An Assessment of the Requirements for a Pharmaceutical Storage Facility (Project Giraffe) in South Africa

Scott Farrell, UGSM-Monarch, Monarch Business School, Zug, Switzerland

Barin N. Nag, Business Analytics & Technology Management, Towson University.
Towson, MD 21253,

ABSTRACT

Capacity and location are key decisions of Operations Management that are often considered together and can make the difference between the success or failure of a business venture. In practice, the decision should consider the product, the industry, and the business position of the enterprise. We examine the complexity of the practical decision through an actual case.

1.0 INTRODUCTION AND OVERVIEW

B. Braun Medical (Pty) Ltd (BBM) was founded in South Africa in 1995. The company is a subsidiary of B. Braun Melsungen AG (BBMAG) in Germany. Annual turnovers of BBMAG globally are USD 8.6 billion (2020), with a presence in 58 countries and remains a family-owned business. Locally, BBM manufactures a limited range of pharmaceutical products comprising sterilized waters, disinfectants and hand sanitizers, and renal dialysis concentrates. Other pharmaceutical and medical device products are imported from BBMAG. BBM has a product portfolio of some fifty thousand different products. BBM has had a strong growth rate coupled with rapid expansion from 2006 through to 2020. BBM is headquartered in the province of Gauteng in South Africa with a presence in either sales offices or renal dialysis clinics in all nine provinces.

Local production activities occur in the provinces of Gauteng and the Western Cape. Approximately 40% of BBM's revenues are currently generated from locally manufactured product in South Africa with the remaining 60% being imported from BBMAG.

