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of **BUSINESS**
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Valuing the rhino: Where is their worth?

Dissertation

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Abstract

Research states that the private sector see rhinoceros becoming a liability; the private sector is thus moving away from rhino conservation. There is a need for a descriptive research to provide an answer to the question of whether rhinos as an investment are profitable or if they are a liability (Child, 2012; Ferreira, Pfab, & Knight, 2014). It is of importance for different stakeholders in rhino conservation to know if rhino conservation is a valid investment for a private game reserve in South Africa.

Different income and cost factors have been researched and linked to a small rhino population. Cash flows are forecasted for five years. Scenarios of various discount rates are used to calculate the net present value (NPV) of the rhino project. The NPV, as expressed in Table 25 to Table 30 in paragraph 5.3, clearly show that the rhino is a lost investment. The rhino is a liability for any private game reserve in South Africa.

Figure 2 and Figure 3 in paragraph 5.4.1. clearly shows the major impact the rhino horn trade can have on the NPV. This proves to be the missing income stream, if realised, justifying private game reserves conserving rhino. It transforms the rhino from a liability to a high-value asset, generating a profitable cash flow.

Table of Contents

Plagiarism Declaration	i
Acknowledgements	i
Abstract	ii
List of figures	iv
List of tables	v
1. Introduction	1
1.1. Research area and problem	1
1.2. Purpose of research	2
1.3. Research assumptions	2
1.4. Research ethics	3
2. Literature review	3
2.1 Overview	3
2.2 The African rhinoceros	3
2.2.1 Rhino conservation in South Africa	4
2.2.2 Rhino poaching in South Africa	5
2.3 Financial analysis.....	7
2.3.1 Valuation of a rhinoceros	8
2.3.2 Total economic value.....	8
2.3.2.1. Live sales.....	9
2.3.2.2. Hunting.....	11
2.3.2.3. Tourism	11
2.3.3 Expenditures linked to the rhinoceros	12
2.3.4 Discounting cash flows.....	13
2.4. Conclusion	13
3 Research methodology	14
3.1 Research approach and Strategy	14
3.2 Research design	14
3.3 Data collection methods and instruments	15
3.4 Sampling	15
3.5 Research criteria.....	16
3.6 Data analysis methods.....	16
3.7 Research limitations.....	17
4 Research findings	18
4.1. Income linked to the rhinoceros.....	18
4.1.1. Tourism.....	18
4.1.2. Live sales	19
4.1.3. Hunting	20
4.2. Costs linked to the rhinoceros.....	20
4.2.1. Initial investment	21
4.2.2. Anti-poaching	21
4.2.3. Veterinary	22
4.2.4. Insurance.....	23
4.2.5. Fencing	23
4.2.6. Feeding costs	24
4.2.7. Labour costs.....	25
4.2.8. General costs	25
4.3 Discount rate	26

4.3.1. Average rate of return.....	26
4.3.2. Risk free rate.....	26
4.4. Probability of the rhino horn trade.....	27
4.4.1. Harvesting of rhino horn.....	27
4.4.2. Price of rhino horn.....	28
4.4.3. Dehorning costs.....	29
5. Research analysis and discussion	30
5.1. Analysis and discussion of the income linked to the rhinoceros	30
5.2. Analysis and discussion of the costs linked to the rhinoceros	31
5.3. Analysis for the main research question	32
5.4. Discussion for the main research question.....	36
5.5. Analysis and discussion of the added rhino horn trade.....	37
5.6. Research limitation	38
5.6.1. Rhino owners being secretive, and tourism.....	38
5.6.2. Focus of the private game reserve	39
5.6.3. Forecasting the price of live sales.....	39
5.6.4. Discount rate.....	39
5.6.5. Terminal value.....	39
5.6.6. Probability of the legal rhino horn trade.....	40
5.6.7. Pro or anti the rhino horn trade.....	40
6. Research conclusion.....	41
7. Future research directions	42
References	43
Appendix A: Compiled questionnaires	49
Insurance:.....	49
Anti-poaching:	49
Feeding:	49
Veterinary:	50
Fencing:	50
Tourism.....	50
Hunting	50
Appendix B: Consent form	52

List of figures

<i>Figure 1: Total Economic Value of rhinoceros</i>	<i>9</i>
<i>Figure 2: NPV rhino horn trade per different discount rate (prices shown in Rands).....</i>	<i>37</i>
<i>Figure 3: NPV rhino horn trade per different discount rate (prices shown in Rands [excluding fencing costs]).....</i>	<i>38</i>

List of tables

<i>Table 1: Rhino population in South Africa in 2010 (Emslie, 2012)</i>	1
<i>Table 2: Rhino poaching statistics (Poaching facts, 2016)</i>	1
<i>Table 3: Rhino poaching statistics of South Africa (Bale, 2016a; Poaching facts, 2016)</i>	6
<i>Table 4: Live sales 2015(African Wildlife Auctions, 2016; Wildlifeauctions.co.za, 2016)</i>	10
<i>Table 5: Live sales 2016 (“Wildveilings,” 2016)</i>	10
<i>Table 6: Tourists' preferred animal (Saayman & Saayman, 2016b)</i>	12
<i>Table 7: Willingness-to-pay (in R) (Saayman & Saayman, 2016b)</i>	12
<i>Table 8: Tourism income (n=5)</i>	19
<i>Table 9: Breeding of rhinoceroses</i>	19
<i>Table 10: Insurance & veterinary costs of live sales in year five</i>	20
<i>Table 11: Starting population cost (“Wildveilings,” 2016, Wildwinkel: Kalahari veiling, 2016)</i>	21
<i>Table 12: Anti-poaching costs (n=4)</i>	22
<i>Table 13: Veterinary costs (n=3)</i>	22
<i>Table 14: Transport costs (n=3)</i>	23
<i>Table 15: Insurance costs (n=3)</i>	23
<i>Table 16: Fencing costs (n=3)</i>	24
<i>Table 17: Feeding costs (n=7)</i>	24
<i>Table 18: Labour costs (Department of Labour, 2016; Trading Economics, 2016)</i>	25
<i>Table 19: General costs (n=2)</i>	25
<i>Table 20: Harvesting of rhino horn and possible income</i>	29
<i>Table 21: Veterinary dehorning costs (n=3)</i>	29
<i>Table 22: Incomes linked to the rhinoceros</i>	31
<i>Table 23: Costs linked to the rhino</i>	32
<i>Table 24: Scenario analysis</i>	33
<i>Table 25: Including annual insurance and poaching cover. The discount rate is the 3-month JIBAR (7.36%)</i>	33
<i>Table 26: Including annual insurance and poaching cover. Excluding fencing costs. The discount rate is the 3-month JIBAR (7.36%)</i>	34
<i>Table 27: Excluding annual insurance and poaching cover. Discount rate is based on the IRR of game breeding (31.26%)</i>	34
<i>Table 28: Excluding fencing costs and annual insurance and poaching cover. Discount rate is based on the IRR of game breeding (31.26%)</i>	35

Table 29: Excluding annual insurance and poaching cover. Discount rate is based on the IRR of private game reserves (10%)..... 35

Table 30: Excluding fencing cost and annual insurance and poaching cover. Discount rate is based on the IRR of private game reserves (10%)..... 36

1. Introduction

1.1. Research area and problem

Table 1: Rhino population in South Africa in 2010 (Emslie, 2012)

Species	Population 2010	Trend
White rhino	18 796	Increasing
Black rhino	1 915	Increasing
Total	20 711	

The population of black rhino and white rhino have been slowly increasing, despite the high threat of poaching. The population figure for 2010 can be found in Table 1. This was the last official population number published (Emslie, 2012). Exact numbers of the rhino populations in South Africa for 2016 are unknown. This is due to the fact that population numbers of rhinoceros are kept confidential by most private game reserves. Poached rhino are being documented however, and this can be seen in Table 2. Rhino poaching is increasing and is a threat to the population. The person or syndicates behind the poaching of the rhino can earn \$60 000 to \$80 000 for each animal by illegal trading in the rhino horn (Ferreira et al., 2014). This is driven by the rising price of rhinoceros horn, which benefits poachers only, as court decided that international trade of rhinoceros horn will stay illegal (Bale, 2016b).

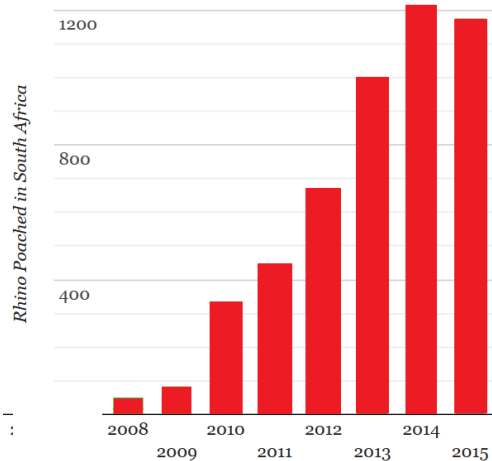


Table 2: Rhino poaching statistics (Poaching facts, 2016)

Rhino horn trade has been banned for 40 years, while demand for the rhino horn has been increasing significantly since 2008 (Child, 2012). The two major markets for rhino horn are Vietnam and China, where the rhino horn is used in a wide array of manners. As a medicine, it is commonly grinded to powder and ingested. The powder is seen as a remedy to almost all diseases, from a hangover to cancer. It is also being used as an aphrodisiac (Christy, 2016). There is also a market for jewellery made from rhino horn, or it is used as a decorative display in houses of the

wealthy (Nuwer, 2016). The prices paid for rhino horn indicate the enormous market size and demand for rhino horn in Vietnam and China.

Private game reserves benefit through tourism (including limited hunting) and live sales, but these benefits presumably do not cover the costs and risks involved in protecting the rhinoceros, resulting in the fact that private game reserves see them as a liability (Child, 2012). The private sector is moving away from rhino conservation due to this liability (Nuwer, 2016). The private sector owns 24 per cent of the Rhinoceros population on two-million hectares of land in South Africa. Loss of this population would further speed up extinction (Ferreira *et al.*, 2014). Therefore, it is of importance for different stakeholders in rhino conservation to know if rhino conservation is a valid investment for a private game reserve in South Africa.

1.2. Purpose of research

In the current situation, where research states that private game reserves might see rhinoceros becoming a liability to the game reserve, there is a need for a descriptive research to provide an answer to the question of whether rhinos as an investment are profitable or if they are a liability (Child, 2012; Ferreira *et al.*, 2014; Nuwer, 2016).

Main research question: Are rhinos a viable investment for private game reserves in South Africa?

Sub question 1: What is the income linked to rhinos for private game reserves in South Africa?

Sub question 2: What are the costs linked to rhinos for private game reserves in South Africa?

The scope is private game reserves with a rhino population in South Africa and the suppliers of services and goods which can be linked to the rhinoceros.

1.3. Research assumptions

Assumptions are made to link incomes and costs to the rhinos in a private game reserve, as some of the costs and incomes are not directly linkable to the rhinos. An example of not directly linkable is tourism as an income, and fencing as a cost. Previous research and experts' opinions are used to determine what will be linked to the rhinos and to what extent. These assumptions may influence the final answer to the research question.

1.4. Research ethics

Ethics are involved as there are confidentiality issues in collecting the income streams and costs linked to rhinos in private game reserves. Rhino owners are secretive about many facts involving rhinos, due to the threat of poachers; also, about the subjective part of what amount of income and what amount of costs to link to rhinos. People who are in favour of the rhino horn trade might link higher costs to the rhinoceros and vice versa.

