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Ministry of Health & Population

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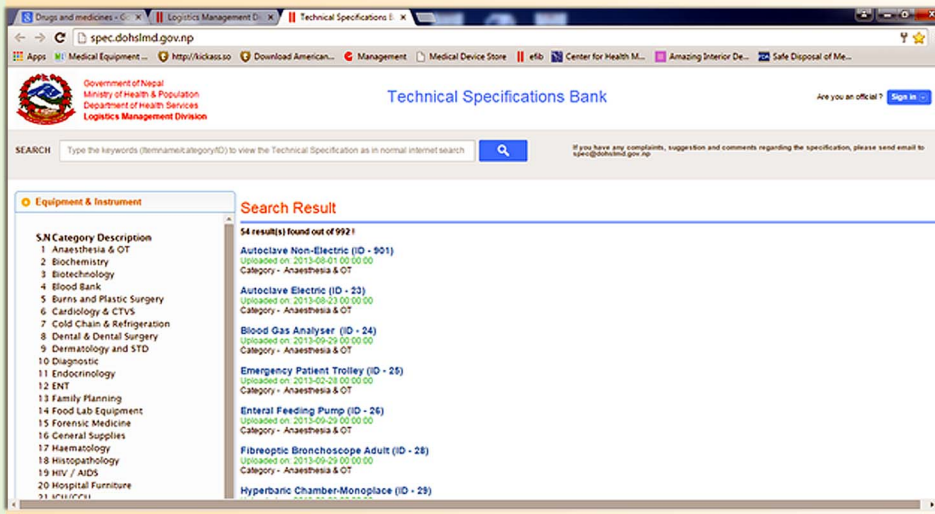
Technical Specifications Bank



Value for Money Case Study

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NHSSP

Strengthening Health Systems-Improving Services

Acknowledgments

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EXECUTIVE SUMMARY

The Nepal Health Sector Support Programme (NHSSP) is a Department for International Development (DFID) funded programme of technical assistance (TA) to the Second Nepal Health Sector Programme (2010-2015) (NHSP-2) led by the Ministry of Health and Population (MoHP). The TA is managed by a consortium led by Options Consultancy Services Ltd (Options) with Oxford Policy Management (OPM) and Crown Agents (CA) which is responsible for improving procurement and certain supply chain processes within the Logistics Management Division (LMD) of MoHP. NHSSP is now in phase two of its activities which began in August 2013.

The consortium is required under its contract with DFID to conduct several value for money (VfM) studies during the second phase of NHSSP (NHSSP-2). The procurement advisory component in the NHSSP-2 inception report was tasked with providing such a case study. In view of this need, a case study was identified relating to the Technical Specifications Bank (the Bank). The Bank is an initiative by NHSSP and is a database using a Microsoft access platform. It contains over 1200 technical specifications for health goods (pharmaceuticals, biomedical equipment, hospital furniture, medical commodity items, etc) that can be used in the Government of Nepal's (GoN) health sector for procurement and other needs. At the time of report preparation, health authorities in Bangladesh and Myanmar have also accessed the website for reference purposes.

This report covers a detailed study of the Bank and assesses the VfM achieved by its introduction. It looks at the benefits identified during a qualitative review and then, by using a quantitative approach, places a monetary value on the savings achieved. The qualitative review showed a number of identifiable benefits such as, but not limited to: (i) the supply of biomedical equipment, spare parts and maintenance has been enabled by use of standard specifications; (ii) increased awareness in hospitals and health facilities on which health goods can be purchased as a result of learning about the comprehensive database and how to access it; (iii) easy and convenient access to numerous specifications for different types of health goods through a centralised database and iv) assistance in reducing corruption as there is only one specification for each item which reduces the possibility of specifications being written to favour a particular manufacturer or supplier.

The quantitative assessment was conducted by comparing the investment cost with the present value (PV) of net savings using three different investment analysis techniques, namely: (i) net present value; (ii) benefit to cost ratio; and (iii) discounted payback period. The VfM results were calculated over a period of 10 years and the investment produced a positive net present value (NPV) under all scenarios with a latest payback period of no more than 3.3 years and with a minimum return of £2.6 to every £1.0 invested.