Figure 1
Sales development of Braun South Africa in Local Currency
2006 - 2020

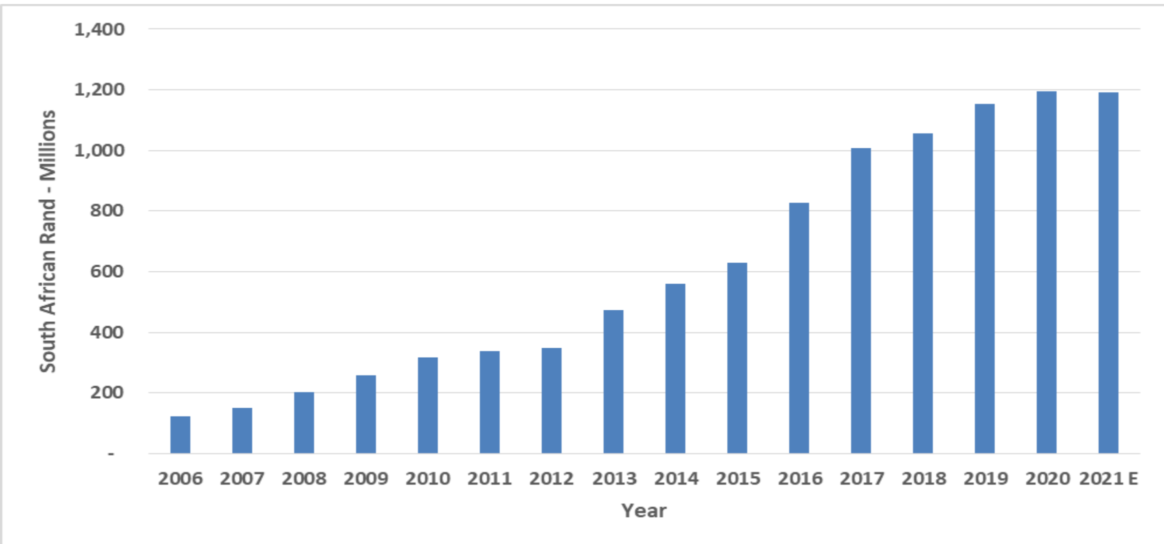


Figure 2
Map of Provinces Within South Africa

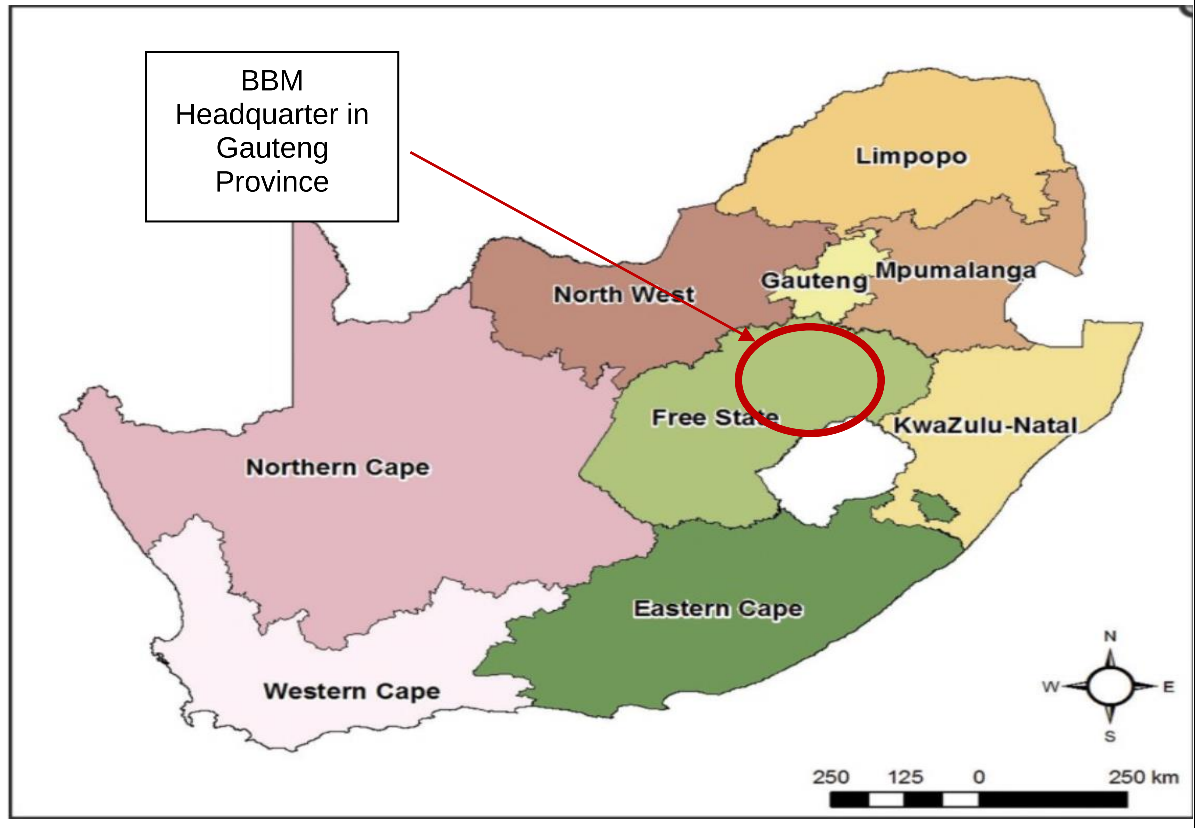


Figure 3
B.Braun's Presence in South Africa

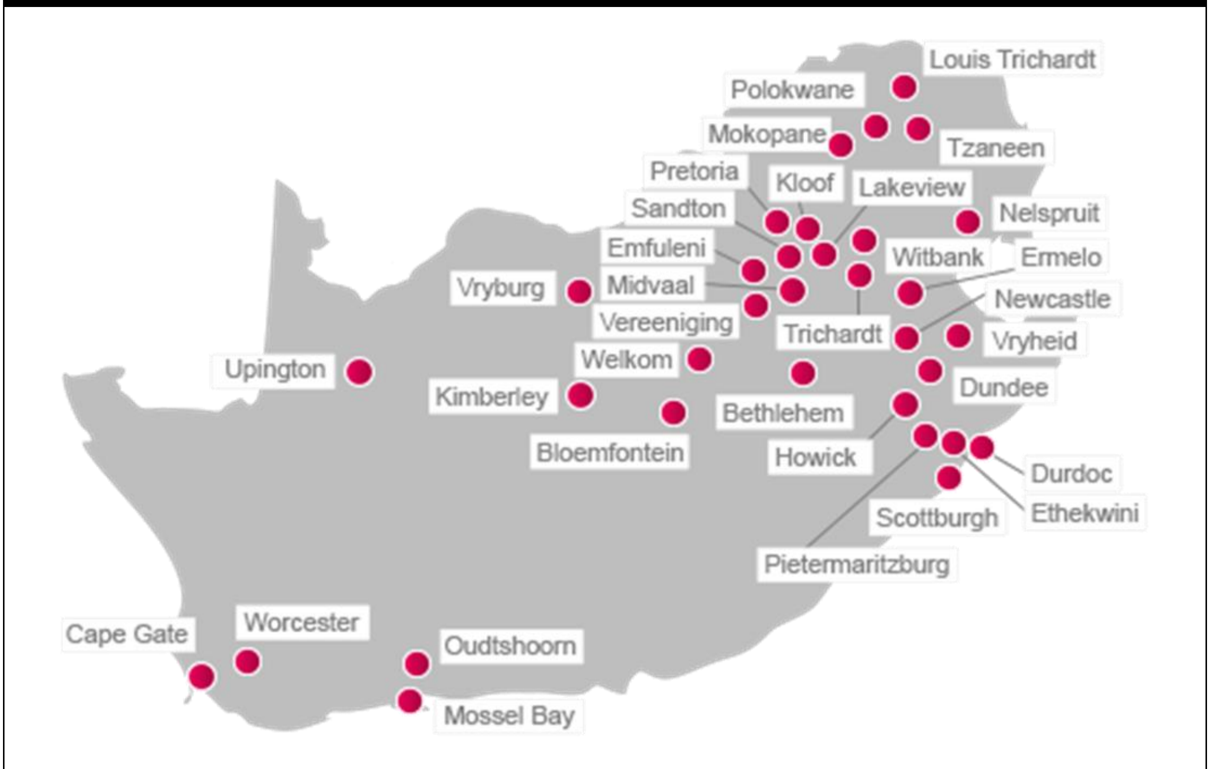
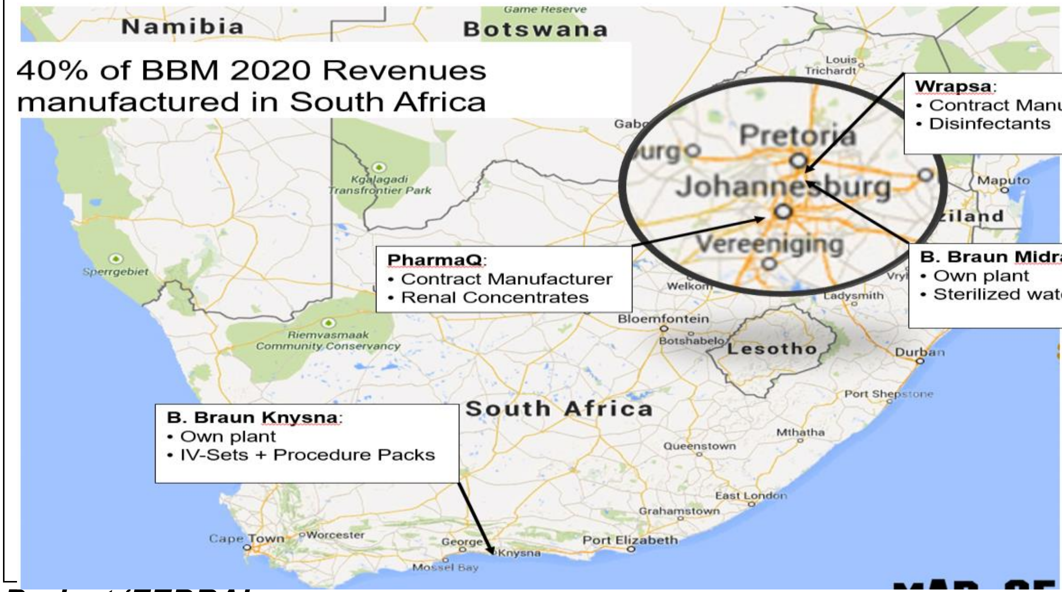


Figure 4
Braun's Production Sites Before Project ZEBRA



Project 'ZEBRA'

In quarter 4 of 2018, BBM proposed to the Board of BBMAG a business case for the construction of a new production facility or integrated pharmaceutical plant. The project received approval by Q2 2019 and was named project 'ZEBRA'. The ZEBRA plant was conceived with the intention of consolidating all three production facilities located in Gauteng under one roof. Thus the sites as indicated in figure 4 relating to PharmaQ, B. Braun Midrand and WRAPSA were to be consolidated under the roof of ZEBRA. The ZEBRA site was to be located in Modderfontein, Johannesburg within the province of Gauteng. The goal of the integrated pharmaceutical plant which has been achieved was to be able to produce different water products which are, a) Large volume parentrals and water for injection, b) disinfectants and hand sanitizers and c) renal dialysis concentrates. However, the headquarter site would still remain at a different location in Johannesburg, housing the sales, central and part of the warehousing functions. On the 9th July 2020, the ZEBRA plant was completed and all necessary equipment installed.