2. Literature review

2.1 Overview

The purpose of the literature review is to understand what factors are involved in rhino conservation in South Africa. The rhinoceros itself is described in an extent to what is of influence on conservation efforts by private game reserves, as is the current status of rhino conservation, and the history that has led to this point. The threat of poaching is reviewed as the current situation is the cause of this research. Furthermore, the different components of the capital budgeting framework are explained to the extent that the different inputs used and how they are measured are understood. Also, the links of these inputs with the rhinoceros or private game reserve is explained.

2.2 The African rhinoceros

Biological factors of the rhinoceros are important, such as breeding and mortality, as this affects the different cost and income factors and the framework used to analyse them. The importance of the rhinoceros to the ecosystem is also a reason for stakeholders to ensure the conservation of these animals.

The white rhinoceros is the largest of the two rhinoceroses, weighing up to 3 600 kilograms and is the third-largest land mammal in South Africa. The black rhinoceros can weigh up to 1 400 kilograms. Their expected lifespan is 35–50 years for both species (Capstick, 1984). The rhinoceros cow can become sexually mature at three to six years. Bull rhinoceros are sexually mature in eight years. Rhinoceros carry one calf at the time and the gestation period of a white

rhinoceros is 16 months. The calf stays with the cow for approximately three years. During that time the cow does not breed. (Bothma & du Toit, 2010; Rhinos info, 2016).

Both rhinoceros species are members of the Big Five, although the black rhinoceros is preferred by hunters (Capstick, 1984). The rhino plays a vital role in the ecosystem. The white rhino uses its wide mouth and lips as a lawnmower and provides grazing lawns for smaller herbivores, which are areas of high nutrient concentration (Department of Environmental Affairs, 2013a). All rhinos contribute in spreading seeds and seedlings of various plants through the region (Hübschle, 2016). A research by Cromsigt & te Beest (2014) states that the rhino is a keystone species in an ecosystem, just like the wolf or the elephant. The results of this study highlights the fact that poaching affects not only the rhino as a species, but it threatens the key role of this animal as the driver of the African savannah. The rhino has a significant impact on the structure and the composition of the African savannah (Cromsigt & te Beest, 2014). If the rhino were to become extinct, it would not only have an emotional impact but it would damage the entire ecosystem.

2.2.1 Rhino conservation in South Africa

Conservation in South Africa is different to conservation in other countries. This unique model needs to be understood to comprehend the situation rhinos find themselves in. The history and policies surrounding the conservation of rhinos in private game reserves is examined in paragraph 2.3.2.1.

Conservation of the rhinoceros in South Africa, between 1990 and 2010, led to an average annual net meta-population increase of 7.2 per cent for the white rhinoceros, and 4.9 per cent for the black rhinoceros. A research report by the Department of Environmental Affairs (2013b) stated that a population growth rate of 5 per cent per year was required afterwards to reach a net population of 25 000 white rhinoceros by the end of 2016 (Department of Environmental Affairs, 2013b). 83 per cent of Africa's rhinoceroses live in South Africa, and 75 per cent of all rhinoceros world-wide (Department of Environmental Affairs, 2013b). Estimates show that, nationally, there are about 15 000 white rhinoceros owned by the state and 5 000 are privately owned, on 395 private game reserves and 36 state protected areas, which covered approximately five-million hectares in the year 2013 (Department of Environmental Affairs, 2013b). It is further specified that the private sector owns 24 per cent of the rhino population on two-million hectares (Ferreira *et al.*, 2014). The

state-run parks have a limited capacity to hold rhino populations and are close to their limit, selling surplus rhinoceros to private game reserves. Future growth is therefore dependent on the demand for rhinoceros by private game reserves (Emslie & Brooks, 1999).

In South Africa's five-million hectares there are 78 important and key populations of rhinoceros. These are divided into twelve important and six key population of black rhinoceros and 41 important and 19 key populations of white rhinoceros. These populations are not bound to a single game reserve but spread over different reserves or protected areas and therefore require partnerships. These populations are critical for the sustainable growth of rhinoceros conservation (Department of Environmental Affairs, 2013b). The importance of these populations lies mostly in biological management, such as measures to prevent overstocking and to prevent inbreeding. Conservation of wildlife is more than protection of the wildlife (Du Toit, Emslie, Brooks, Daconto, & Mungwashu, 2006). South Africa plays a great role in conservation of the African rhinoceros.

Regardless of all conservation efforts, poaching is a major threat to rhinoceros and has worsened in recent years in South Africa. There is a high demand for rhino horns and the black market price proves to be a worthy incentive for poachers (Ferreira *et al.*, 2014).

2.2.2 Rhino poaching in South Africa

The trade in rhino horn, or any product related to rhinos, is forbidden since 1977. Rhino horn is mostly exported to the markets of China and Vietnam (Child, 2012; Christy, 2016). The number of rhinos poached in South Africa has increased from 13 in 2008 to 1215 in 2014. For 2015 the number of poached rhinoceros in South Africa was 1175, a decrease from the year before (Bale, 2016a; IUCN, 2016; Toon & Toon, 2017; WWF, 2016). Table 3 clearly shows that the trend in poaching is increasing, despite the minor decrease in 2015. Especially frightening is that the number of poached rhinos across Africa was 1338, which means that 88 per cent of rhinoceros poaching in Africa happens in South Africa (IUCN, 2016; Toon & Toon, 2017).

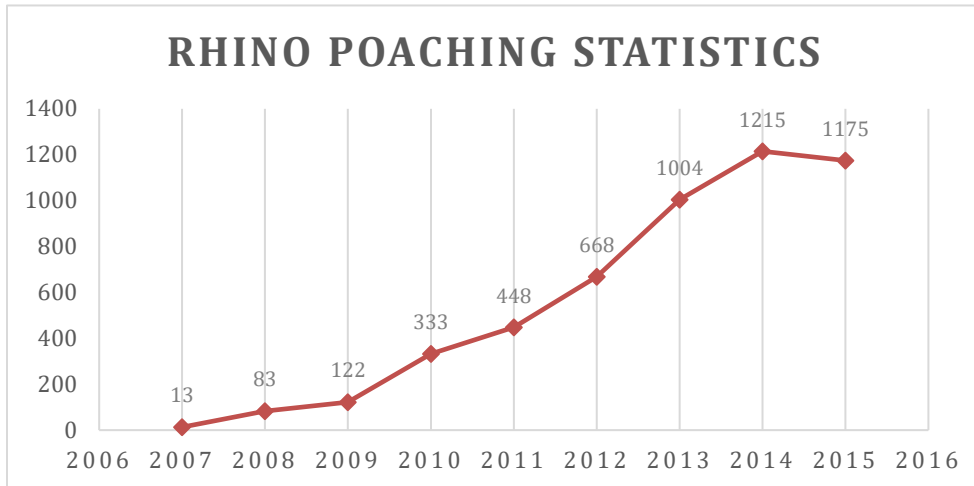


Table 3: Rhino poaching statistics of South Africa (Bale, 2016a; Poaching facts, 2016)

The syndicates behind the poaching and illegal trading earn \$60 000 to \$80 000 for each animal (Ferreira *et al.*, 2014). This is driven by the rising price of rhino horn, which benefits poachers only, as it was decided that international trade in rhino horn would remain illegal (Bale, 2016b). Although there are non-lethal ways of de-horning a rhino, poachers kill and de-horn rhinos to get the highly valued horn (Hübschle, 2016).

The price of the rhino horn is directly associated with poaching. There are several ways of protecting the African rhinoceros in South Africa's game reserves from poaching, both direct and indirect. Successful protection reduces the available supply of horn, reduces the demand for horn or supplies rhino horn in a different format (Department of Environmental Affairs, 2013a).

Rhinoceros can be directly protected against poaching by private game reserves by dehorning, chemically treating horns, fitting satellite technology to rhinos, implanting micro-chips into horns and obtaining DNA samples from horns. These measures discourage poachers from killing a rhino. If they do kill a rhino, some of these measures provide a link between the poacher and the rhino. Aerial-based detection sensors on drones, cellphone-based network sensors, shot detectors and night-vision equipment improve the chances of capturing a poacher (Department of Environmental Affairs, 2013a).

Reducing the demand for rhino horn in consumer countries can be done by media and advertising campaigns. Supplying the horn in another format can directly influence the price of the horn. International authorities and South African authorities have banned the trade in rhino horn, so a

change in the supply would require new policies and laws (Department of Environmental Affairs, 2013a).

Research by Ferreira, Pfab, & Knight (2014) shows that the benefits and income from hunting, tourism and live sales of rhinos are no longer sufficient, when placed against the security and anti-poaching costs for rhinos in South Africa (Ferreira *et al.*, 2014). This fact pushes private game reserves out of rhino conservation, whose contribution is essential to the carrying capacity and population growth of the African rhinoceros.

2.3 Financial analysis

Businesses will try to increase its profit by investing in projects that produce revenues in surplus of the costs of the resources required for that project (Dickerson, 1963). The reason to use capital budgeting is to find assets that are worth more than they cost (Myers & Turnbull, 1977). The amount of revenue must be taken into account as well as the timing and their relationship to expenses. Calculations that combine the factors measurement of profit, outlays and a time factor will be used to determine if the project is attractive (Dickerson, 1963).

The investment in rhinoceros is a project for any private game reserve. To provide an answer to the question of whether rhinoceroses are becoming a liability, the project needs to be evaluated using a valuation method suited for the cash flows generated by rhinoceros. The actual research determines what cash flows are generated and, therefore, which method is most suitable for the measurement. As stated by Gossel (2016), the following process can be used for capital budgeting:

1	Calculate capital implications	
2	Calculate operating cash flows	Incremental revenues Incremental costs Depreciation
3	Calculate cash flows	NPAT + depreciation Discount cash flows
4	Produce NPV, IRR, PI, ARR and PP	
5	Final decision	

(Gossel, 2016)

2.3.1 Valuation of a rhinoceros

The price of an asset is different from the value. Valuation can play different roles and is useful in a range of situations. The importance is not dependent on the activeness of the investor, but it is dependent on the frequency with which valuation is needed. The value of an asset can be described as the present value of the expected cash flows from that asset.

$$Value\ of\ asset = \sum_{t=1}^{t=N} \frac{E(Cash\ flow_t)}{(1+r)^t}$$

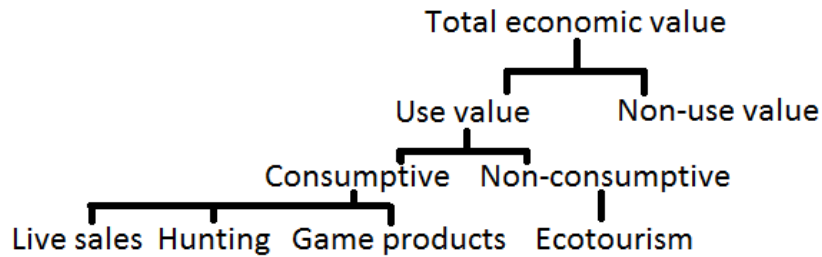
Where the life of the asset is N and r is the discount rate (Damodaran, 2000). When an asset is complex and subject to constant change, prediction of future cash flows can be difficult (Damodaran, 2012). Rhinos find themselves in this space as the methods used in poaching, and therefore anti-poaching, change constantly. The market for and value of rhinos is changing constantly, due to the risks. A rhino can be categorised as a unique, cash-flow-producing biological asset. The rhino is a key species in the game reserve, similar to a key person in a business.