In summary, the key VfM finding is that the Bank, after being tested by a number of quantitative investment techniques (including sensitivity tests), produced positive results. This, coupled with the qualitative benefits, suggests that the Bank represents good VfM. The findings also show that the introduction of the Bank is justified in terms of economy and efficiency and has resulted in considerable cost savings, significant benefits through work simplification, increased availability and awareness of health goods by Nepalese health institutions and corruption mitigation in GoN health procurement. The overall effectiveness of the Bank needs to be assessed once it has become fully operational and an appropriate period has passed. However, preliminary information on customer satisfaction and Bank client coverage has been encouraging.

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Acronyms and Abbreviations

CA	Crown Agents
DFID	Department for International Development (UKaid)
DG	director general
DoHS	Department of Health Services
FY	fiscal year
GBP	Great Britain Pound
GoN	Government of Nepal
GPAF	Global Poverty Action Fund
IT	information technology
KfW	Kreditanstalt für Wiederaufbau (German Development Bank)
LMD	Logistics Management Division
MDG	Millennium Development Goals
MoH	Ministry of Health
MoHP	Ministry of Health and Population
NHSP-1	First Nepal Health Sector Programme (2004-2010)
NHSP-2	Second Nepal Health Sector Programme (2010-2015)
NHSSP	Nepal Health Sector Support Programme
NOL	no objection letter
NPV	net present value
Options	Options Consultancy Services Ltd
PPA	Public Procurement Act
PV	present value
SPA	senior procurement advisor
The Bank	Technical Specifications Bank
TOR	terms of reference
UNDP	United Nations Development Programme
VfM	value for money

SECTION 1 – CONTEXT

1.1 Introduction

Leading on from the First Nepal Health Sector Programme (2004–2010) (NHSP-1), the Ministry of Health and Population (MoHP), with the assistance of external development partners, designed the Second Nepal Health Sector Programme (2010-2015) (NHSP-2), which aims to improve Nepal's health systems and services. NHSP-2 recognises the efficient procurement of health goods (pharmaceuticals, hospital furniture, medical commodities, biomedical equipment, etc) as a critical function that, poorly managed, can inhibit the performance and governance of the whole health sector.

The Logistics Management Division (LMD) is a part of the Department of Health Services (DoHS) and is responsible for the majority of procurement, contract management and warehouse storage of health goods across all health service levels (central, regional and district). It is also responsible for onward distribution to the country's more than 4,000 health facilities. LMD has approximately 200 staff with 70 based at Teku, Kathmandu while the rest are located at regional and district warehouses and stores.

Technical assistance is provided to NHSP-2 through the National Health Sector Support Programme (NHSSP), a Department for International Development (DFID) funded programme now in its second phase. During the design of the second phase, NHSSP consultants investigated and reported on the value for money (VfM) achieved on various activities within the NHSSP work programme. This report provides an analysis of VfM during the establishment of LMD's Technical Specifications Bank (the Bank) to the extent that the available information permits.

1.2 Defining Value for Money (VfM)

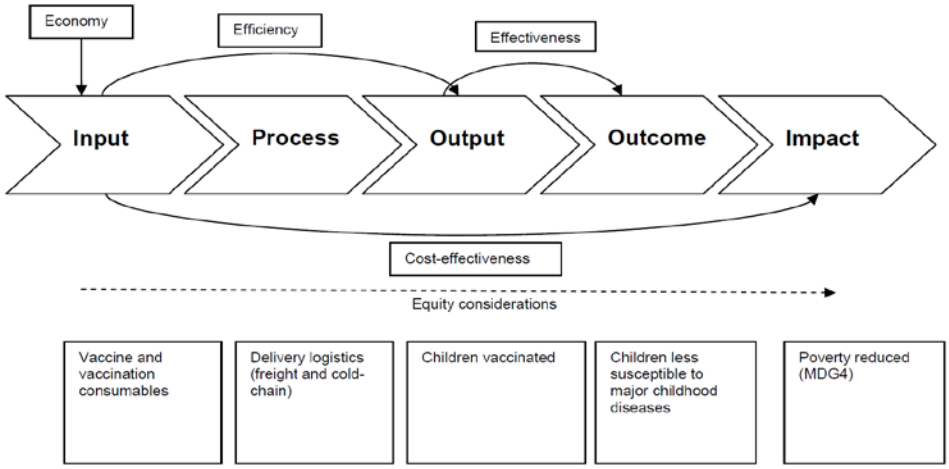
VfM can be viewed from a several perspectives. In simple terms, it is the relationship between the cost of services and the outcomes resulting from their delivery. The standard definition of VfM considers the 3Es: Economy in use of inputs; Efficiency in converting inputs to outputs; and Effectiveness in linking outputs to outcomes and impact and also cost effectiveness[1]. In short, VfM is about maximising each of the 3Es so that there is maximum economy, efficiency and effectiveness for each intervention.