Figure 5
Aerial view of new completed production plant ZEBRA

The need to consolidate all warehousing facilities closer to ZEBRA

BBM has four storage facilities located within Gauteng. These storage locations are used to store products manufactured at ZEBRA, however they remain costly due to a) rental costs at the various sites and b) logistics costs between the sites, which in many cases incur 'reverse' logistics fees since product can only be despatched from the headquarter storage facility. Therefore, there is continuous movement of product between the storage facilities to align to the customer's delivery demands which makes logistics difficult and complex. A proposal to build a pharmaceutical warehouse storage facility is being considered in order to a) lower the storage costs of finished product and raw materials by consolidating all storage facilities into one, b) lower the logistics fees of finished product and raw materials, c) increase the production output performance by having quicker turnaround times of finished and raw material product moving through the production plant since waiting for trucks to load and unload from other sites is very time consuming and costly, and d) improve the efficiency of delivering product to customers quicker by using one despatch point.

Figure 6 shows the proposed site for the new pharmaceutical warehouse storage facility, highlighted by the red rectangle. The proposal aims to build on the remaining land plus the land directly next to this. In summary the new pharmaceutical storage facility will have capacity for 29,000 pallet positions versus the current capacity of 13,500 pallet positions located at the four various sites.

Figure 6
Proposed site for new warehouse storage facility

2.0 Problem Description

According to Nag (2020) any decision relating to a location must be specific and factual leading to a fully functioning facility within a planned period of time. Nag (2020) notes that in general decisions will apply from one of the four following factors, a) to expand on an existing facility which is the least costing option, b) add a new location which usually is based on an expanding market, c) move to a new location or d) do nothing since the analysis shows nothing is to be gained from moving to another location. Chatzoglou, Chatzoudes, Petrakopoulou & Ploychrou (2018) highlight that the need for a location decision can emanate due to a) existing conditions that have changed, for example depletion of raw materials, b) the drastic improvement of conditions in another location, such as a new port construction or c) the necessity to expand since the current facilities are insufficient to cover the expected increases in demand or volume regarding production. Within a competitive environment the choice of location plays an important role in the success of a business.

Location decisions are of significant importance and remain crucial to how a business facility would perform, whether it would survive and grow (Alam, Wali, Hossain & Wali, 2015). According to Chatzoglou et al, (2018) selecting an appropriate facility location is among the most critical and important decisions a company will ever make. Albareda-Sambola, Fernandez & Laporte (2009); Chen & Yu (2008); Ishikawa & Komoriya (2010) and Yang & Mai (2012) emphasizes that the selection of a location involves the commitment of essential resources which as a consequence remains a very significant decision that has a dire effect on the long term success of the company. Furthermore, as noted by Brush, Marutan & Karnani (1999) a proper location determines how long raw materials and produced goods need to be transported, how skilled the workforce are and how efficient the operations of the location ultimately will be. According to Townroe (1972) an appropriate location is determined by various tools present which considers both qualitative and quantitative factors.

Location factors that can be considered and classified in a variety of ways are a) costs, b) labour characteristics, c) infrastructure, d) proximity to suppliers, e) proximity to markets or customers, f) proximity to competition, g) proximity to parent company, h) quality of life, for example community activities, schools, churches and hospitals, i) legal and regulatory, j) economic factors, k) government and political factors, l) social and cultural factors such as language and customer characteristics and m) characteristics of a specific location, for example weather, attitude of local community and availability of space for future expansion (Lee & Franz, 1979; Epping, 1982; Sule, 1994; Evan et al, 1990; Nahamias, 1993; Badri. 1996; Hoffman & Schneiderjans, 1994; Barkley & McNamara, 1994; Burnham, 1994; Badri et al, 1995; Chase & Aquilano, 1995; Dilworth, 1996; Russell & Taylor, 1998; Dorneir et al, 1998).

Notably, Chatzoglou et al, (2018) highlights that other factors such as legal and technology can influence the location decision of a facility. It should be noted that BBM is a subsidiary of a multinational German company, therefore other factors such as global competition and macroeconomic factors can be more notable to the decision-making process rather than conventional factors such as operational and transportation costs (Badri, Davis & Davis, 1995). In particular Chatzoglou et al, (2018) identifies cost characteristics such as a) land costs and operating costs such as labour and raw materials, b) indirect costs such as delivery times and transport network efficiency and c) opportunity costs pinned to the cost of pursuing a particular site and thus passing up any identified alternatives.

According to Nag (2020) the cost of producing a single unit remains a critical characteristic of a manufactured product, therefore productivity becomes a key focus in maintaining efficiencies within the manufacturing cost structures. Nag (2020) highlights that productivity at any one location can be measured by applying a cost per unit calculation. The formula to calculate the cost per unit is total wages paid per day divided by total units produced per day (Nag, 2020). Storage facility costs naturally will form part and have a bearing on the manufactured cost per unit produced.

However, Bhatnagar & Sohal (2005) highlight that the location decision not only influences cost characteristics but has a bearing on the quality of the final products produced. Other aspects such as supply chain environment, customer service, flexibility and lead times will have an impact on the location decision (Bhatnagar & Sohal, 2005). According to Çetinkaya, Kaskin & Üster (2014) transportation costs do impact both facility location decisions and the frequency of inventory replenishment. Nag (2020) notes supply chain factors such as availability and movement of raw materials and finished product will also influence the location decision. Moreover, Nag (2020) highlights the above considerations warrant further attention when regard is had to process inputs, process resources and process outputs, since movement of materials and resources will pivot around necessity, perishability, and ease of logistics and transportation costs. In some cases however, raw materials can emanate from multiple sites and it often makes sense to locate the operation close to the geographical centre (Nag, 2020). Those resources used in a process need to be found within the local area and accordingly can become an important factor for location decisions. Resources in this context not only mean material but human also. The market is normally an important factor in deciding on a location.