2.3.2 Total economic value

The value of rhinos is different to each user, as different users assign different values. Hunters will derive value from consuming rhinoceros, while breeders derive value from breeding and selling quality rhinos; tourists derive value from viewing and photographing rhinoceros. Therefore, the value can be distinguished between consumptive and non-consumptive use (Saayman & Saayman, 2016a). The total benefits of a wildlife species can be measured by the concept, total economic value (TEV) (Barnes *et al.*, 2004). The TEV combines values from non-consumptive uses and consumptive uses. TEV=direct use value (consumptive and non-consumptive) + indirect use value + option value + existence value. Existence value is a value given to the fact that a person knows that the animal exists. Bequest value is a value given to the fact that future generations can enjoy the rhinoceros and gain satisfaction from the animal. Option value is created due to the uncertainty of the survival of the species and the need to protect it for potential future demand (Saayman & Saayman, 2016b). These values will not be part of this research. Rhinoceros have a value under the sections as shown in Figure 1 (Chardonnet *et al.*, 2002; Swanson, Mourato, Swierbinski, & Kontoleon, 2002). However, the monetary values can be categorized in trophy hunting, ecotourism and live sales (Chardonnet *et al.*, 2002; Crookes & Blignaut, 2015; Swanson *et al.*, 2002). The

market price only takes into account the current consumptive values (Saayman & Saayman, 2016b). In this research, non-consumptive value is also applicable as the rhino is a key animal in the game reserve making the game reserve more attractive to tourists and therefore generating income (Maciejewski & Kerley, 2014).

Figure 1: Total Economic Value of rhinoceros



2.3.2.1. Live sales

The wildlife in South Africa used to be treated by law as un-owned property, better known as *res nullius*. For an owner to actually have seen the benefit of the ownership of a wild animal, the animal had to be captured, killed or domesticated (Hübschle, 2016). This can be seen as an incentive to harvest wildlife and not to conserve it. Furthermore, the Natal Parks Board (main supplier of rhinoceros) in 1982 sold the white rhino for a listed price of R1 000. The average trophy price was R6 000, at that time. Therefore, any private landowner who received a white rhinoceros, tried to sell it as a trophy as soon as possible to earn R5 000. The alternative, for the owner, was to hold the animal, with the risk of the animal being poached or losing it to a neighbour (’t Sas-Rolfes, 2011). The prices for white rhinos increased slowly as demand kept being higher than supply, mainly due the fixed pricing of the animal. The turning point was in 1985, when some private ranchers offered rhinos for auction. The auctioned rhinos were sold for an average price of R10 000, which was double the listed price of rhinos at that time. In 1989, the market price grew to R49 000 per rhino. At this time, the price for a rhino trophy peaked at R92 000. After 1990, listed prices were abandoned and rhinos were mostly auctioned at live sales. During this period, the South African Law Commission changed the ownership of wildlife. The problems of *res nullius* were finally recognised and a new policy was created: The Theft of Game Act of 1991. This changed the incentives for private owners. The combined effect of market pricing through auctions and the stronger ownership rights over rhinos gave sense to the breeding of rhinos. The

market value of live rhino sales grew to R64.5- million by 2008. And as the market grew in value, so did the populations (*t Sas-Rolfes, 2011). Net rhinoceros auction prices are gathered and shown in Table 4 for 2015 and Table 5 for 2016. The live sales data is gathered from African Wildlife Auction, the online auctions of wildlifeauctions.co.za and from the magazine Wild & Jagt.

Table 4: Live sales 2015(African Wildlife Auctions, 2016; Wildlifeauctions.co.za, 2016)

Category	Number	Revenue 2015	Average 2015
Bull	67	38 015 004	567 388
Young bull	9	15 800 000	1 755 556
Cow	6	2 795 000	465 833
Cow pregnant	5	2 315 000	463 000
Cow pregnant & calf	2	1 200 000	600 000
Heifer	4	1 545 000	386 250
Heifer pregnant	2	600 000	300 000
Cow + bull calf	6	3 050 000	508 333
Cow + heifer calf	3	1 810 000	603 333
Family group	2	600 000	300 000

Table 5: Live sales 2016 ("Wildveilings," 2016)

Category	Number	Revenue 2016	Average 2016	% change of avg
Bull	2	1 550 000	775 000	37%
Young bull	2	685 000	342 500	-80%
Cow	3	2 075 000	691 667	48%
Cow pregnant	-			
Cow pregnant & calf	-			
Heifer	2	825 000	412 500	7%
Heifer pregnant	-			
Cow + bull calf	1	550 000	550 000	8%
Cow + heifer calf	1	850 000	850 000	41%
Family group				
Heifer + young bull	1	250 000	250 000	

2.3.2.2. Hunting

The demand for rhinoceros hunting is relatively unaffected by the price, making the demand inelastic. The rhinoceros is described as elusive and challenging to hunt. The difficulty and danger in hunting the rhinoceros add to the prestige of the hunter, which contributes to its demand as a trophy. The value for the hunter, and therefore the price of the trophy, is also dependent on the size of the rhino and the size of the horn (Johnson, Kansky, Loveridge, & Macdonald, 2010). A hunter can only hunt the rhinoceros legally if a permit is issued (Saayman & Saayman, 2016b). Hunting permits are only given to a private rhino owner if the rhino is biologically approved for hunting, which means that the rhino is usually old, does not breed anymore or is aggressive against other rhinos (savetherhino.org, 2016). There is no public available data on the market size of rhino hunting. The number of rhino trophies exported from South Africa from 2004 to 2014 is 1625 (International Fund for Animal Welfare, 2016).

2.3.2.3. Tourism

In South Africa, tourism has grown from approximately one-million tourists a year in 1990, to 10-million tourists in 2015. This growth was matched by the increase in private game reserves offering tourists game viewing, photographic safaris, hunting and other wildlife experiences (Saayman & Saayman, 2016a). The rhinoceros's contribution to the experience and satisfaction of the tourist must be determined to calculate the value of the rhinoceros.

A study by Maciejewski and Kerley (2014) indicate that the amount of time spent by tourists viewing wildlife is influenced by the visibility and availability. It suggests that the endangered, larger and charismatic species, such as the rhinoceros, contribute highly to the tourist's satisfaction. Tourists spend 11.31 per cent of their total viewing time at the white rhinoceros (Maciejewski & Kerley, 2014). Another method which would give value to the rhinoceros would be the amount tourists are willing to pay.

The Contingent Valuation Method is the preferred method of determining willingness-to-pay, as it is applicable to non-use values and use values of ecological services and goods. With this method, the tourist is approached with a scenario and questioned how much he/she is willing to pay. In the context of this research, only the non-consumptive value of the rhino needs to be assessed. That is the value that the respondent attaches to the privilege of viewing the rhino in its natural habitat

(Saayman & Saayman, 2016b). The Tourism Research Unit (2016b) conducted three annual surveys from 2011 to 2013 in South Africa to find how much tourists were willing to spend to see a rhinoceros and what the respondents' preferred animal was of the Big Five (TREES as cited in Saayman & Saayman, 2016b). The dip in 2012 is not explained, although it could be explained by the fact that due to poaching, the respondents did not see any or less rhino. If not, then the visitor would be willing to pay more for the viewing. The data shown in Table 6 and Table 7 is used to determine what the contribution of tourism is in 2016.

Table 6: Tourists' preferred animal (Saayman & Saayman, 2016b)

	2011	2012	2013
Lion	2 (25%)	2 (24%)	2 (24%)
Elephant	4 (13%)	4 (12%)	4 (15%)
Buffalo	5 (11%)	5 (10%)	5 (12%)
Leopard	1 (36%)	1 (38%)	1 (31%)
Rhino	3 (15%)	3 (16%)	3 (18%)

Table 7: Willingness-to-pay (in R) (Saayman & Saayman, 2016b)

	2011		2012		2013	
	RSA	Foreign	RSA	Foreign	RSA	Foreign
Lion	196.59 (1.86)	259.76 (1.49)	94.82 (1.32)	93.56 (1.43)	167.07 (2.12)	356.36 (2.21)
Elephant	181.41 (2.67)	212.20 (1.80)	41.33 (1.41)	73.33 (1.90)	82.31 (2.30)	214.72 (1.97)
Buffalo	146.59 (2.45)	100.71 (1.56)	37.18 (1.44)	65.32 (2.16)	84.14 (2.28)	149.75 (1.65)
Leopard	259.12 (1.84)	331.53 (1.47)	140.16 (1.65)	96.94 (1.38)	225.85 (1.80)	405.72 (1.94)
Rhino	199.19 (2.42)	237.36 (1.65)	90.19 (1.61)	79.68 (1.70)	174.84 (2.21)	504.45 (3.12)

Relative standard deviation in brackets, defined as s.d./mean.

2.3.3 Expenditures linked to the rhinoceros

There are certain factors that need to be documented and quantified in order to understand the costs related to rhinos in private game reserves. The cost structure of rhino conservation projects in private game reserves is defined in the research. Costs are either fixed, where costs are fixed unrelated to volume; or variable, where costs change in respect to the volume (Wyatt, 2012).

Costs are further investigated during the research for this study. Information was collected from experts, suppliers of services and goods, and owners and management of private game reserves. A study by Hall (2012) identified the following costs to be investigated surrounding the intensive breeding of white rhinos:

- Cost of land

- Infrastructure costs
- Costs of buying a rhinoceros
- Insurance costs
- Horn harvesting costs
- Veterinary costs
- Feeding costs
- Inflation
- Labour costs
- Security costs

Intensive breeding is different, but the categories as researched by Hall could provide to be useful when linking income and costs to the rhinoceros for a private game reserve. Her thesis is based on a single farm which only breeds and dehorn rhino intensively, which is therefor based on a different model.

2.3.4 Discounting cash flows

The cost of capital is the required rate of return that shareholders want, combined with the cost of borrowing in the weighted average costs of capital (WACC). Capital expenditure that delivers benefits in excess of the cost of capital should, in theory, be worthwhile (Wyatt, 2012).

NPV and DCF are methods of investment appraisal that recognises all cash flows and also take into account the time value of money (Wyatt, 2012).

2.4. Conclusion

Insights in the unique model of wildlife conservation are of importance to understand the context of this research. Privatising wildlife has been a major contributor to the successful conservation of many species in South Africa, including rhino. The private sector is important for the future of this animal, as the state-owned parks are at their limit for holding rhinos. The trend in poaching, however, is shocking. There is a slight drop in the year 2015 compared to 2014, but the numbers are still threatening as more than 3 rhinos have been killed every day (Poaching facts, 2016). The private sector is moving away from rhinos. The threat of poaching is directly linked to the highly-valued horn. The trade is illegal in the rhino horn, which is why only poachers benefit of this value.

The incomes have been described clearly and the expenditures have been touched on. The financial aspects are shown to be complex and substantial, thus the capital budgeting framework has been described as it forms the basis for this study and is fully exposed in the methods and data.

3 Research methodology

3.1 Research approach and Strategy

The approach to this research is deductive, as an existing theory is used with new data collected (Saunders, Lewis, & Thornhill, 2009). To answer the research question, data needed to be collected which could be measured. Measurement is the process of turning data into numbers, and therefore this study is quantitative (Punch, 2012). The first and the second sub- questions have been researched using quantitative methods.