Box 1: Defining the 3Es[1]

Economy – the cost of the inputs: are the necessary inputs (e.g. human resource costs, drug costs, training costs, repair and maintenance costs, etc.) being secured at the minimum necessary cost? In other words, are things being done at the right price?
Efficiency – the ratio of inputs to outputs: are outputs being produced efficiently? In other words, are the right things being done at the right price?; and
Effectiveness – the link between outputs and outcomes: to what extent do the outputs translate into the anticipated outcomes? In other words, are the right things being done at the right price, in the right way?

[1] DFID's Approach to Value for Money, DFID, July 2011.

Figure 1: DFID's 3Es Framework



1.3 Case Study Objectives – Technical Specifications Bank

The objective of this case study was to assess, to the extent possible from the available data, whether the introduction of the Bank intervention was successful in terms of VfM. In order to do so, this study looks in detail at its design, development, usage and costs.

SECTION 2 – ESTABLISHING THE TECHNICAL SPECIFICATIONS BANK

2.1 Procurement Process before Introduction of the Technical Specifications Bank

Before the introduction of the Bank (i.e. prior to fiscal year 2012/13), health goods' specifications were developed by the requesting unit (a division or a centre) and this was normally done by a junior level officer from the concerned unit. The officer would either use earlier developed specifications or create a more generic set using the existing specifications combined with information found on the internet. No written procedures were available for developing the technical specifications prior to fiscal year 2012/13.

Following development of the specifications, these were checked by relevant staff in the requesting unit and signed-off by the unit head. The signed off specifications, along with the required quantity and time for delivery, were then forwarded to LMD's contract management unit (this unit has now been absorbed into the procurement unit) which was responsible for checking technical specifications and price estimates. This was normally followed by a dialogue between the contract management officer(s) and the requesting unit and the final agreed technical specifications were then given a final sign-off by the head of the unit.

In the next stage, an information technology (IT) officer among the contract managers retyped the technical specifications into the required format for inclusion in the final draft bidding document. This draft document was then forwarded to LMD's director and then onto the director general of DoHS for approval after which it was submitted to the World Bank to obtain a No Objection Letter (NOL). Bidding documents were frequently returned from these three individuals/organisations with requests for changes to the technical specifications, all of which took considerable time.

2.2 Development of the Technical Specifications Bank

The decision to develop the Bank was based on the following observations and discussions:

(i) Requesting units (users) usually took a long time to develop technical specifications which were often non-generic. In order to make the specifications more generic, lengthy discussions were held with LMD's contract managers. This involved a significant investment in terms of time for the relevant officials and also led to significant delays in the procurement process.

(ii) The lack of technical details in the specifications developed meant that it was much harder to receive a NOL from the World Bank which frequently asked for improved specifications which led to a further delay in the procurement process.

(iii) When LMD conducted pre-bidding workshops, there were instances when its staff wanted to change specifications based on bidders' comments. The ensuing discussions with the World Bank regarding the changes extended the bidding period and slowed the procurement process.

(iv) Lower ranking procurement staff (in regions, districts and at hospitals) often took a considerable amount of time discussing specifications with higher ranking medical experts and administrators who frequently had a preference for non-generic

specifications over generic ones. This again resulted in delays in the procurement process and consumed valuable time of the staff involved.

In order to address the issues described, MoHP decided to develop a Technical Specifications Bank. It was envisaged that this would be able to increase the efficiency and effectiveness of procurements made in the health sector. In particular, the Bank would help to:

(i) Save time for all involved in the procurement process beginning with the requesting unit and all other units up to the World Bank;

(ii) Improve the transparency of procurements made by LMD;

(iii) Assist the regions, districts, government hospitals and clinics in their procurement procedures with the purpose of saving time and improving the quality of products being procured;

(iv) Make evaluations easier as all specifications would have an identical structure;

(v) Improve harmonisation across LMD as well as improve knowledge collection and knowledge management by making specifications available from a central online location.