In BBM’s case due to an ever expanding business, the proposal to build a new pharmaceutical storage facility is being considered. Reasons for this consideration besides an expanding market demand are also necessitated by the current facilities high costs, the inefficient logistical movements and costs, and a storage capacity nearing its limits. Within this scope of adding a new location due to an expanding market, BBM will have to satisfy the following criteria within the decision making process, a) the project must show financial feasibility in that savings made from closing down the other sites will afford the investment a reasonable payback period and acceptable internal rate of return, b) the project must demonstrate the satisfying of future requirements for the business’ storage capacity and that this capacity is affordable with the savings made in a) and c) the logistic costs are lowered and routes become more efficient for the movement of raw materials and finished product between the ZEBRA production plant and delivery point of the customer.

Notably, Nag (2020) highlights that large businesses would use a rather structured approach for the evaluation of a location decision with emphasis being placed on maximizing profits. Ultimately, any facility location decision remains of strategic importance for any organization and should only be made after a detailed examination of the characteristics of the locations under consideration (Feldmann & Olhager, 2013; Ferdows, 1997).

It is in the context of the above written discourse that the following research question has been proposed:
“Can BBM demonstrate that the new proposed pharmaceutical storage facility is both financially and logistically feasible, whilst concurrently can provide adequate storage capacity for the future requirements of the business?”

3.0 Data Analysis and Procedures

All data for the analysis has been derived from a) the books and records of the company and b) input from the developer of the new build. The success of the business model rests on the savings that can be realized from the following cost factors, a) property rentals, b) operating costs associated with any property rentals such as rates and taxes, water and utilities, c) external storage costs, d) logistics costs and e) the cost per pallet per annum. It is anticipated that these savings can be used to finance the investment of the new pharmaceutical warehouse.

The valuation itself is calculated using a discounted cash flow model. Cash out transactions are valued and determined as to when these will be paid, whilst the cash in transactions (being the savings) are also valued and determined for when these will be realized. Future cash flows are discounted at the current BBM guideline for South Africa’s cost of capital, which is 9.75% per annum in order to realize the present value of the net cash flows for the business case. The present value must be positive in order for the business case to stand as financially feasible. A payback period thereafter is determined together with an internal rate of return percentage. Since the discounted rate (weighted average cost of capital) of 9.75% is being used any internal rate of return percentage below 9.75% will disqualify the investment. The BBM guideline provides that any internal rate of return below a company’s cost of capital cannot be considered and such cash flows generated are better used to pay down current debt.

Timeline of project

The project is proposed to commence on 1st February 2022 by the developer and beneficial occupation will be achieved by 28th February 2023. The timeline is illustrated below in figure 7. Investments made by BBM after February 2023 are due to the increased capacity requirements planned for from increased demand within the business. Such investments relate to additional racking systems and forklift equipment. Amounts are shown in Millions in South African Rand.

Figure 7
Proposed timeline for new warehouse storage facility

	1st Feb 2022	May-22	Jul-22	Nov-22	Feb-23	May-23	Jun-25
Construction of new warehouse by developer							
1st tranche of BBM investment		R10m					
2nd tranche of BBM investment			R10m				
3rd tranche of BBM investment				R10m			
4th tranche of BBM investment					R10m		
5th tranche of BBM investment						R15m	
6th tranche of BBM investment							R5m

Figure 8
Proposed budget for new warehouse facility

	ZAR
Outfit, Insulation and HVAC (Air filtration system)	20,000,000
Less: Tenant allowance	(587,250)
	19,412,750
Insurances and fire preventative measures	4,000,000
Racking and Stacking	20,000,000
Office outfit & Furniture	2,000,000
IT	3,000,000
Contingencies & others	11,587,250
Total	**60,000,000**

The proposed investment

The budget has been drawn up using the local currency South African Rand (ZAR). Current exchange to the United States Dollar is $1 = ZAR14.35 as at 3rd September 2021. All goods and materials required for the investment will be procured and supplied locally in South Africa. The building itself will be built by the developer at their own cost, thereafter BBM will rent the premises from the developer. BBM will spend and invest the following amounts for the new warehouse as shown in figure 8 below.

However, not all the ZAR 60 million will be spent immediately at the start of the project since the different phases of the project will require certain elements of equipment and infrastructure to be in place. An amount of ZAR 20 million will be spent by BBM after the completion of the building, refer to figure 7. As mentioned already this is due to the fact that expected additional demand within the business will warrant additional capacity investment in terms of racking and forklift systems.

The business case

In order for BBM to afford the investment of ZAR 60 million, savings from the current cost base structure need to be realized. BBM has isolated the following cost elements that would be able to produce savings should the new pharmaceutical warehouse be built.

Property rentals including operating costs (taxes and utilities)

Currently BBM rents four buildings in respect of storage facilities. Three of the current storage facilities are located in Northriding, province of Gauteng. They are known as Northriding 1, 2 and 3 with a combined capacity of 8,916 pallet positions, which is currently utilized at 100% capacity. The fourth facility is located at an external provider some 50km away with a current capacity usage by BBM of 1,500 pallet positions. BBM pays the external provider by pallet position occupied. The current 2021 annual rentals for Northriding 1, 2 and 3 amount to ZAR 13.6 million which are inclusive of taxes and utilities whilst the fourth external facility's annual rental amounts to ZAR 4.4 million, inclusive of taxes and utilities. Therefore a total annual rental cost of ZAR 18.0 million for property usage is recorded for 10,416 pallet positions, giving a blended annual cost per pallet of ZAR 1,728 as at 2021.

Although it should be noted that the external storage costs BBM ZAR 2,933 per pallet per annum whilst the Northriding facilities have an annual fee of ZAR 1,525 per pallet per annum. Regarding the new storage facility, the developer has proposed an annual rental as at 1st February 2022 inclusive of taxes and utilities of ZAR 14.8 million which BBM will make use of 25,000 pallet positions. Thus the calculated pallet cost per annum for the new facility is ZAR 592, far more cost effective than the current blended rate of ZAR 1,728 per pallet per annum.

Capacity

Based on forecasts done in respect of future customer demand, BBM is forecasted to need by 2024 some 20,000 pallet positions. Thereafter the capacity will remain normalized at 25,000 pallet positions. Figure 9 below illustrates the pallet position development and requirements up until 2026.