The research strategy is a survey. Access to a single private game reserve is important to gain insights into the different factors and inputs concerning rhinoceros and to know who to send the questionnaire to. This gives insight to the real-life context of the research (Dul & Hak, 2008). Private game reserves which take part in rhino conservation are usually secretive with their information. It is not publicly known what exact factors are involved for a private game reserve; rhino owners do not give away methods they use for anti-poaching or how many rhinos there are in the reserve. Therefore, the experts in rhino conservation, who are active at the private game reserve, are a reliable source of information from which the information is collected. From that point, the different surveys were created which were used to gather data for each different input concerning rhinoceros in a private game reserve. The survey is commonly used for descriptive research. The survey strategy allows a collection of quantitative data (Saunders et al., 2009).

3.2 Research design

The data collected through the survey is a snap-shot of a particular time. The research design is a cross-sectional study, as this suits the survey strategy and is important for comparability. The data collected from the surveys was used in models which have been built through other researches to build a forecast. Therefore, the data at a particular time is sufficient. A survey is used to determine data used as inputs for the different factors, as stated in the literature review, and shared by a

private rhino owner. How the data is used and forecast is described transparently to maximize reliability.

3.3 Data collection methods and instruments

The different inputs were collected using two methods. The first is secondary data. This is used when data is found in academic literature, former surveys, journals, public data, and reports. The second is primary data, in the form of surveys, as the comparability of data is significantly important for this study. Some inputs are gathered at a different source, such as the supplier of the good or service, the private game reserve or institutions. The data that is collected can be summarised to inputs for income and inputs for costs.

The three main inputs for income are live sales, hunting and tourism. Live sales inputs have been collected from auction houses which have made their sales information publicly available. Inputs from hunting have been collected through a survey of private game reserves, who let rhino be hunted on their property, outfitters and permit offices. Inputs for tourism have been collected by researching the average occupancy rate and capacity on private game reserves in South Africa which then was multiplied by the willingness-to-pay factor, as stated in the research by Saayman and Saayman (2016b).

Concerning the cost inputs, first all cost factors needed to be researched. A private game reserve which owns rhino provided information about the cost (and income) factors which are related and could be linked to a rhinoceros. When the factors had been categorised, the inputs were collected from suppliers, private game reserves or publicly available data from institutions.

The costs were collected by receiving data from a single private game reserve. The inputs were then categorised. Different suppliers and private game reserves were surveyed to collect the inputs for the costs to secure the representation and generalness of the numbers collected.

3.4 Sampling

Some inputs for this research could only be provided by one supplier, such as a government institution, while for other inputs there were multiple sources, such as different private game farms or different suppliers. This needed to be taken into account for sampling. Non-probability sampling was used to determine the sample of the population for comparability. The samples needed to be

known to be connected with rhino conservation and have a history or experience in dealing with rhinoceros. The data for each input in this research required a selective sample (Saunders *et al.*, 2009).

The size of the samples had to be investigated further as this was different for each input of this research. Further research was needed to first determine from whom the data could be collected. This research was done by visiting a private game reserve which provided the different income and cost inputs. Magazines, such as Wildlife Ranching and Wild & Jag were analysed for suppliers' advertisements. From there the suppliers, and for some inputs, the private game reserve data was collected which formed the inputs in the capital budgeting framework. Accessibility to the data can be decisive in the sampling of the population, as data involving rhinos is kept confidential by most private rhino owners.

3.5 Research criteria

This study is reliable for private game reserves as the data collected has been transparently analysed using existing techniques. The inputs were collected from multiple suppliers and so it is not applicable to a particular game reserve, but to any private game reserve that desires such goods or services related to rhino conservation. Furthermore, secondary research was done and the data collected is from reliable literature and reports. All the methods used are explained transparently and every assumption clearly argued and documented.

3.6 Data analysis methods

The data collected has been analysed and used as inputs in the capital budgeting framework. Different methods are used for each category to fit in the capital budgeting framework.

The Total Economic Value is used to determine the income streams of the rhinoceros for the private game reserve. The three main inputs are live sales, hunting and tourism. Live sales inputs have been collected from auction houses, which have made their sales publicly available. Inputs of hunting have been collected from private game reserves, permit offices and publicly available data. Inputs for tourism were collected by researching what the average capacity and occupancy rate is at private game reserves with rhinos in South Africa, which then was multiplied by the willingness-to-pay factor, as stated in the research by (Saayman & Saayman, 2016b).

The different costs inputs collected have been averaged and annualised for use in the capital budgeting framework. The private game reserves surrounding the Dinokeng reserve assisted in this research to provide insights into what the different inputs were, and also into how to interpret the different inputs linked to the rhinoceros. To answer the research question, a measurement method was used, which was most suited to the discovered cash flows. As this is dependent of the types of cash flow, and if they were relatively steady over time, the decision criteria were decided on later in this research. To make this decision, expert's advice was necessary.

3.7 Research limitations

The linkage of non-consumptive values to the rhino is limited. This is due to the fact that many macro-economic factors influence tourism. Therefore, it is impossible to state with certainty that the rhino is the cause of a change in turnover of a private game reserve. Assumptions were made of the percentage of which costs and incomes would increase or decrease, which could prove to be a limitation. There is no comparable listed company or publicly available data on the game breeding and ecotourism industry. This made it difficult to calculate a discount factor and can be a limitation to the reliability. Also, as the rhino is under serious threat of poaching, some private game reserves or breeders would not share data. If data about the rhino population or anti-poaching methods becomes publicly known, the risk of rhino being poached increases and, therefore, they are very secretive about their rhinos. The time constraint of conducting this research and, the resulting limited responses, can also be seen as a limitation in itself: especially considering the information which has been collected from different game reserves. More time would possibly have meant more responses, as building trust is important when collecting confidential information. The many assumptions, on which the private game reserve and the rhino population are based in this research, were also a limitation. A discussion could be included, for example, that the area of the private game reserve (flat, squared) might be optimal for fencing and managing the rhino population. But would an area like that attract as many tourists and, therefore the income, found in this research? These assumptions, presumably, made it easier for suppliers to calculate their prices, therefore increasing the response rate. But it might have also given some goods or services in this project a lower cost than they would have in reality.

4 Research findings

A private game reserve needs to be at least 4000 ha to sustain rhinoceros. To stimulate breeding at least two rhino bulls need to be included in the population, one adult and one young bull. The adult will establish dominance and, because of the age difference, there will most likely be no fighting involved. Fighting among rhino bulls has a high chance of fatal results. Furthermore, two cows and two heifers are ideal to start with (Bothma & du Toit, 2010; Hall, 2012). Six to eight rhinoceros are the start of a nucleus breeding herd. The research findings are premised on this population.

4.1. Income linked to the rhinoceros

The different income factors are consumptive (hunting, live sales) and non-consumptive (tourism) values.

4.1.1. Tourism

Private game reserves were not able to link their income from tourism to the game animals, let alone the rhinoceros. Also, the income generated from game drives is not sufficient to calculate the income proportion to the rhino, as the population of rhinoceros is kept secret. It has been indicated that sharing the population of rhino on their farms leads to poaching. Furthermore, another research has shown that the tourism turnover does not change with the introduction of rhino in the private game reserve. There are many macro-economic factors that influence tourism, so the cause of a higher or lower turnover cannot be linked to the rhino (Spenceley & Barnes, 2005).

The private game reserves that have taken part in the questionnaire had an average capacity of 12 persons. The average occupancy rate for guest farms and guesthouses in 2016 was 44.2 per cent (Govender, 2016). The occupancy rate of the private game reserves that catered for tourist who participated in the questionnaire was 42 per cent. To calculate an income from tourism linked to the rhino, the occupancy rate is multiplied with the capacity times 365 days. This answer is then multiplied with the average willingness-to-pay as seen in Table 8.

Table 8: Tourism income (n=5)

	Average willingness to pay (Saayman & Saayman, 2016b)	Number of guests	Occupancy rate 2015	Income linked to the rhinoceros
2015	R214.28	12	42%	R394 189.49

Tourism growth of 4.3 per cent of guesthouses and guest farms has been used to forecast the coming years (Govender, 2015).

4.1.2. Live sales

Live sale prices are dependent on market appetite. Experts in this field, who shared their opinion at the Castle De Wildt auction, indicated that drought is an important factor in the price of game animals. During draught, auctions are a buyers’ market as breeders try to sell their animals at a lower price due to the increase in costs of maintaining them. Vice versa when there has been enough rainfall. It is not possible to forecast the changes in price realistically. The change in price from 2015 to 2016 cannot be forecast throughout the five-year period, as this would imply the bull calf losing 80 per cent of its value per year. Therefore, the 2016 prices have been used throughout the forecast.

As described in chapter 2.2, the gestation period is 16 months and the calf stays with the mother for an estimated period of three years. Therefore, the interval of calving is set to four years. It is assumed that the two heifers become sexually mature in the year one (2017) at the private game reserve.

Table 9: Breeding of rhinoceroses

Legend:	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	
Pregnant	Rhino Bull	Rhino Bull	Rhino Bull	Rhino Bull	Rhino Bull		
Interval of calving	Rhino Young Bull	Rhino Young Bull	Rhino Young Bull	Rhino Young Bull	Rhino Young Bull	Rhino Bull	
To be sold	Rhino Cow	Rhino Cow	Rhino Cow + bull calf	Rhino Cow + bull calf	Rhino Cow + bull calf	Rhino Cow	
To be bought	Rhino Cow	Rhino Cow	Rhino Cow + bull calf	Rhino Cow + bull calf	Rhino Cow + bull calf	Rhino Cow	
	Rhino Heifer	Rhino Cow	Rhino Cow + calf	Rhino Cow + calf	Rhino Cow + calf	Rhino Cow	
	Rhino Heifer	Rhino Cow	Rhino Cow + calf	Rhino Cow + calf	Rhino Cow + calf	Rhino Cow	
						Rhino Young Bull	ZAR 342.500,00
						Rhino Young Bull	ZAR 342.500,00
						Rhino Heifer	ZAR 412.500,00
						Rhino Heifer	ZAR 412.500,00
						Rhino Young bull	ZAR -342.500,00

It is assumed that 50 per cent of the new calves are bulls. The assumed breeding schedule of rhinoceros can be found in Table 9. The new young bulls and calves will be sold via live auctions once they are ready to leave their mothers. That would imply that in year five, two young bulls

and heifers can be sold. Another young bull will be bought once the oldest bull is no longer suited for breeding, in year five. The bull will be bought to keep genetics diverse.

When these rhinos are sold, veterinary services and insurance must be used for transport. This would imply extra costs as shown in Table 10.

Table 10: Insurance & veterinary costs of live sales in year five.

Insurance	% of value	Total
Capture	1,3%	R 19 630
Transport	0,85%	R 12 853
Post release stress	1,6%	R 24 160
Total		R 56 653
Veterinary service or good	Costs per transport	Costs for 100 km transport for four rhinoceros
Capturing and loading	R 16 500	R 66 000
Darts and drugs	R 3 000	R 12 000
Transport in game truck with crane and rhino crate	R 25 per km	R 10 000
Total		R 88 000

4.1.3. Hunting

The oldest bull will be put up for hunting once it is no longer able to breed. This, it is assumed will be in 2021. The value which the landowner gets for the rhino is dependent on the horn size. The price of the bull that is bought is an average of two bulls, which have been sold at the auction Wildswinkel Kalahari on 1 July in lot 20 and 25. These bulls have a horn length of $30 \frac{2}{8}$ inch and $25 \frac{3}{8}$ inch (“Wildveilings,” 2016, *Wildwinkel: Kalahari veiling*, 2016). It is assumed that the bull used in this research has a horn size which is the average of $27 \frac{4}{5}$ inch.

Private owners of rhinoceros have indicated that, on average, the earnings for the landowner are between R15 000 and R35 000 per inch of the front horn, where a rhinoceros with a horn of 25 inches is worth R25 000 per inch and upwards. It is assumed that this bull would be worth R 29 000 per inch, which would total an amount of R805 563.