2.3 Procurement Process after Establishing the Technical Specifications Bank

All bidding documents issued in fiscal year 2012/13 until now have been developed using the technical specifications developed for the Bank. This was possible because no bidding documents for fiscal year 2012/13 had been issued prior to February 2013 and this allowed time for the specifications to be introduced. All of the specifications developed were published on LMD's homepage (starting from 31 December 2012) prior to the bidding documents being issued.

Consultation meetings were organised for potential bidders in order to familiarize them with the Bank and to provide a forum for feedback. In the past, numerous complaints had been received from bidders regarding technical specifications and resolving them had proved highly time consuming for LMD and frequently led to delays in the tendering phase/procurement process.

The traditional process of development and approval of technical specifications has now been streamlined so that, from the outset, the specifications are taken directly from the Bank. The head of the requesting unit simply uses the already developed specifications from the Bank (no need for signatures) and states the quantities required with the preferred dates of delivery and then submits. LMD's contract managers are no longer involved in the process as LMD's procurement section receives the specifications directly from LMD's biomedical engineers who deliver the specifications in a Word format file designed to go directly into the bidding document.

2.4 Cost of Developing the Technical Specifications Bank

DFID had earlier assisted the Indian Ministry of Health (MoH) to develop a Technical Specifications Bank based on a range of standalone PDF documents on the website of the Indian MoH. While

developing the Bank in Nepal, it was decided to use, from the outset, the specifications already developed for the Indian MoH. These specifications were, however, not part of a database, but rather single documents that were not structured in an identical manner and which included equipment of poor quality. In order to better conceptualise the specifications and tailor them to the needs of Nepal, it was decided to employ three biomedical engineers (one regional and one national full-time for a year and one regional short-term for three months) to develop professional standard specifications. These engineers were provided with backstopping support by an external international expert. An external information technology expert was also hired to design a database to be made accessible on LMD's website.

Table 1: Cost of Developing the Technical Specifications Bank

Sr. No.	Details	Cost in GBP
A	FY 2012/13	
1	Preparation: Discussions with LMD, development and editing of TORs, design, etc. involving a range of NHSSP consultants, LMD, CA and DFID staff (to obtain material from the Indian MoH as Word Documents). Cost includes recruiting and contracting of biomedical engineers and international consultant.	12,800
2	Development of the IT solution (database and web-site)	3,600
3	Development of the technical specifications	70,130
4	Development of two user manuals and policy/maintenance manual	1,080
	Total cost – FY 2012/13	*87,610*
B	FY 2013/14	
5	NHSSP consultants for developing equipment specifications	83,100
	Total cost – FY 2013/14	*83,100*
Total cost – FY 2012/13 to 2013/14.		170,710

Source: Invoices, work reports and other records

The estimated cost to develop the Bank is shown in Table 1. The two full time biomedical engineering consultants (NHSSP) invested considerable time in 2012/13 and 2013/2014 in developing the Bank. The balance of their inputs was utilised assisting LMD in other matters such as evaluation, employment of LMD's biomedical engineers and training, etc.

The total cost to develop the Bank is estimated to be GBP 170,710 as shown in Table 1 while table 2 presents the estimated running costs (operational expenditure).

Table 2: Estimated Running Costs by Year

Sr. No.	Details	Cost in GBP
1	Running costs for FY 2013/14	11,400
2	Estimated running costs for FY 2014/15	11,400
3	Estimated running costs per annum for FY 2015/16 onwards	1,195

It is assumed that the time spent maintaining the Bank will be relatively consistent in years to come. However, as new types/features of equipment/drugs/medical commodities become available in the market, adjustments may be needed to existing specifications and there may even be a need to develop new specifications. It is also expected that the requirement for international expertise will cease and LMD staff will be able to fully operate and manage the Bank.

SECTION 3 – VALUE FOR MONEY ASSESSMENT

3.1 Results of the Intervention

Development of the Bank has led to improved efficiency in terms of time saved for DoHS, requesting units and LMD with fewer complaints received from bidders. Furthermore, in fiscal years 2012/13 and 2013/2014, no submission date needed to be extended as a result of problems with technical specifications.

Statements from different sections of DoHS confirm that the Bank has also helped increase the likelihood of obtaining better (more standardised) quality goods and has improved the transparency of the procurement procedure in the country.