The spike in pallet capacity in 2023 is due to the fact the BBM will not move out of all the Northriding facilities immediately, however the external storage facility will be migrated first to the new storage facility due to the higher costs and therefore significant savings that can be realized. The cost per pallet development can be seen in figure 10 below, amounts are reflected in South African Rand.

As observed from figure 10, once the new facility is built the cost per pallet reduces to ZAR 954 per pallet per annum in 2023 and reduces further over subsequent years. Notably, the external storage fees as at 2022 are almost double those of facilities that BBM occupies. Thus it does make sense to explore the option of a new storage facility.

Figure 9. Capacity development of number of pallets 2011 - 2026

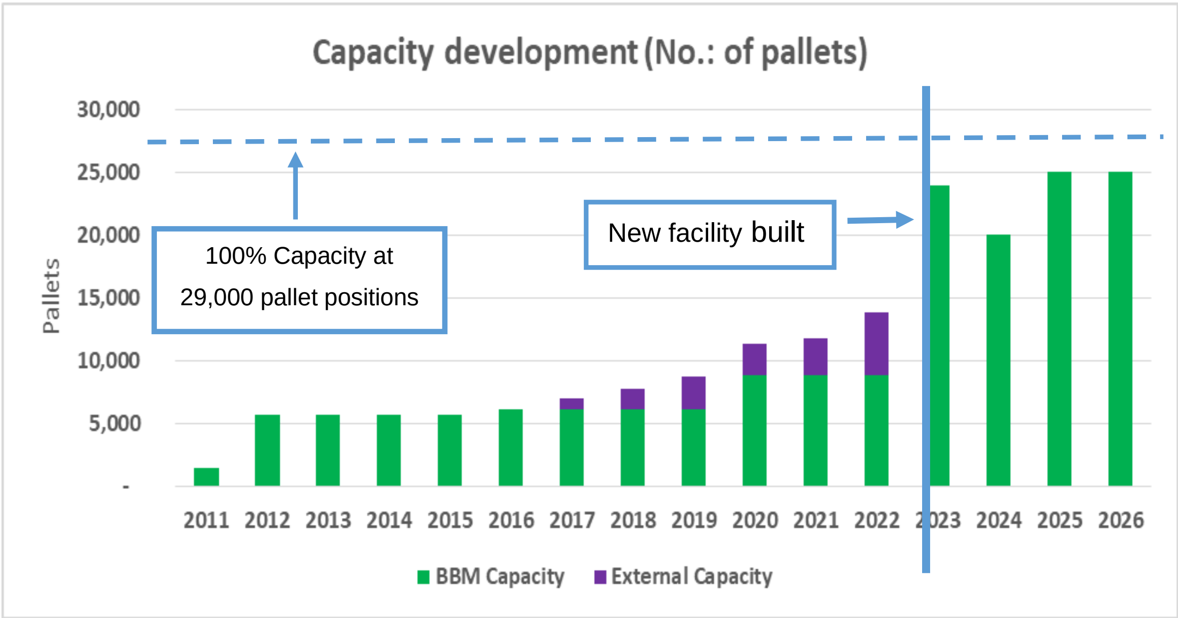
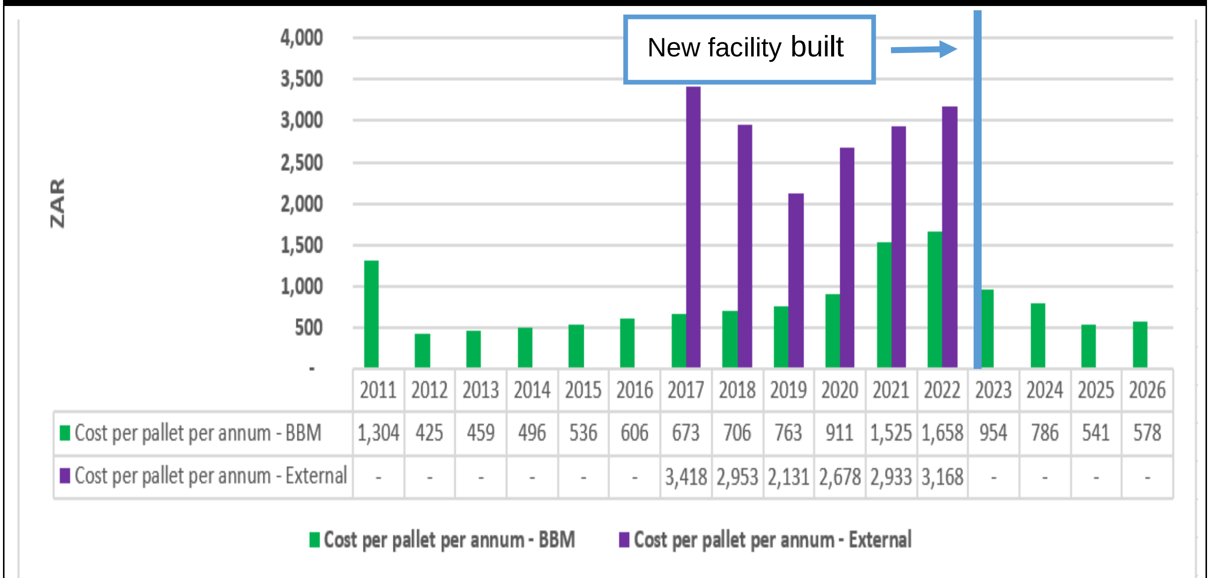