4.2. Costs linked to the rhinoceros

The costs linked to the rhino have been collected from numerous suppliers of different goods and services, as well as private game reserves.

4.2.1. Initial investment

To stimulate breeding, at least two bulls, need to be included in the population. Furthermore, two cows and two heifers are ideal to start with (Bothma & du Toit, 2010; Hall, 2012). This has also been confirmed by multiple rhino owners or experts in the rhino conservation field (n=6). The investment in this starting population of six rhinoceros will be shown in Table 11.

Table 11: Starting population cost (“Wildveilings,” 2016, *Wildwinkel: Kalahari veiling, 2016*)

Category	Price
Rhino Bull	R 775.000
Rhino Young Bull	R 342.500
Rhino Cow (2x)	R 1.383.334
Rhino Heifer (2x)	R 825.000
Total investment	R 3.325.834

4.2.2. Anti-poaching

The costs of different methods of security for anti-poaching have been based on a questionnaire for owners or operational managers of a private game reserve which owns rhinos. The following methods, supplies and goods are being used as seen in Table 12. Most private game reserves did not want to share their methods used, only the costs involved. The private game reserves that did give their methods described the following as very efficient; the Khoi San and a helicopter with FLIR. The Khoi San follow the rhino in shifts of eight hours. Every rhino has two Khoi San following it in turns. The rhino is always being watched and, with their skills and expertise, the animal does not know it is being followed. They are incredibly hard to spot, even if you know where they are. The helicopter with FLIR is used when there is a threat. The helicopter itself is not bought only for the rhinos. It is used for multiple tasks on the private game reserve, therefore there is no capital investment linked to the rhino. The FLIR however, is anti-poaching equipment which the surveyed private game reserves bought solely for the poaching threat of their rhinos, although it is also used when other animals are being poached or threatened to be poached. The FLIR can lock onto multiple targets, making it easier to follow them. Different visions of the FLIR, such as infrared or thermal, make sure the targets are clearly visible and trackable. The costs are based on monthly usage of the helicopter. These costs are forecasted according to an annual growth rate of ten per cent, as indicated by private rhino owners. The costs associated with fencing, which is for

keeping the rhinos in and also to keep poachers out, are in a separate paragraph for fencing.

Table 12: Anti-poaching costs (n=4)

Category	Costs	Annual costs	Growth rate
Khoi San (two per rhino)	R18 000 per month per rhino	R216 000 per rhino	
Helicopter with FLIR	R5 000 per month	R60 000	
Total		R276 000	10%

4.2.3. Veterinary

Assumptions have been made on how many veterinary visits a rhino would need in a year, as this is dependent on the aggression among rhinoceros and poaching. It is also dependent on the distance of the private game reserve from the veterinary office and the terrain. On average, a rhinoceros needs a visit from the veterinarian every three years. The distance between the private game reserve and the veterinary office is assumed to be 100 km. Veterinarians have indicated that prices have been increasing at approximately ten per cent from 2015 to 2016. This increase has been used as growth in the forecast. The travel costs and helicopter costs can be spread over multiple rhinos, if they need to receive veterinary service at the same time. Because this possibility is too difficult to forecast, it is assumed that a visit is for one rhino. The costs are annually averaged for six rhinos.

Table 13: Veterinary costs (n=3)

Service or goods	100 km costs: 1hour's work	Annual cost per rhino	Annual cost for six rhinos	Growth rate
Travel costs (R14 per km)	R1 400			
Helicopter	R4 500			
Veterinary rate	R1 200			
Darts and drugs	R3 000			
Total	R10 100	R3 366.67	R20 200	10%

(On average a rhino needs a visit from the veterinarian once every three years, so 1/3 of R10 100 is R3 366.67. This, multiplied by six, is R20 200, which is the annual costs for six rhinoceros).

The veterinarian's services are also needed when the rhinoceros is bought or sold. The veterinarian darts and transports the animal. These prices also increase by 10 per cent annually, as indicated by the veterinaries. The rhinoceros is also insured during transportation; the costs associated with insurance are at paragraph 4.2.4.

Table 14: Transport costs (n=3)

Veterinary service or goods	Costs per transport	Costs for 100 km transport for six rhinoceros
Capturing and loading	R16 500	R99 000
Darts and drugs	R3 000	R18 000
Transport in game truck with crane and rhino crate	R25 per km	R15 000
Total		R132 000

4.2.4. Insurance

The rhino is insured during transportation. Rhino owners have indicated that they do not insure their rhino against poaching as this is too expensive. The annual and poaching cover is shown however, because the rhinos are insured in the scenario where the risk-free rate is used as a discount rate. The average insurance costs for the starting population are shown in Table 15.

Table 15: Insurance costs (n=3)

Insurance	% of value	Total
Capture	1.3%	R43 235.84
Transport	0.85%	R28 269.59
Post release stress	1.6%	R53 213.34
Total transport insurance		R124 718.77
Annual cover	4.975%	R165 460.25
Poaching cover	1.5%	R49 887.50
Total annual cover		R215 347.75

4.2.5. Fencing

It is assumed in this research that the rhinoceros being added to the private game reserve requires new fencing. It is also assumed that the area is 20 km by 20 km, which equals 4 000 ha. This is the ideal area for a small rhino population (Bothma & du Toit, 2010). The reserve would require a total of 80 km of fencing.

Costs involved can be found in Table 16. From 2014 to 2015 prices were increased by ten per cent, and from 2015 to 2016 prices increased by eight per cent. In the forecast, an increase of nine per cent has been used on the tools and spare equipment costs (Brown, Gildenhuis, Hignett, & van Deventer, 2014).

Because many private game reserves already have buffalo or elephant, in which case the fence would not need upgrading or the maintenance of the fence can be linked to other animals including rhino, the capital budgeting framework is also shown without fencing costs.

Table 16: Fencing costs (n=3)

Service or goods	2016
Fence per metre	R95
Total	R7 600 000
<i>Growth rate</i>	7,9%
Tools and spare equipment	R36 000 annually

Labour costs to maintain the fence are in paragraph 4.2.7. The costs involved with labour hours and vehicle use are applicable to more tasks than maintaining the fence.

4.2.6. Feeding costs

The rhinoceros needs extra feeding in most private game reserve. The animal is a grazer and eats bales of hay. Some companies that specialised in feeding game, stated that they mostly supply game pellets designed for browsers, for feeding rhinoceros. Private game reserves and some feeding companies indicated they feed rhinos with bales of hay. Because private rhino owners indicated they use bales of hay, bales will be used in this research. The prices for bales are shown in Table 17. The price of a bale of hay is dependent on the draught of the season. 2016 was a very dry year, while 2015 was considered normal. In the forecast these two prices will be switched per year to represent the changing climate.

Table 17: Feeding costs (n=7)

Year	Feeding	Costs	Annual costs
2015	Bale	R65 per day per rhino	R23 750 per rhino
2016 dry year	Bale	R100 per day per rhino	R36 000 per rhino

4.2.7. Labour costs

The labour, which is necessary specifically for the rhinoceros, has different tasks such as monitoring and feeding. Labour consists of four employees. Tasks are, but not limited to, monitoring, maintenance of infrastructure and feeding. The wage increase is based on the previous wage + CPI + 1% (Department of Labour, 2016). Forecast CPI and the annual wage are shown in table 18 (Trading Economics, 2016).

Table 18: Labour costs (Department of Labour, 2016; Trading Economics, 2016)

Labour	2016	2017	2018	2019	2020	2021
Annual wage costs	R324 000	R346 680	R369 907	R393 434	R417 236	R441 019
CPI		6%	5,7%	5,36%	5,05%	4,7%

4.2.8. General costs

General costs are shared among the other inputs. A vehicle is used by labourers for numerous tasks, such as monitoring, transportation, infrastructure checks, feeding etc. so it could be placed under labour, fencing, anti-poaching or feeding. General costs as a separate category makes more sense as they are not directly linked to any of the other categories. The vehicle costs consist of the capital cost and insurance of the vehicle. Fuel and ammunition are based on the average use and consumption as indicated by private rhino owners who participated in this study. The costs are shown in Table 19. These costs will grow according to the forecast inflation rate of South Africa, which is also shown in Table 19. These inputs have been collected from private rhino owners and are their annual costs.

Table 19: General costs (n=2)

Category	2016	2017	2018	2019	2020	2021
Inflation rate (Trading Economics, 2016)		6%	5,70%	5,36%	5,05%	4,70%
Vehicle	R49 200	R52 152	R55 125	R58 079	R61 012	R63 880
Fuel & ammunition	R20 000	R21 200	R22 408	R23 609	R24 802	R25 968
Total	R69 200	R73 352	R77 533	R81 689	R85 814	R89 847

4.3 Discount rate

Currently, there is no best practice for valuing a private company in a developing market, such as South Africa (Tham & Velez-Pareja, 2004). The assumptions made are explained clearly and transparently, to provide a full understanding of the issues. The required rate of return would normally equal WACC (Firer, Ross, Westerfield, & Jordan, 2012). These models estimate the expected return on alternative investments with a similar risk (Koller, Goedhard, & Wessels, 2015). But because there is no market data or comparable listed company, there are some major difficulties in getting the inputs of WACC or cost of capital equation (Damodaran, 2000). Therefore, three different discount factors are used to discount the cash flows: average rate of return of the game-breeding industry, the risk-free rate and the average rate of return of private game reserves.

4.3.1. Average rate of return

Because investors and owners of private game reserves have the option to choose between different species of game to invest in, the required return of game breeding is used as the discount rate. By using this method, the difficulties encountered in, for example, the CAPM method, will not be applicable. The required rate of return will be different for investors in ecotourism, but the need for a certain game animal in ecotourism or hunting is directly linked to the price paid for the animal at live sales. If the animal is worth a lot to tourists, or when the animal is a wanted trophy by hunters, the auction price will increase. Therefore the average rate of return of the game breeding industry will be used as the discount factor. The average IRR for game breeding species such as sable, buffalo, roan antelope and nyala is 31.26 per cent (Adami, Bester, Mogashoa, & van der Linde, 2016; Gamevest, 2016; Kolwah, 2016).

Another average IRR from a private game reserve is also being used. The activities at those two game reserves are tourism, hunting and game breeding. These two private game reserves have indicated that they aim for a 10 per cent return on their capital.

4.3.2. Risk free rate

Using the risk-free rate is a method which is well argued by Warren Buffet. This takes away the possibility of double counting the risk. When using the risk-free rate, the cash flows need to be adjusted for the risk (Damodaran, 2008). Full insurance cover of the rhino is necessary to compensate for the risks associated with rhino conservation, so it provides certainty of the cash

flows. Another argument is that because the cash flows are negative, a high discount rate would actually give a higher value to the project. Therefore a lower discount rate, such as the risk-free rate, seems more appropriate (Damodaran, 2008).

The risk-free rate used is the three-month JIBAR (Johannesburg Interbank Average Rate). This is an average of three-month NCD rates. The rate is calculated after all the rates are received by participating banks. Prior to November 2012, known as the Johannesburg Interbank Agreed rate. The risk-free rate is 7.36 (South African Reserve Bank, 2016).