Director National Public Health Laboratory

'The databank is very useful as it will save us a lot of time by providing off-the-shelf standard specifications to procure quality equipment. The specifications enable faster, more efficient and more transparent procurement'.

Source: NHSSP's PULSE report on the Technical Specification Bank (June 2013)

Also of note is that all international competitive bidding (ICB) specifications have to go through the World Bank for approval and all have so far been able to satisfy their quality criteria. The significance of the Bank is the standardisation of specifications for any specific item. This contrasts with the situation before its introduction when a number of different specifications standards frequently existed for the same item resulting in transparency problems with bidders.

3.2 VfM Assessment

In order to quantify and monetise the benefits of introducing the Bank, following an in depth review of information available and consultations, it was decided to use time saved by those individuals who would otherwise been involved in the procurement process had the Bank not existed, as a key indicator.

Estimating the amount of time saved in processing different types of specifications is closely tied in with complexities and other factors affecting the process such as: (i) whether it is a first time purchase or a repeat procurement; and: (ii) the capacity of the requesting unit etc. The approach chosen in this case study is based on the procurement of 258 health goods included in LMD's consolidated annual procurement plan (CAPP) for the fiscal years 2012-14. The procurement of various items requires different levels of effort related to their complexity. In this case study, the complexity levels have been categorised into low, medium and high.

Table 3 shows the estimated level of effort (in hours) required by those who would have been involved in the procurement process, for items of different complexity, should the Bank not have existed.

Table 3: Cost of Developing One Specification with Varying Levels of Complexity

Persons Involved with Estimated Time	Estimated Cost (GBP) Per Day	Time Used On Processing One Specification By Complexity Level		
		Low	Medium	High
Requesting Unit (Mid-Level Officer) 7 hours a day	10	4 hours	2 days	3 days
LMD (Mid-Level Officer) 7 hours a day	10	4 hours	2 days	3 days
Requesting Unit Director, (LMD Director, DoHS DG) 7 hours a day	16	1 hour	2 hours	4 hours
International SPA + National KfW Consultants (in total) 8 hours a day	583	1 hour	2 hours	4 hours
KfW's International Short Term Consultants 8 hours a day	650	-	1/2 hour	2 hours
World Bank 8 hours a day	350	1/4 hour	1/2 hour	1/2 hour
Total Cost		GBP 98	GBP 253	GBP 463

Table 4 shows three different scenarios, each using different combinations of the 258 health goods as categorised by levels of complexity.

Table 4: Number of Health Goods under Varying Levels of Complexity

Complexity Level	Scenario 1		Scenario 2		Scenario 3	
	(%)	Number of Health Goods	(%)	Number of Health Goods	(%)	Number of Health Goods
Low	20%	52	30%	77	40%	103
Medium	60%	154	50%	129	40%	103
High	20%	52	20%	52	20%	52
Total	**100%**	**258**	**100%**	**258**	**100%**	**258**

Saving values are calculated on the assumption that as a result of using the Bank, the additional time needed to develop a specification for each procurement would be saved as shown in Table 3. These savings are estimated at £68,112/£64,113/£60,114 per annum under scenarios 1, 2 and 3 respectively.

In order to see if the investment made in the Bank amounts to good VfM in quantitative terms (see Table 1), the investment cost was compared with the present value[2] (PV) of net savings[3]. Three measures to assess this were used: (i) net present value; (ii) benefit to cost ratio; and (iii) discounted payback period. All three measures suggest that the investment made in developing the Bank represents a good VfM investment (see Table 5 for details).

[2] Discounted at 3.5%.
[3] Net savings here refers to [*total savings generated – annual maintenance costs]*

Table 5: VfM Results

VfM Measures	Scenario 1	Scenario 2	Scenario 3
Net Present Value (GBP)	389,909	355,487	321,065
Benefit to Cost Ratio	3.0	2.8	2.6
Discounted Payback Period (years)	2.8	3.1	3.3

VfM results were calculated over a period of 10 years and showed that the investment produced a positive net present value under all scenarios with a payback period of no longer than 3.3 years and with a minimum return of £2.6 to £1.0 invested (see Appendix 2 for detailed calculations). This suggests that the investment made in the Bank is producing good VfM in quantitative terms. Further interpretation along with other positive qualitative aspects of developing the Bank is however needed, discussed later in the study.