Figure 10. Cost per pallet per annum 2011 - 2026



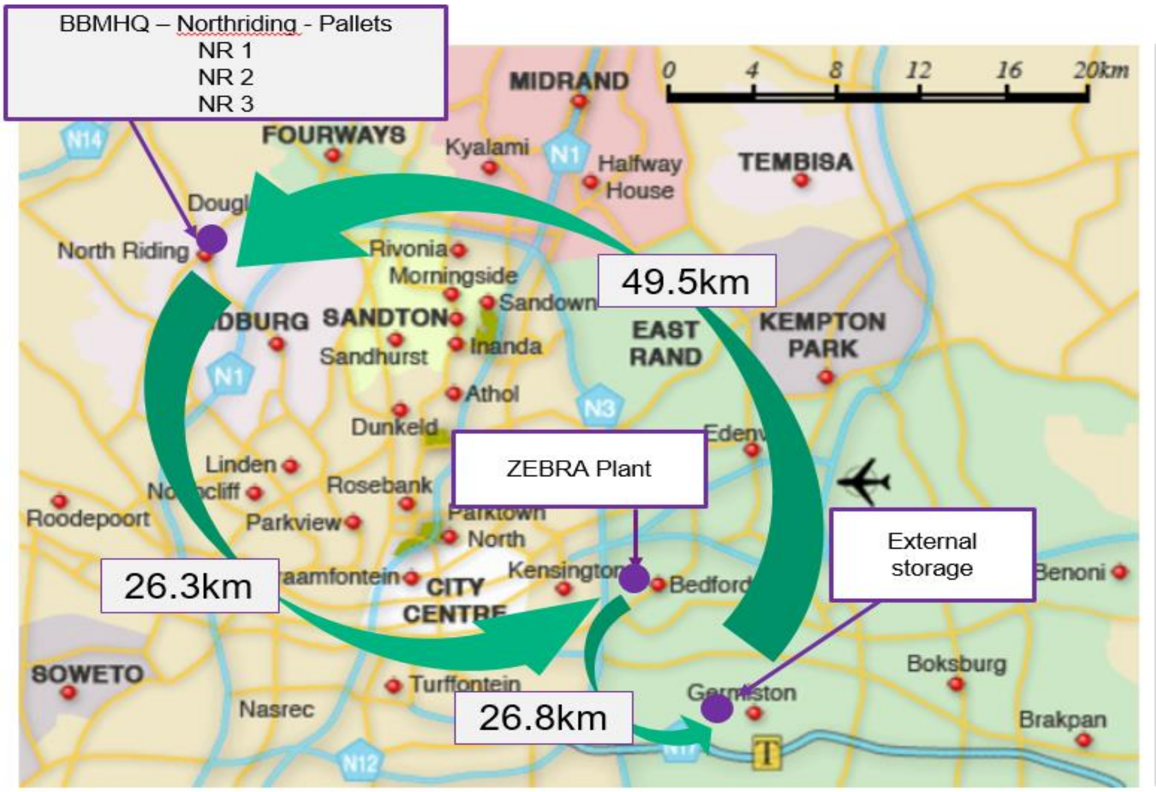
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Cost per pallet per annum - BBM	1,304	425	459	496	536	606	673	706	763	911	1,525	1,658	954	786	541	578
Cost per pallet per annum - External	-	-	-	-	-	-	3,418	2,953	2,131	2,678	2,933	3,168	-	-	-	-

Logistics costs

BBM currently has four storage facilities, three of them are at one location known as Northriding 1, 2 and 3. The fourth location is at an external provider some 50km away. Currently the logistics flow is inefficient and costly since deliveries to the customer can only occur from the Northiridng facilities due to current regulatory requirements. This means a significant amount of reverse logistic costs are incurred transporting stock from the external facility to the Northriding facility, or from the new ZEBRA manufacturing plant to the external storage facility to only again be moved to the

Northriding facility when it is required to be delivered to customers. Furthermore should the Northriding facilities become too full, the external facility is used to ease any capacity constraints that the Northiridng facilities may experience. Figure 11 below illustrates these logistical movements.

Figure 11. Current logistics cycle 2011 - 2026



Currently for 2021 BBM will spend ZAR 62.6 million on logistics annually. Should the new facility be built with a completion date of February 2023 directly opposite the manufacturing plant (ZEBRA), it is forecasted that in 2023 ZAR 7.4 million would be saved on logistics costs. By forecasting current volumes and improved logistics efficiencies, particularly for distances travelled and notwithstanding that stocks can be delivered directly to the customer from the new facility an estimated savings of ZAR 36.6 million can be realized between 2023 up until and including 2026. Figure 12 below illustrates these savings on an annual basis.

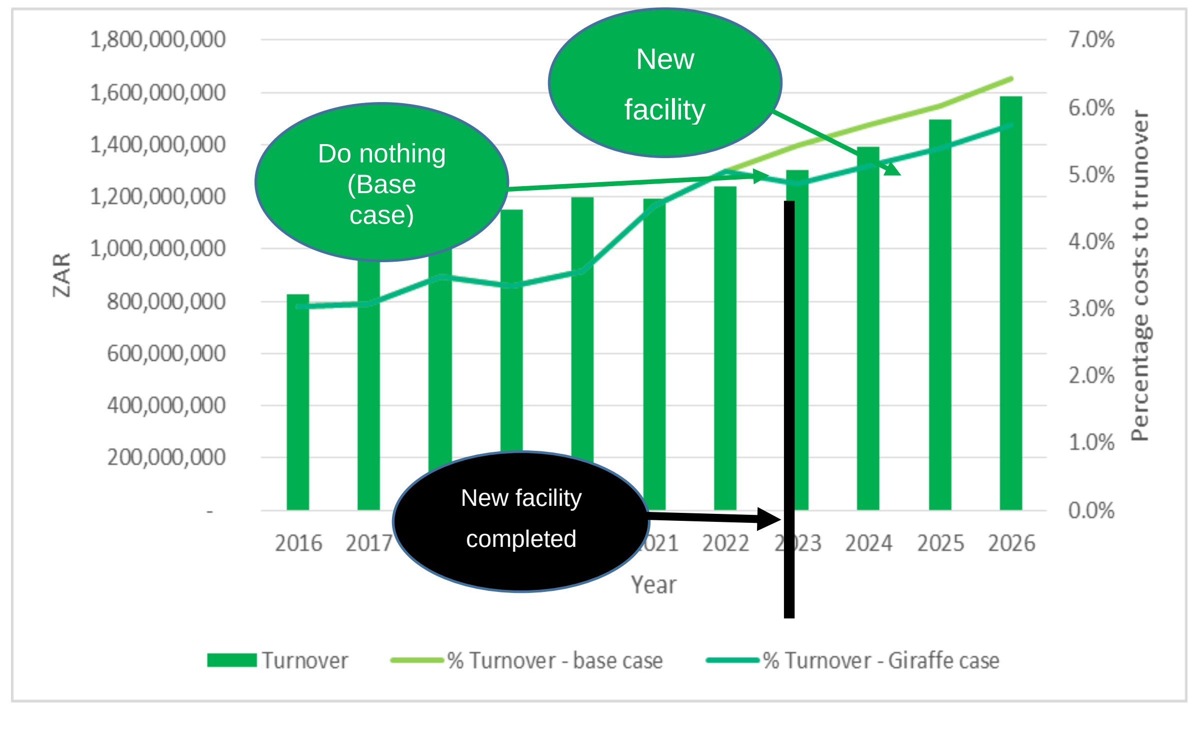
Figure 12
Logistics costs and savings 2022 - 2026

Year	Current scenario (BBM does nothing)	New facility	Savings
	ZAR	ZAR	ZAR
2023	70,685,619	63,304,951	7,380,668
2024	79,874,749	71,405,428	8,469,321
2025	90,258,467	80,573,498	9,684,969
2026	101,992,067	90,951,281	11,040,786
Totals	**342,810,902**	**306,235,158**	**36,575,744**

A key measurement of logistic fees within BBM is the logistic costs as a percentage of turnover. By forecasting the logistics costs if BBM had to remain as is and the logistics costs should a new facility be built with the sales revenues over the next few years, BBM is able to establish this key ratio and the results between the two scenarios. Figure 13 demonstrates the trend and the resultant drop in logistic fees as a percentage to turnover if the new storage facility is built.