4.4. Probability of the rhino horn trade

Another way of discounting the future cash flows is using the probability of the rhino horn trade being legalised. This could lead to a new income stream and this is a reason for some rhino owners to keep breeding them. CITES and the South African government have decided that the rhino horn trade will stay illegal (Bale, 2016b). There are many lobbyists in favour of the horn trade and there still is a possibility that it will be allowed in the future. Chances are relatively low, as the conference of CITES October 2016 in Johannesburg has just been held and it has been stated that the trade in rhino horn will stay illegal. A message from Eugene Lapointe, founder of IWMC World Conservation Trust and former Secretary General of CITES, from 1982-1990, states that CITES needs to reconsider lifting the trade ban on rhino horn. The trade ban, which has been in place since 1977, has not been successful, seeing that the rhino population is declining severely due to poaching (International Wildlife Management Consortium, 2016). The lobby for legalising the trade is at an all-time high, but the anti-trade lobby is too.

4.4.1. Harvesting of rhino horn

The horns of a rhino grow at a mean rate of 50 mm per year and do not differ between bulls and cows (Bothma & du Toit, 2010). The weight, however, does differ as bulls grow one kilogram per year and cows 0.6 kilogram per year on average (Hall, 2012). The horn continuous to grow throughout the animal's lifetime (Bothma & du Toit, 2010; Emslie & Brooks, 1999). Because the horn grows and thus produces an income for its entire lifetime, using hunting as a salvage value becomes unwanted. Problem is that a bull might remain dominant while it is not breeding and thus can prevent another bull from breeding with the cows. Letting this rhino be hunted raises another issue, and that is the income from hunting, as the price is based on the size of the horn. Therefore the rhino will not be hunted.

A study by Lindsey & Taylor (2011) showed that private rhino owners frequency of dehorning their rhinos is between 12 and 60 months. It was stated that the frequency of dehorning is also dependent on how tempted poachers are to kill the rhino. This means that when the price they get for a horn is high enough, poachers will still kill a rhino, even for a little stump of rhino horn. The mean was 24 months (Lindsey & Taylor, 2011). In this study, it is assumed that the rhinos will be dehorned every 24 months.

A limitation in this study is that with the first dehorning taking place, the exact weight of horn cannot be determined. The average horn size of a rhino will be dehorned in year one. The average weight of a rhino's anterior and posterior horn is four kilogram (Hall, 2012). Twenty-four months after the first dehorning, the average regrowth rate in kilograms dehorned is shown in Table 20.

4.4.2. Price of rhino horn

Research by Child (2012) finds that, by annually dehorning a rhino a private owner can harvest almost one kilogram of horn, which was worth about \$20 000 per animal at the end of 2011. Another study shows that the retail price of rhino horn in 2011 was in the region of \$65 000 per kilogram on the Asian market (’t Sas-Rolfes, 2012). In 2012 the price was estimated to be around \$50 000 per kg (Conrad, 2012). In 2013 the price increased to \$60 000 per kilo of rhino horn (Sharife, 2013). The research by Eustace (2014) finds that a rhino horn, wholesale, would receive approximately \$30 000 per kilo in 2013 (Eustace, 2014). Research by Christy (2016) quotes the infamous Mr Groenewald that rhino horn prices are \$3 000 per pound on the South African black market, while selling it to Asia would give a price in the range of \$15 000 to \$30 000 per pound, which translates to roughly \$66 000 per kilo (Christy, 2016). There are many different markets and estimating the value if trade is legalised, has many difficulties and uncertainties. Because of these difficulties and assumptions made, the change in price which will be caused by the change in policy is unpredictable. A range of prices is shown in a sensitivity analysis as if it were legal to sell rhino horn in the Asian market. The actual effect legalisation would have on the rhino horn price cannot be estimated with certainty. The prices will range from R50 000 to R950 000 per kilogram of rhino horn, with intervals of R150 000 as shown in Table 20. A price drop to R50 000 is assumed, because of possible flooding of the rhino horn market, and the maximum price is translated to Rands with the currency exchange rate of R14.58 per US dollar on 18 November 2016 (Bloomberg, 2016).

Table 20: Harvesting of rhino horn and possible income

Year	2016 0	2017 1	2018 2	2019 3	2020 4	2021 5
Rhino horn in kilograms:						
Rhino Bull (2x)		8		2		2
Rhino Cow (4x)		16		2,4		2,4
Total		24		4,4		4,4
Operating income and costs:						
Price per kg:						
50.000		1.200.000		220.000		220.000
200.000		4.800.000		880.000		880.000
350.000		8.400.000		1.540.000		1.540.000
500.000		12.000.000		2.200.000		2.200.000
650.000		15.600.000		2.860.000		2.860.000
800.000		19.200.000		3.520.000		3.520.000
950.000		22.800.000		4.180.000		4.180.000
Dehorning costs		35.635		43.118		52.172

4.4.3. Dehorning costs

To dehorn a rhino, a veterinary team must first find the rhino from a helicopter. Then they dart the rhino from the helicopter, quickly dehorn the rhino with an electric saw or similar tool, and then provide drugs to awaken the animal. The costs associated with these activities are similar to normal veterinary services for the rhino. It is assumed that 100 km travel costs are involved. Travel costs can be shared among the rhinos, if several rhinos are dehorned on the same day, and this is assumed. Finding the rhinos and the dehorning should take approximately four hours in total. The mandatory DNA kits are currently free of charge, and it is assumed that these will remain free. As indicated, the costs grow at 10 per cent per year. The breakdown of the costs of dehorning a rhino are shown in Table 21, total costs are also shown in Table 20.

Table 21: Veterinary dehorning costs (n=3)

Service or goods	Variable	Price
Travel costs	100 km	R1400
Helicopter	4.5 hours	R20 250
Veterinarian's rate	4 hours	R4 800
Darts and dehorning	For six rhinos	R5 622
DNA kits		R0
Total		R32 072

5. Research analysis and discussion

The purpose of this research is to discover whether rhinos are a viable investment for a private game reserve. To analyse this, the different cost and income factors are used to determine future cash flows and put in the capital budgeting framework. These cash flows are then discounted back to get the NPV of the rhino population. Firstly, the salvage value and the operating incomes are shown in paragraph 5.1. In paragraph 5.2 the capital implications of buying the rhino population and operating costs are shown. The main findings, which are the incomes, costs and discount factors are analysed as seen in paragraph 5.3.

5.1. Analysis and discussion of the income linked to the rhinoceros

The income linked to the rhino in the framework can be narrowed down to live sales and tourism. The other income stream, from hunting, has been put in the framework as the salvage value, which makes sense as there is no depreciation or other way of getting any value out of an old non-breeding rhino. After the rhino has been hunted, all income streams stop for that animal. This is different from the TEV as described in the literature review. The TEV was useful for categorising the different inputs of the rhino, but when analysing the rhino as a financial investment, the values need to be interpreted differently. The TEV can be very high, as with the rhinoceros, while the income linked to the rhino is a small fraction of that value. The possible income from rhino horn trade is shown for different prices per kilogram. There are difficulties estimating the price of a rhino horn in a legal market. The price elasticity, for example, is based on many assumptions. The income factors are shown and forecast for five years in Table 22.

Table 22: Incomes linked to the rhinoceros

Year	2016 0	2017 1	2018 2	2019 3	2020 4	2021 5
Capital Implications:						
Salvage (Hunting)	-	-	-	-		806.563
Operating incomes:						
Tourism		411.140	428.819	447.258	466.490	486.549
Live sales	-	-	-	-	-	1.510.000
Operating income from rhino horn trade						
Price per kg:						
50.000		1.200.000		220.000		220.000
200.000		4.800.000		880.000		880.000
350.000		8.400.000		1.540.000		1.540.000
500.000		12.000.000		2.200.000		2.200.000
650.000		15.600.000		2.860.000		2.860.000
800.000		19.200.000		3.520.000		3.520.000
950.000		22.800.000		4.180.000		4.180.000

5.2. Analysis and discussion of the costs linked to the rhinoceros

The costs linked to the rhinoceros are: insurance, veterinary services, fencing, feeding, anti-poaching, transportation and general costs. These costs have been forecast according to what suppliers and owners have replied in the questionnaires. Full information on each factor has been described in separate paragraphs of each cost factor. All the different scenarios, as described in Table 24, have an added scenario without the fencing costs. The costs as shown in Table 23 are the sum of all the costs used, including annual insurance and fencing. Dehorning of rhino has also been added, while it is not used in most scenarios. The costs are kept as generic as possible by using averages of multiple suppliers. Some costs, such as anti-poaching, come directly from private rhino owners. This is due to the fact that suppliers will provide supplies, but the methods and actual operation is managed by the private game reserve. Therefore, only they can provide the costs. Dehorning is not taken into account as an anti-poaching method as this disrupts the income from hunting. The income from hunting is based on the size of the trophy, which is the rhino horn.

Table 23: Costs linked to the rhino

Year	2016 0	2017 1	2018 2	2019 3	2020 4	2021 5
Capital Implications:						
Rhino Bull	(775.000)	-	-	-	-	-
Rhino Young Bull	(342.500)					(342.500)
Rhino Cow (2x)	(1.383.334)					
Rhino Heifer (2x)	(825.000)					
Operating costs:						
Insurance	(124.719)	(215.348)	(215.348)	(215.348)	(215.348)	(272.001)
Transport	(132.000)					(141.725)
Fencing, fencing tools and spares	(7.600.000)	(36.000)	(39.240)	(42.772)	(46.621)	(50.817)
Veterinary	(20.200)	(22.220)	(24.442)	(26.886)	(29.575)	(32.532)
Feeding		(142.500)	(216.000)	(142.500)	(216.000)	(142.500)
Labour		(346.680)	(369.908)	(393.434)	(417.236)	(441.019)
Anti-poaching		(303.600)	(333.960)	(367.356)	(404.092)	(444.501)
General		(73.352)	(77.533)	(81.689)	(85.814)	(89.847)
Dehorning		(35.635)		(43.118)		(52.172)

5.3. Analysis for the main research question

The different inputs for the costs and income have been collected and the future cash flows are calculated. The discounting of the cash flows has been done using different measurements of the discount rate. The NPV is calculated in a few different scenarios. The scenarios use different discount rates and some costs are excluded or included in the cash flows. The scenarios as described in Table 24 are shown in order. A caption describes the adjustments to each scenario for clarity. Terminal value has not been added to the valuation. There are some major difficulties in calculating the terminal value. Most importantly that it can significantly change the NPV based on the chosen calculation. The most obvious calculation would be the liquidation of all assets, meaning selling the rhinos. This proves to be difficult when the rhino horns are harvested. Selling rhino without horn is not realistic at an auction. Using a different method for calculating the terminal value when the rhino horn trade is added makes it unable to compare the scenarios, which is important to write a conclusion. Therefore, the terminal value is not added. This is a research limitation and is described further in paragraph 5.6.6.

Table 24: Scenario analysis

#	Scenario	Discount rate	Adjustments	Table
1	Risk free rate	7.36	Annual insurance is added as a cost	25
2	Risk free rate	7.36	Annual insurance is added as a cost. Fencing costs have been deleted.	26
3	Average rate of return of game breeding	31.26	No annual insurance cost	27
4	Average rate of return of game breeding	31.26	No annual insurance cost and no fencing costs	28
5	Average rate of return of private game reserve (activities include hunting, tourism and game breeding)	10	No annual insurance cost	29
6	Average rate of return of private game reserve (activities include hunting, tourism and game breeding)	10	No annual insurance cost and no fencing cost	30

The NPV of the investment with rhino horn trade sensitivity analysis are shown in a Figure 2 with fencing costs, and in Figure 3 without fencing costs. All different discount rates are used to determine the NPV of the rhino project. As the fencing is a big capital investment and distorts the NPV, while the linkage with only the rhino might not seem fair, the NPVs are shown with and without the cost of fencing. The tax rate is 28 per cent. And as the frameworks show, the earnings in most years, in every scenario, are negative. Because the earnings are negative, the tax expense amounts to a tax saving. It is shown as a positive amount because if this investment is accepted, the private game reserve will combine its regular operations with operations related to the rhino population, which causes the overall income tax to be lower.