3.3 Sensitivity Tests

In order to test the robustness of the VfM calculations, two sensitivity tests were applied to the results of scenario 3 (which already assumes lower savings as compared to scenarios 1 and 2). The tests are explained in table 6:

Table 6: Parameters Set for Sensitivity Tests

Test	Parameters Set
Sensitivity Test 1	Increase the annual maintenance cost under scenario 3 by 100%; i.e. assume the cost to be £2,390.
Sensitivity Test 2	Decrease the annual estimated savings under scenario 3 by 30%; i.e. assume the savings to be £42,080.

Results from both sensitivity tests suggest that the Bank would still produce a positive net present value given the parameters set and would still represent a good VfM investment (refer to Figures 2 and 3). However, it should be noted that the model developed is more sensitive to the assumptions made for potential savings as compared to the costs for running the Bank.

Figure 2: Results of Sensitivity Test on NPV

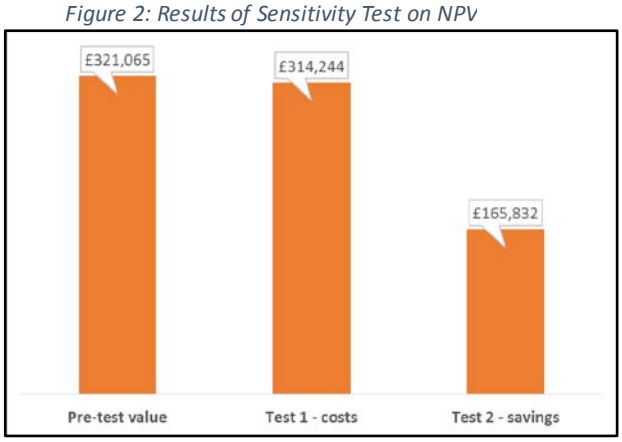
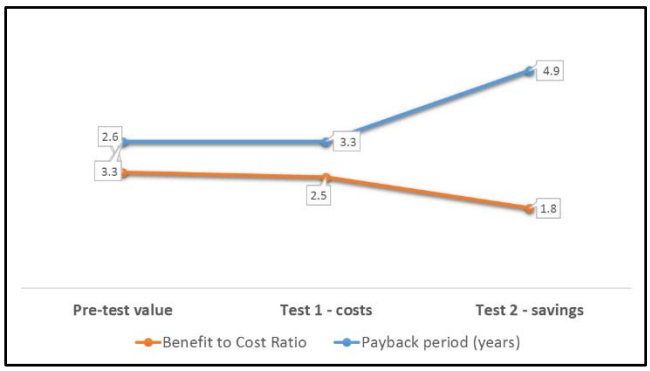


Figure 3: Results of Sensitivity Test on Payback Period and Benefit to Cost Ratio



SECTION 4 – CONCLUSIONS

The Technical Specifications Bank has been subjected to rigorous quantitative assessment using three different investment analysis techniques, namely: (i) net present value; (ii) benefit to cost ratio; and (iii) discounted payback period. In addition, sensitivity tests using decreased cost savings and increased maintenance costs have been applied to further check the robustness of the variables used in the analysis. Results of each of the investment analysis techniques indicate that the development of the Bank represents a good VfM investment having sustainable results. Furthermore, the sensitivity tests showed a positive net present value.

In addition to the quantitative benefits, qualitative issues have also been addressed by the development of the Bank. These are hard to quantify but are equally important when it comes to the overall VfM assessment. Identifiable qualitative benefits include, but are not limited to: (i) the supply of biomedical equipment, spare parts and maintenance has been simplified due to the use of standard specifications which has resulted in economies of scale in procurement; (ii) hospitals and health facilities have become aware of those health goods that can be purchased as they learn about the comprehensive database and how to access it; (iii) there is now easy and convenient access to numerous specifications for different types of health goods (biomedical equipment, hospital furniture, medical commodities, pharmaceuticals, etc.) through the centralised database; and iv) the avenues for corruption have been reduced as there is only one specification per item which reduces the possibility of writing specifications to favour a particular manufacturer or supplier. This, however, must remain a subjective assessment since measuring the success of corruption fighting measures on an input versus output basis is notably difficult (UNDP Report Measuring Corruption).