As can be observed from figure 13, logistic costs as a percentage to turnover reduce to 5.5% by 2026 based on the new facility costs as in comparison to the base case of ‘doing nothing’ with logistic costs rising to 6.4% of turnover by 2026.

Figure 13
Logistics costs as a percentage of turnover 2016 - 2026



The valuation of the business case

BBM uses a discounted cash flow model to determine the financial feasibility of the business case. A cost base case of ‘do nothing’ is projected for a period of five years against the costs that would be realized in respect of the new storage facility. Naturally for the business case to present as feasible, savings must be realized and furthermore these savings need to provide for a reasonable payback period and internal rate of return of the original invested amount.

The above costs were forecasted based on inflationary triggers and demand from customers. Notably, in all cost categories there are savings recognized amounting to a total saving of ZAR 133,838,896 million (USD $9,326,752 million) which is the difference between ZAR 602,722,776 and ZAR 468,883,880 per figure 14. These are savings before any discounted cash flow rates are applied. Figure 15 below illustrates the total savings per cost element leading to a summarized total. All numbers are shown in local currency South African Rand.

Amounts in brackets denote additional costs, these are due to the overlap and timing of the Northriding properties leases expiring and the start of the new storage facility. These savings were modelled against the proposed investment spend of ZAR 60 million as shown in figure 8 with a discounted rate of 9.75% (current cost of capital). Figure 16 below shows the outcome of the evaluation which illustrates a positive net present value of ZAR 71,853,500, a payback period of 1.9 years and an internal rate of return of 67.7%. Based on these calculated results an approval by the German Board of B. Braun Medical AG can be realized.

Figure 14. Base case costs 'do nothing scenario' versus New facility costs 2022 - 2026

Base Case Property, storage and logistics	Year	Property Rentals	Op costs	External Storage	Logistics Fees	Totals
		ZAR	ZAR	ZAR	ZAR	ZAR
	2022	12,874,187	1,931,128	13,921,268	62,553,645	91,280,228
	2023	14,000,679	2,100,102	17,540,797	70,685,619	104,327,196
	2024	15,225,738	2,283,861	21,487,476	79,874,749	118,871,824
	2025	16,557,990	2,483,698	25,784,972	90,258,467	135,085,127
	2026	18,006,814	2,701,022	30,458,498	101,992,067	153,158,401
Totals		**76,665,408**	**11,499,811**	**109,193,010**	**405,364,547**	**602,722,776**

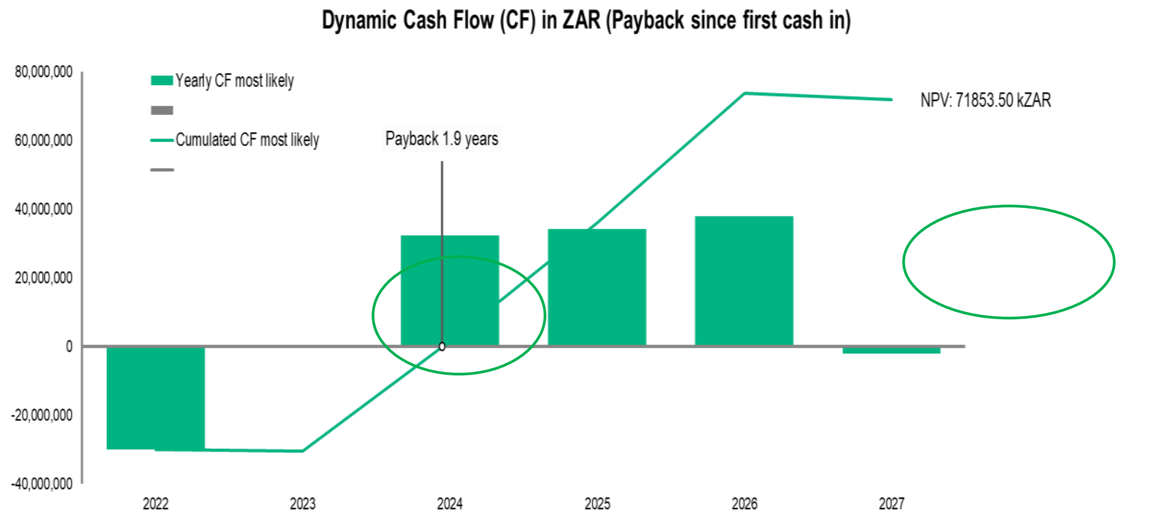
New Facility Prope… logistics	Year	Property Rentals	Op costs	External Storage	Logistics Fees	Totals
		ZAR	ZAR	ZAR	ZAR	ZAR
	2022	12,874,187	1,931,128	13,921,268	62,553,645	91,280,228
	2023	22,826,679	3,424,002	-	63,304,951	89,555,631
	2024	15,726,021	2,358,903	-	71,405,428	89,490,353
	2025	11,369,703	1,705,455	-	80,573,498	93,648,656
	2026	12,137,158	1,820,574	-	90,951,281	104,909,013
Totals		**74,933,748**	**11,240,062**	**13,921,268**	**368,788,803**	**468,883,880**

Figure 15
Savings regarding the comparison of base case costs 'do nothing scenario' versus new facility costs 2022 - 2026