Table 25: Including annual insurance and poaching cover. The discount rate is the 3-month JIBAR (7.36%)

Year	2016 0	2017 1	2018 2	2019 3	2020 4	2021 5
NPBT	(7.876.919)	(728.560)	(847.611)	(822.726)	(948.195)	381.607
Tax (28%)	-	203.997	237.331	230.363	265.495	(106.850)
NPAT	(7.876.919)	(524.563)	(610.280)	(592.363)	(682.701)	274.757
Free cash flows	(7.876.919)	(524.563)	(610.280)	(592.363)	(682.701)	274.757
FCF net of capital flows	(11.202.753)	(524.563)	(610.280)	(592.363)	(682.701)	738.820
Discount factor	1,00	0,93	0,87	0,81	0,75	0,70
Discounted FCF	(11.202.753)	(488.602)	(529.474)	(478.696)	(513.878)	517.996
NPV	(12.695.407)					
PI	(3,01)					
ARR	(12,84%)					

Table 26: Including annual insurance and poaching cover. Excluding fencing costs. The discount rate is the 3-month JIBAR (7.36%)

Year	2016 0	2017 1	2018 2	2019 3	2020 4	2021 5
NPBT	(276.919)	(692.560)	(808.372)	(779.954)	(901.575)	432.424
Tax (28%)	-	193.917	226.344	218.387	252.441	(121.079)
NPAT	(276.919)	(498.643)	(582.028)	(561.567)	(649.134)	311.345
Free cash flows	(276.919)	(498.643)	(582.028)	(561.567)	(649.134)	311.345
FCF net of capital flows	(3.602.753)	(498.643)	(582.028)	(561.567)	(649.134)	775.408
Discount factor	1,00	0,93	0,87	0,81	0,75	0,70
Discounted FCF	(3.602.753)	(464.459)	(504.962)	(453.810)	(488.612)	543.648
NPV	(4.970.948)					
PI	(0,68)					
ARR	(11,91%)					

Scenario one (Table 25) shows that the rhino is a major liability. Only in year five, when some young rhinos are sold and the old bull is hunted, does the income exceed the costs, resulting in a profit. The NPV is negative, resulting in the statement that rhinos are a liability.

The second scenario (Table 26) shows that without the cost of fencing the NPV is severely higher, but still negative. As in scenario one, the only profitable year is year five. But this profit does not make up the losses made in the previous years. The rhino project is a loss-making investment.

Table 27: Excluding annual insurance and poaching cover. Discount rate is based on the IRR of game breeding (31.26%)

Year	2016 0	2017 1	2018 2	2019 3	2020 4	2021 5
NPBT	(7.876.919)	(513.212)	(632.264)	(607.378)	(732.848)	596.955
Tax (28%)	-	143.699	177.034	170.066	205.197	(167.147)
NPAT	(7.876.919)	(369.513)	(455.230)	(437.312)	(527.650)	429.808
Free cash flows	(7.876.919)	(369.513)	(455.230)	(437.312)	(527.650)	429.808
FCF net of capital flows	(11.202.753)	(369.513)	(455.230)	(437.312)	(527.650)	893.871
Discount factor	1,00	0,76	0,58	0,44	0,34	0,26
Discounted FCF	(11.202.753)	(281.512)	(264.220)	(193.372)	(177.753)	229.410
NPV	(11.890.200)					
PI	(2,78)					
ARR	(8,18%)					

Table 28: Excluding fencing costs and annual insurance and poaching cover. Discount rate is based on the IRR of game breeding (31.26%)

Year	2016 0	2017 1	2018 2	2019 3	2020 4	2021 5
NPBT	(276.919)	(477.212)	(593.024)	(564.606)	(686.227)	647.772
Tax (28%)	-	133.619	166.047	158.090	192.143	(181.376)
NPAT	(276.919)	(343.593)	(426.977)	(406.517)	(494.083)	466.396
	-	-	-	-	-	-
Free cash flows	(276.919)	(343.593)	(426.977)	(406.517)	(494.083)	466.396
FCF net of capital flows	(3.602.753)	(343.593)	(426.977)	(406.517)	(494.083)	930.459
Discount factor	1,00	0,76	0,58	0,44	0,34	0,26
Discounted FCF	(3.602.753)	(261.765)	(247.822)	(179.755)	(166.445)	238.800
NPV	(4.219.739)					
PI	(0,45)					
ARR	(7,24%)					

When using a higher discount rate on negative earnings, it actually benefits the NPV. This can be seen clearly when comparing the NPV of Scenario 3 to Scenario 1. The profits of year five are also discounted heavily. The NPV in this scenario is still negative, as shown in Table 27.

In Table 28 the fencing costs are excluded. The difference of the NPV between Table 27 and Table 28 shows the impact of the fencing costs. Nonetheless, the rhino is a liability in both Scenarios 3 and 4.

Table 29: Excluding annual insurance and poaching cover. Discount rate is based on the IRR of private game reserves (10%)

Year	2016 0	2017 1	2018 2	2019 3	2020 4	2021 5
NPBT	(7.876.919)	(513.212)	(632.264)	(607.378)	(732.848)	596.955
Tax (28%)	-	143.699	177.034	170.066	205.197	(167.147)
NPAT	(7.876.919)	(369.513)	(455.230)	(437.312)	(527.650)	429.808
	-	-	-	-	-	-
Free cash flows	(7.876.919)	(369.513)	(455.230)	(437.312)	(527.650)	429.808
FCF net of capital flows	(11.202.753)	(369.513)	(455.230)	(437.312)	(527.650)	893.871
Discount factor	1,00	0,91	0,83	0,75	0,68	0,62
Discounted FCF	(11.202.753)	(335.921)	(376.223)	(328.559)	(360.392)	555.023
NPV	(12.048.825)					
PI	(2,78)					
ARR	(8,18%)					

Table 30: Excluding fencing cost and annual insurance and poaching cover. Discount rate is based on the IRR of private game reserves (10%)

Year	2016 0	2017 1	2018 2	2019 3	2020 4	2021 5
NPBT	(276.919)	(477.212)	(593.024)	(564.606)	(686.227)	647.772
Tax (28%)	-	133.619	166.047	158.090	192.143	(181.376)
NPAT	(276.919)	(343.593)	(426.977)	(406.517)	(494.083)	466.396
	-	-	-	-	-	-
Free cash flows	(276.919)	(343.593)	(426.977)	(406.517)	(494.083)	466.396
FCF net of capital flows	(3.602.753)	(343.593)	(426.977)	(406.517)	(494.083)	930.459
Discount factor	1,00	0,91	0,83	0,75	0,68	0,62
Discounted FCF	(3.602.753)	(312.357)	(352.874)	(305.422)	(337.465)	577.742
NPV	(4.333.129)					
PI	(0,45)					
ARR	(7,24%)					

Tables 29 and 30, which reflect Scenarios 5 and 6, again show a negative NPV. The different discount factors have a minor impact. The huge losses made each year have a vast impact on the NPV.

5.4. Discussion for the main research question

The rhino is a liability for any private game reserve. The income from hunting proves to be higher than the price of buying a rhino, but as the capital budgeting framework shows, if the rhino is being held at the private game reserve for one year, the loss is too significant and hunting and tourism income streams are not near the amount which would make conserving rhinos profitable.

When looking at the breeding of rhinos, year five provides a positive earning. This income however, is related to the risk of poaching. Therefore, this income might not be sustainable in the future. As private game reserves are making a loss at the moment on rhino conservation, more rhinos will be offered for sale at auctions. This might lead to a decrease in prices, speeding up the process of opting out of rhino conservation, as this is one of the main income streams directly linked to the rhino.

The reason for private rhino owners to keep their rhinos is the love of nature and the rhino. Some rhino owners have indicated that they bought the lifestyle when they started managing a private game reserve. The high risks, however, with conserving rhino at this moment pushes many out of rhino conservation. The risks take away the fun for many; some stated that it is a war and the rhino

owners are losing. Some believe in the possibility of legal rhino horn trade and therefore keep their rhinos and protect them with all they can afford.

5.5. Analysis and discussion of the added rhino horn trade

Legal trade in rhino horn could provide the necessary income to fight poachers, taking away their incentive by supplying the market and enabling owners to spend more money on better and more effective security measures. Private rhino owners have indicated that the probability of rhino horn sales being legalised is real, but there is no consensus. Some indicate a five per cent chance; others a 50 per cent chance of the trade ban being lifted. The next CITES conference is in 2019 and that is where the ban may be lifted. The financial impact of the rhino horn trade being legalised is researched and shown in Figure 2 and Figure 3. Rhinos are still being sold for high prices at different auctions, while the NPV is negative. A reason why rhinos are still valued highly by buyers at auctions can be the possibility of horn harvesting.

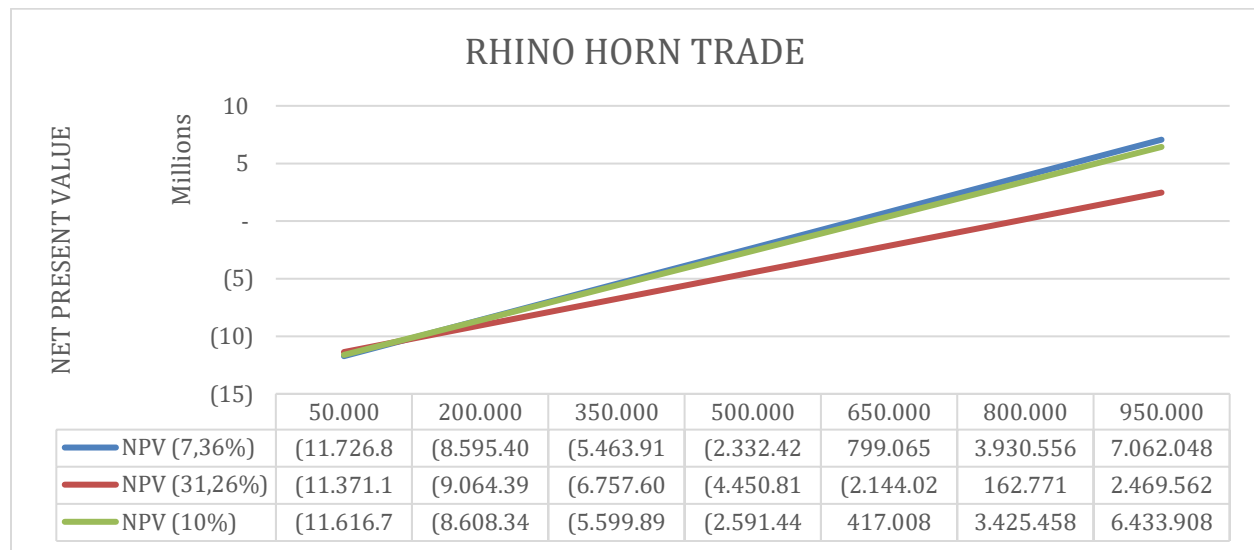


Figure 2: NPV rhino horn trade per different discount rate (prices shown in Rands)



Figure 3: NPV rhino horn trade per different discount rate (prices shown in Rands [excluding fencing costs])

The graphs and the table under the graph show the major impact the rhino horn trade can have on the NPV. The rhino horn trade to foreign markets such as China and Vietnam prove to be the missing income stream for private game reserves to conserve rhino profitably. It makes the rhino a high-value asset.