To conclude, the Bank's introduction has been shown by quantitative assessment and qualitative examination to be a significant and positive VfM investment. Efficiency and economy in the handling of the technical specifications of health goods by the MoHP has been considerably improved by the introduction of the Bank and, while evaluating "effectiveness" is a longer term exercise beyond the timeframe of this study, initial results on customer satisfaction and Bank client coverage have been encouraging.

Appendix 1: Value for Money Calculations

Scenario 1 (in GBP)

Details	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22
Investment	87,610	83,100	-	-	-	-	-	-	-	-
Running	-	11,400	11,400	1,195	1,195	1,195	1,195	1,195	1,195	1,195
Total Costs	87,610	94,500	11,400	1,195	1,195	1,195	1,195	1,195	1,195	1,195
PV of costs	**87,610**	**91,304**	**10,642**	**1,078**	**1,041**	**1,006**	**972**	**939**	**907**	**877**
Estimated	68,112	68,112	68,112	68,112	68,112	68,112	68,112	68,112	68,112	68,112
PV of	**68,112**	**65,809**	**63,583**	**61,433**	**59,356**	**57,348**	**55,409**	**53,535**	**51,725**	**49,976**
Net Savings	(19,498)	(26,388)	56,712	66,917	66,917	66,917	66,917	66,917	66,917	66,917
Net Savings	**(19,498)**	**(25,496)**	**52,941**	**60,355**	**58,314**	**56,342**	**54,437**	**52,596**	**50,818**	**49,099**
Payback Period										
Cumulative	(19,498)	(44,994)	7,948	68,303	126,617	182,960	237,397	289,993	340,810	389,909
Payback	***2.85***									
Benefit to Cost Ratio										
PV of Costs	196,377									
PV of	586,287									
Benefit to	***3.0***									
Net Present Value										
PV of Costs	196,377									
PV of Net	586,287									
NPV	***389,909***									
Discount	**1.000**	**0.966**	**0.934**	**0.902**	**0.871**	**0.842**	**0.814**	**0.786**	**0.759**	**0.734**

Scenario 2 (in GBP)

Details	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22
Investment Costs	87,610	83,100	-	-	-	-	-	-	-	-
Running Costs	-	11,400	11,400	1,195	1,195	1,195	1,195	1,195	1,195	1,195
Total Costs	87,610	94,500	11,400	1,195	1,195	1,195	1,195	1,195	1,195	1,195
PV of Costs	87,610	91,304	10,642	1,078	1,041	1,006	972	939	907	877
Estimated Savings	64,113	64,113	64,113	64,113	64,113	64,113	64,113	64,113	64,113	64,113
PV of Estimated Savings	64,113	61,945	59,850	57,826	55,871	53,981	52,156	50,392	48,688	47,042
Net Savings - undiscounted	(23,497)	(30,387)	52,713	62,918	62,918	62,918	62,918	62,918	62,918	62,918
Net Savings - discounted	(23,497)	(29,359)	49,208	56,748	54,829	52,975	51,184	49,453	47,781	46,165
Payback Period										
Cumulative Savings - discounted	(23,497)	(52,856)	(3,648)	53,100	107,930	160,905	212,089	261,542	309,322	355,487
Payback Period (years) - discounted	***3.06***									
Benefit to Cost Ratio										
PV of Costs	196,377									
PV of Savings	551,865									
Benefit to Cost Ratio	***2.8***									
Net Present Value										
PV of Costs	196,377									
PV of Net Savings	551,865									
NPV	***355,487***									
Discount Factor	**1.000**	**0.966**	**0.934**	**0.902**	**0.871**	**0.842**	**0.814**	**0.786**	**0.759**	**0.734**

