Society of Appraisers, 2010).
Replacement cost new	is the current cost of a similar new property having the nearest equivalent utility as the property being appraised.
Fair Market Value	is the estimated amount, expressed in terms of money that may be reasonably expected for a property in an exchange between a willing buyer and a willing seller, with equity to both, neither under any compulsion to buy or sell, and both fully aware of all relevant facts, as of a specific date.
Fair Market Value in Use Continued	is the estimated amount, expressed in terms of money, that may reasonably be expected for a property in an exchange between a willing buyer and a willing seller, with equity to both, neither under any compulsion to buy or sell, and both fully aware of all relevant facts, including installation, as of a specific date, and assuming that the earnings support the value reported. (This amount includes all normal direct and indirect costs to make the property fully operational and may not readily pertain to aircraft.)
Fair Market Value - Installed	is the estimated amount, expressed in terms of money, that may reasonably be expected for an installed property in an exchange between a willing buyer and a willing seller, with equity to both, neither under any compulsion to buy or sell, and both fully aware of all relevant facts, including installation, as of a specific date. (This amount includes all normal direct and indirect costs, such as installation and other assemblage costs, to make the property fully operational but does not have to be supported by the business earnings.)
Fair Market Value -removal	is the estimated amount, expressed in terms of money, that may reasonably be expected for a property, between a willing buyer and a willing seller, with equity to both, neither under any compulsion to buy or sell and both fully aware of all relevant facts, as of a specific date, considering the cost of removal of the property to another location.
Liquidation Value in place	is the estimated gross amount expressed in terms of money that could typically be realized from a failed facility, assuming that the entire facility would be sold intact within a limited time to complete the sale, as of a specific date.
Orderly Liquidation Value	is the estimated gross amount expressed in terms of money, that could be typically realized from a liquidation sale, given a reasonable period of time to find a purchaser(s) with the seller being compelled to sell on an as-is, where-is basis as of a specific date(L. H. Miles, 2009).
Forced Liquidation Value	is the estimated gross amount expressed in terms of money that could be typically realized from a properly advertised and conducted public auction, with the seller being compelled to sell with a sense of immediacy on an as-is, where-is basis, as of a specific date.
Salvage Value	is the estimated amount expressed in terms of money that may be expected for the whole property or a component of the whole property that is retired from service for use elsewhere, as of a specific date.
Scrap Value	is the estimated amount expressed in terms of money that could be realized for the property if it were sold for its material content, not for a productive use, as of a specific date.

APPENDIX B : RESEARCH INSTRUMENTS

1	**Demographics**					
	Male	**Female**				
2	**Qualifications**					
	Bachelors	**Honours**	**Masters**	**Chartered Accountant**		
3	**Work Experience**					
	0 -5	6 - 10	11+			
	Instructions and Information					
	Please provide the answer after properly reflecting on the previous work submitted					
	Please provide truthful and honest answers					
	Likert Scale 1-Strongly disagree. 5 = Strongly Agree					
	Research Questions					
	Level of satisfaction with the overall content of the valuation reports prepared	**Strongly Disagree**				**Strongly Ag**
		1	2	3	4	5
	State the extent of satisfaction with respect to each of the various sub-heading of a typical plant and equipment valuation report					
	Suitability of the specific plant and equipment for a loan at the amount and on terms proposed					
	Physical description of the equipment					
	Valuation method used					
	degree of uncertainty of valuation figures					
	Valuation figures higher than expected					
	Valuation figures lower than expected					
	The provision of sufficient general information on comparables					
	Improvement Expected in Valuation Report					
	Please identify ways of improving the quality of valuation reports, with a view of increasing their level of satisfaction.					

Sample when collecting data from Records.

Client Name	SBU Name/Equipment Category	Valuation Report	Actual Transaction
		Liquidation Value	Liquidation Value
		in Rands	in Rands
e.g. Client XYZ	Mining	85 000 000	60 000 000

APPENDIX C: CONSITENCY MATRIX

Research Problem: resolve the issue of inappropriate use of valuation method in determining the depreciation of plant and machinery assets valuation procedure, particularly those under security.

Sub-problem	Literature Review	Proposition	Source of data	Type of data	Analysis
To identify and review the current use of depreciation factors when undertaking a valuation of plant and machinery assets, particularly those under security.	Ahn, J. K. (2006). Alico, J., (1989); Appraisers(2009). Appraisers, (2010);Barry, G. and Duncan, P. (2005); Budhbhatti, K. (2002); Marston, A. R. W., and J. Hempstead (1953); McClurg, S. M. (2002); Remsha, M. J. (2009); Sahray, K. (2009) Seow, I. S. (2009); St.John, A. R. a. S. (2009)	How does the current approach to the way depreciation is calculated improve security from prospective and current operational clients.	Survey/Records.	Quantitative/Quantitative data.	Triangulation
To assess the appropriateness of the current depreciation factors for securitisation.	Derry, C. (1993); L. H. Miles, J. (2009); Machinery, A. S. o. A. and Committee, E. T.(2005)Ellsworth, R. K. (2009b); Evaluations, I. (2010); Gunderson, B. (2009));	Is the current depreciation practice approach appropriate for the valuation of plant and equipment capital assets that are under security?	Survey/Records	Quantitative/Quantitative data.	Triangulation.
To propose a suitable or alternative process of determining the depreciation factors of plant and machinery asset valuation, particularly those under security and those	Miles, L. (1998); Miles, L. H. (2009); Monday, S. E. (2008); Musa, H. and Škoda, M. (2009); Newman, I. and McNeil, K. A. (1998); Onwuegbuzie, A. J. and Collins, K. M. T. (2007); Paganetto, L	What will the suitable process be?	Survey/Records	Quantitative/Quantitative data	Triangulation.