5.6. Research limitation

Limitations are found throughout this research in many aspects. Rhino owners are always under threat of poaching, and therefore do not want to share all their information about the rhino population they own. Suppliers have based their costs on several assumptions, such as the terrain, farm size and rhino population. The incomes linked to the rhino can only be calculated with the help of different assumptions.

5.6.1. Rhino owners being secretive, and tourism

A significant assumption is the income from tourism. As private rhino owners do not want to share exact population figures and do not link their tourism income to a single rhino. The amount a tourist is willing-to-pay is used to determine the income stream. Willingness to pay, however, is theoretical and has its own assumptions and limitations. For example, the experience the tourists had with a rhino before filling in this questionnaire will have an impact on the amount the tourist is willing to pay. Also, the capacity and occupancy rate which is used in this research might not

be applicable to all private rhino owners. Some do not have the option to cater for tourists and solely base their income on breeding and live sales or letting outfitters hunt on their property.

5.6.2. Focus of the private game reserve

On the other hand, some private game reserves do not breed rhino for an income and let the population grow naturally and do not let any animal be hunted. But as these are the three main income streams, assumptions have been made on which the private game reserves focus, which in this case is all three. In terms of tourist accommodation, the surveyed private game reserves catered for tourists mainly in the form of guesthouses. When looking at total South Africa, many private game reserves also provide accommodation in the form of luxury lodges and hotels. This might provide a higher capacity and occupancy rate which, therefore, increases the tourism income stream. Another limitation of the tourism income stream is that the costs for catering to the tourists is not taken into account, while this is part of catering for the tourist who is willing to pay for the rhino.

5.6.3. Forecasting the price of live sales

The live sales income has limitations on the growth rate. The price for a rhino at auction is dependent on the horn size and other genetic attributes. The average price per year can therefore change if a record trophy is being auctioned. The average price changes from 2015 to 2016 could not be used as a forecast due to the significant decrease for rhino bulls and increase for rhino cows.

5.6.4. Discount rate

The discount rates have limitations in this research. The cash flows are negative; there is no historic data and there is no comparable public company. The discount rates used in this research are well argued, but are based on assumptions.

5.6.5. Terminal value

The terminal value of the rhino project of a private game reserve has many assumptions and is not realistic. Therefore the terminal value has not been added in the calculations. The NPV in this research shows the loss or profit the project makes in the different scenarios over a 5-year period. There are different ways of calculating the terminal value. The cashflows however, are very unstable. And a stable growth is necessary to calculate most terminal values. This would add too many assumptions, which would make this research untrustworthy and unrealistic. The growth

rate which would have needed to be assumed can affect the value too significantly, positively and negatively. By using an assumed growth rate, it could reflect a bias towards the valuation. The most obvious method would be by the liquidation of all assets. This would mean that all rhinos are being sold at the end of year 5. Aside from that it is not realistic, it would not have impacted the NPV significantly. Also, by adding the rhino horn trade the price of the rhinos could not have been determined. The price paid for a rhino at an auction is mostly based on the size of its horn, as that determines the trophy price. If a different method was used to calculate the terminal value for each of the different scenarios, they could not be compared. Comparability is an important output of this study. To lessen the impact of the terminal value, the choice has been made to not add the terminal value to the NPV. This means that the NPV might be lower, but the pattern shown is still trustworthy.

5.6.6. Probability of the legal rhino horn trade

The probability of future rhino horn trade is a limitation to this research. It depends on the source of information, as the anti-trade lobby will provide a low probability, while the pro-trade lobby will provide a higher probability number. Consensus could not be calculated and therefore this could not be used as part of the discount rate. The price of rhino horn is also a limitation. Forecasting the actual price for rhino horn when trade is legalised has too many difficulties to be trustworthy. A sensitivity analysis provided an outcome which covers most possibilities.

5.6.7. Pro or anti the rhino horn trade

Another limitation is the fact that rhino owners could have provided me higher cost numbers than the actual case, as it would be to their benefit that this research shows that rhinos are a liability. The benefit would be that this research shows that current policies are contradicting their purpose, which may contribute to a change in policy or the legalisation of the rhino horn trade. That could lead to new investments in rhinos, which in turn lead to higher auction prices and more orders from the different suppliers. It must be said, however, that even if the numbers given are higher (or lower), the outcome of this research would not have changed significantly.

6. Research conclusion

The purpose of this research is to determine whether rhinos are becoming a liability for a private game reserve. The state-run parks have a limited capacity to hold rhino populations and are close to their limit, selling surplus rhinoceros to private game reserves. Future growth is therefore dependent on the demand for rhinoceros by private game reserves (Emslie & Brooks, 1999). As the framework clearly shows, the rhino is a lost investment. When South Africa privatised game animals, the purpose was to incentivise conservation. Prior to The Theft of Game Act of 1991, the rhinos were treated by law as un-owned property. As history shows, this incentivised harvesting game and not conservation (’t Sas-Rolfes, 2011). The current situation resembles the *res nullis* as a live rhino is now a liability for any private game reserve. They are incentivised to sell or let the rhino be hunted as soon as possible. The costs of conserving and breeding the animals ensure negative earnings. Private game reserves are opting out of rhino conservation. The financial losses could hit the private game reserves so that other projects are in danger too.

The rhino attracts poachers. Poachers do a lot of damage to the private game reserve. Rangers are in danger every day with possible poachers in the area. Also, other game is in danger as poachers use distraction tactics. All of the private game reserve’s activities are directly affected by these poachers.

Private game reserves which are still conserving rhino are doing it for either the love of the animal and/or the possibility of future trade in horn. The future trade in rhino horn is interesting. A legal trade will need strong policies and an enforceable system of export permits. Assumptions have been made about the price, but this proves to be a way of making a rhino worth more alive than dead, which is vice versa at the moment. Private rhino owners can use the money to conserve more rhino and protect them. Tax can be collected which can be used to enforce and strengthen policies and institutions. Communities can be involved in rhino conservation. They can be taught how to harvest the horn and take care of the animals. This can create a sustainable income for a community and an incentive to protect rhinos. It is the missing income stream which, if realised, would make the rhino a valuable asset for any private game reserve, generating a profitable cash flow.

7. Future research directions

This research provides an answer to the question of rhinos being a financial liability. It can be the base for future research which can build on this to see the effects different policy changes may have on rhino conservation. First, the probability of a change in policy could provide a future research direction. A more in-depth sensitivity analysis could benefit this research area. The impact of legalising the rhino-horn trade should be a focal point. This can provide a significant change in the profitability of rhino conservation. Future research can also focus on the discount rate to be used for private game reserves and game breeders. The information currently publicly available is inadequate to calculate the discount rate. Assumptions had to be made for this research and different discount rates have been used. Future research may focus on independently collecting information about this industry. This would form a strong base for other financial research on the game-breeding and eco-tourism industry.

As this research investigates the financial risks; another study of the non-financial risks of rhino conservation, could provide a useful assessment. By doing this, all risks associated with rhino conservation, which mostly consist of the risks associated with poaching, can provide a basis for future rhino conservation strategies. The ultimate goal of this investigation was to assess the value of a rhino for a private game reserve. Apart from the financial value, there is also the existence value and the role the rhino plays in the ecosystem. Because of its key role, it would be interesting for future research to investigate the financial impact a rhino population has on other game and the landscape at a private game reserve.

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Appendix A: Compiled questionnaires

The consent form (Appendix B) has been sent to the participants of these questionnaires. The next paragraphs show the question or questions that have been sent to that particular supplier of goods or services.

Insurance:

Could you possibly provide me with data for the questions below?

- What are the annual insurance costs for the following six rhinoceroses in 2016?

Rhino:	Total price:
Rhino Bull	(775.000)
Rhino Young Bull	(342.500)
Rhino Cow (2x)	(1.383.334)
Rhino Heifer (2x)	(825.000)

- Insurance costs for transportation of the rhino from the auction to the private game reserve? (distance 100 km)

The information you send me will be confidential and only used in my research as anonymous. I am collecting the average annual insurance costs from multiple suppliers of this service which will then be averaged.

Anti-poaching:

- What anti-poaching methods can be linked to the rhinoceros on your private game reserve?
- What are the costs of these anti-poaching methods?

Feeding:

Could you possibly provide me with the following prices/data?

- Annual feeding costs for a rhinoceros in 2016? (If possible, the annual costs for 2014 and 2015 too, to see if these costs are increasing/decreasing which is of importance for my forecast)

The information you send me will be confidential and only used in my research as anonymous. I am collecting the average annual feeding costs from multiple companies and private game reserves which will then be averaged.

Veterinary:

- Annual veterinary costs for a rhinoceros? (If possible, the annual costs for 2014 and 2015 too, to see if these costs are increasing/decreasing which is of importance when forecasting)
- The costs for darting and transporting a rhinoceros? (distance from an auction to the private game reserve is assumed to be 100km normal terrain)
- Costs involved with dehorning a rhino?

The information you send me will be confidential and only used in my research as anonymous. I am collecting the average annual veterinary costs from multiple vets which will then be averaged.

Fencing:

There are numerous factors which could influence the costs of fencing an area, but I am trying to keep this research as generic as possible. The area is assumed to be flat and a squared 20km by 20km.

Could you please provide the following data:

- Costs for fencing a 4000-ha enclosure, 1,8m and electrified with the minimum strength of 8000V?
- Costs for maintaining such a fence

The information you send me will be confidential and only used in my research as anonymous. I am collecting the average fencing costs from multiple suppliers, which will then be averaged.

Tourism

- What is the occupancy rate of your guesthouse or hotel?
- What is your maximum capacity for guests?
- What is the income generated from game view drives?
- How many rhinoceros are on your private game reserve?

The information you send me will be confidential and only used in my research as anonymous. I am collecting data from multiple private game reserves, which will then be averaged.

Hunting

Hunting is one of the incomes that can be linked to a rhinoceros. Most private game reserves put up their rhino for hunting once they are old and do not breed anymore.

Would you be so kind to provide me with the price a private game reserve would get when they let a rhino be hunted on their premises? If possible, also the price of 2014 and 2015 as this change in price is important for my forecast.

The information you send me will be confidential and only to be used in my research as anonymous. I am collecting the hunting price from multiple outfitters and private game reserves, which will then be averaged.

Appendix B: Consent form



Dissertation Consent Form

Project description and purpose:

In the current situation where research states that private game reserves might see rhinoceros becoming a liability to the game reserve, there is a need of independent research to provide an answer to the question if rhinos as an investment are profitable or if they are a liability.

What are the participants asked to do:

The participants are asked to respond to questions and provide inputs to certain cost factors which are applicable to the rhinoceros in a private game reserve.

This research has been approved by the Commerce Faculty Ethics in Research Committee. Your participation in this research is voluntary. You can choose to withdraw from the research at any time. The questionnaire/survey will take approximately 30 minutes to complete. You will not be requested to supply any identifiable information, ensuring anonymity of your responses. Should you have any questions regarding the research please feel free to contact Jelrick Claus at clsjel001@gsb.uct.ac.za.

There are no known risks or dangers to you associated with this study. The researchers will not attempt to identify you with the responses to your questionnaire, or to name you as a participant in the study, nor will they facilitate anyone else's doing so.

By signing; I acknowledge that I am participating in this study of my own free will. I understand that I may refuse to participate or stop participating at any time without penalty. If I wish, I will be given a copy of this consent form.

Signature: _____ Date: _____

Jelrick Claus