Scenario 3

Details	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22
Investment Costs	87,610	83,100	-	-	-	-	-	-	-	-
Running Costs	-	11,400	11,400	1,195	1,195	1,195	1,195	1,195	1,195	1,195
Total Costs	87,610	94,500	11,400	1,195	1,195	1,195	1,195	1,195	1,195	1,195
PV of Costs	87,610	91,304	10,642	1,078	1,041	1,006	972	939	907	877
Estimated Savings	60,114	60,114	60,114	60,114	60,114	60,114	60,114	60,114	60,114	60,114
PV of Estimated Savings	60,114	58,081	56,117	54,219	52,386	50,614	48,903	47,249	45,651	44,108
Net Savings - undiscounted	(27,496)	(34,386)	48,714	58,919	58,919	58,919	58,919	58,919	58,919	58,919
Net Savings - discounted	(27,496)	(33,223)	45,475	53,142	51,345	49,608	47,931	46,310	44,744	43,231
Payback Period										
Cumulative Savings - discounted	(27,496)	(60,719)	(15,244)	37,897	89,242	138,850	186,781	233,091	277,834	321,065
Payback Period (years) - discounted	***3.287***									
Benefit to Cost Ratio										
PV of Costs	196,377									
PV of Savings	517,442									
Benefit to Cost Ratio	***2.6***									
Net Present Value										
PV of Costs	196,377									
PV of Net Savings	517,442									
NPV	***321,065***									
Discount Factor	1.000	0.966	0.934	0.902	0.871	0.842	0.814	0.786	0.759	0.734

Appendix 2: Detailed Calculations for Sensitivity Tests

Test 1: Increase Maintenance Costs By 100%

Details	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22
Investment Costs	87,610	83,100	-	-	-	-	-	-	-	-
Running Costs	-	11,400	11,400	2,390	2,390	2,390	2,390	2,390	2,390	2,390
Total Costs	87,610	94,500	11,400	2,390	2,390	2,390	2,390	2,390	2,390	2,390
PV of Costs	87,610	91,304	10,642	2,156	2,083	2,012	1,944	1,879	1,815	1,754
Estimated Savings	60,114	60,114	60,114	60,114	60,114	60,114	60,114	60,114	60,114	60,114
PV of Estimated Savings	60,114	58,081	56,117	54,219	52,386	50,614	48,903	47,249	45,651	44,108
Net Savings - undiscounted	(27,496)	(34,386)	48,714	57,724	57,724	57,724	57,724	57,724	57,724	57,724
Net Savings - discounted	(27,496)	(33,223)	45,475	52,064	50,303	48,602	46,959	45,371	43,836	42,354
Payback Period										
Cumulative Savings - discounted	(27,496)	(60,719)	(15,244)	36,820	87,123	135,725	182,683	228,054	271,890	314,244
Payback Period (years) - discounted	***3.29***									
Benefit to Cost Ratio										
PV of Costs	203,198									
PV of Savings	517,442									
Benefit to Cost Ratio	***2.5***									
Net Present Value										
PV of Costs	203,198									
PV of Net Savings	517,442									
NPV	***314,244***									
Discount Factor	**1.000**	**0.966**	**0.934**	**0.902**	**0.871**	**0.842**	**0.814**	**0.786**	**0.759**	**0.734**

Test 2: Reduce Savings By 30%

Details	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22
Investment Costs	87,610	83,100	-	-	-	-	-	-	-	-
Running Costs	-	11,400	11,400	1,195	1,195	1,195	1,195	1,195	1,195	1,195
Total Costs	87,610	94,500	11,400	1,195	1,195	1,195	1,195	1,195	1,195	1,195
PV of Costs	87,610	91,304	10,642	1,078	1,041	1,006	972	939	907	877
Estimated Savings	42,080	42,080	42,080	42,080	42,080	42,080	42,080	42,080	42,080	42,080
PV of Estimated Savings	42,080	40,657	39,282	37,954	36,670	35,430	34,232	33,074	31,956	30,875
Net Savings - undiscounted	(45,530)	(52,420)	30,680	40,885	40,885	40,885	40,885	40,885	40,885	40,885
Net Savings - discounted	(45,530)	(50,648)	28,640	36,876	35,629	34,424	33,260	32,135	31,048	29,998
Payback Period										
Cumulative Savings - discounted	(45,530)	(96,178)	(67,538)	(30,662)	4,967	39,391	72,650	104,785	135,834	165,832
Payback Period (years) - discounted	***4.86***									
Benefit to Cost Ratio										
PV of Costs	196,377									
PV of Savings	362,210									
Benefit to Cost Ratio	***1.8***									
Net Present Value										
PV of Costs	196,377									
PV of Net Savings	362,210									
NPV	***165,832***									
Discount Factor	**1.000**	**0.966**	**0.934**	**0.902**	**0.871**	**0.842**	**0.814**	**0.786**	**0.759**	**0.734**