Property, storage and logistics	Year	Property Rentals	Op costs	External Storage	Logistics Fees	Totals
		ZAR	ZAR	ZAR	ZAR	ZAR
Savings	2022	-	-	-	-	-
	2023	(8,826,000)	(1,323,900)	17,540,797	7,380,668	14,771,565
	2024	(500,284)	(75,043)	21,487,476	8,469,321	29,381,471
	2025	5,188,287	778,243	25,784,972	9,684,969	41,436,471
	2026	5,869,656	880,448	30,458,498	11,040,786	48,249,388
	Total	**1,731,660**	**259,749**	**95,271,743**	**36,575,744**	**133,838,896**

Figure 16. Valuation outcome of discounted cash flow calculation

Profitability Calculation Results	Dynamic
Amortization since cash inflow in years	1.9
Amortization since cash outflow in years	2.9
Net present value after 5 years	71,853,500
Internal Rate of return in %	67.7%



4.0 Solution

Financial - Overall

Based on the calculated results shown in figure 16 above, the project from a financial feasibility perspective should be approved by the German Headquarters of B. Braun Medical. It is clear that the initial investment of ZAR 60 million will be paid off via savings made in building and migrating to the new storage facility. The rather quick payback period of 1.9 years represents a limited risk for the company against a protracted repayment period of the invested amount. In terms of the internal rate of return % amounting to 67.7% indicates a very strong return on the invested funds well above the company's cost of capital of 9.75%. Finally, a positive net present value of ZAR 71.9 million cumulated cash flows indicates a secure investment producing strong cash flows.

Furthermore, if the savings identified are integrated into the manufactured cost per litre we realize a cumulative savings of ZAR 2.03 per litre between 2022 up until and including 2026. The total litres manufactured between this period amounts to 65,895,247, which equates to a monetary saving of ZAR 133,838,895 as described in figure 17. According Nag (2020) location decisions, which in this case relates to the storage facility and its financial impact on the manufactured cost per litre, remains a critical characteristic of a manufactured product. Indicative of lower production costs will result in higher profits. According to Kehoe (1971), production cost accounting emphasizes the cost per unit of a product.

Capacity
It has been shown that at future forecasts well into 2026 there is still room for a further 4,000 pallet positions to be deployed. At a storage capacity of 25,000 pallet positions the storage facility will be at 86% capacity, however it should be noted that at these levels of storage capacity the production plant opposite would be running at 100% capacity. Therefore, there would be no risk that production capacity would exceed storage capacity. Moreover, the cost per pallet per annum has been shown to reduce from a blended rate of ZAR1,728 in 2021 to ZAR 954 in 2023 after completion of the new storage facility. As shown in figure 15 external storage costs show a savings of ZAR 95,3 million for the years 2023 to 2026.

Figure 17. Manufactured cost per litre
Base case versus new storage facility

Base Case	2022	2023	2024	2025	2026	Totals
Litres produced	9,350,000	10,752,500	12,580,425	15,096,510	18,115,812	65,895,247
	ZAR	ZAR	ZAR	ZAR	ZAR	ZAR
Costs excluding storage, logistics & rents	180,412,000	216,494,400	264,123,168	330,153,960	419,295,529	1,410,479,057
Current rent, storage and logistic costs	91,280,228	104,327,196	118,871,824	135,085,127	153,158,401	602,722,776
Total production costs	271,692,228	320,821,596	382,994,992	465,239,087	572,453,930	2,013,201,833
Production cost per litre	29.06	29.84	30.44	30.82	31.60	30.55

New Storage Facility	2022	2023	2024	2025	2026	Totals
Litres produced	9,350,000	10,752,500	12,580,425	15,096,510	18,115,812	65,895,247
	ZAR	ZAR	ZAR	ZAR	ZAR	ZAR
Costs excluding storage, logistics & rents	180,412,000	216,494,400	264,123,168	330,153,960	419,295,529	1,410,479,057
Current rent, storage and logistic costs	91,280,228	89,555,631	89,490,353	93,648,656	104,909,013	468,883,881
Total production costs	271,692,228	306,050,031	353,613,521	423,802,616	524,204,542	1,879,362,938
Production cost per litre	29.06	28.46	28.11	28.07	28.94	28.52
Savings per litre in ZAR	**-**	**1.37**	**2.34**	**2.74**	**2.66**	**2.03**
Annual savings in ZAR	**-**	**14,771,565**	**29,381,471**	**41,436,471**	**48,249,388**	**133,838,895**

Logistics
The reduction in internal movements of finished product and raw materials from or to the ZEBRA plant means an increase in logistics efficiency and a reduction in costs. Less distances travelled means a quicker delivery time by BBM to its customers thus improving BBM's competitive advantage both from a costs perspective and time taken to deliver the product. According to Andries

& Gelders (1995), lead times and delivery reliability play an important role and are interrelated for a firm. Logistics costs are shown to reduce from ZAR 342,8 million if BBM did not build any new storage facility to ZAR 306,2 million over the same 4 year period, 2023 – 2026 (refer to figure 12), thus a savings of ZAR 36,6 million. For the year 2022 the logistic fees are expected to remain the same due to the fact that the new storage facility will only be completed by February 2023. As noted by Fawcett & Closs (1993) logistics and their associated costs play an important role in a firm's ability to produce and deliver high quality, low cost products.

Location

A well-established location, in that the location is close to the national highway routes and international airport, making ease of access for transportation that much more efficient and an advantage for the company since the location is closer to a larger choice of residential areas making BBM a desirable employer. Moreover, the property rentals reduce from ZAR 76.7m between the years 2022 - 2026 if BBM did not build a new storage facility to ZAR 74,9 million if the new facility was built over the same time period (refer to figure 14), thus a savings of ZAR 1,7 million. It should be noted that the new storage facility has a capacity of 29,000 pallets, whereas the current facilities combined have a much lower capacity of 13,916 pallets as shown in 2022 (refer to figure 9). Recognizing any savings with regards to property rentals certainly gives credence to the business case due to the fact that for much more capacity BBM is paying less rentals over the long term.

5.0 Conclusion

Based on the research question and the contents of the solution results offered in section 5, it is clear that BBM has demonstrated that the business case is both financially and logistically sound. The results of the business case imply that BBM will improve its competitive advantage by lowering costs relating to storage, property expenses and logistics. Therefore the research question is adequately answered in the positive. Moreover, the customer delivery time will be improved since there will be only one facility to deliver from, which is the same facility that provides the storage of the finished products. Furthermore the capacity requirements are adequate since at 100% production capacity the new storage facility will be at 86%, these at forecasted levels into 2026. It is recommended that BBM proceed with the business case of developing and building a new pharmaceutical storage facility.

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