



# METHODOLOGY APPLICATION

APPLICATION NO:	VE002
APPLICATION TITLE:	Learning Facility
INDUSTRY:	Construction
VALUE METHODOLOGY APPLIED:	Value Engineering (Redundancy Analysis)

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## INTRODUCTION

The Value Methodology was applied to optimise Functionality and Costs of a Learning Facility.

The terms of reference of establishing Building and Finishing Specifications for the Learning Facility are to recommend the lowest cost of ownership whilst ensuring full functionality.

The detailed specifications have been determined through detailed analysis of information obtained from the Client, the Consulting Team / Architects and Supplier's.

## PURPOSE STATEMENT

Enhance functionality and cost of the XYZ Learning Facility Preliminary Design

## EXPECTATIONS

- Satisfy the end user
- Comply to space allocation program
- Must be cost optimisation focused
- Must have functional conformance
- Selected & agreed on recommendations
- Action plans (if applicable)

## SCOPE OF THE VE WORKSHOP:

- Minimal deviation of the preliminary design
- Confirmation of the designs functional and cost performance
- Enhance / improve the designs functionality and cost

## AGENDA

- 01.) Introduction of Participants
- 02.) Project overview
- 03.) List expectations (what do we want to gain from the VE workshop)
- 04.) Confirm / establish scope / purpose of the VE workshop
- 01.) Selection of Elements (80/20 Principle) to be Value Engineered – based on evaluating a preliminary design
- 05.) Overview of the Value Methodology to be applied
- 06.) Determine Function / Cost relationship of each element and the impact on the design criteria**
- 07.) Identify and list opportunities for each element to improve functionality and cost (brainstorm)
- 08.) Evaluate each opportunity against functional conformity and possible reduction in cost (check risk factors)
- 09.) Finalise recommendations for each element
- 10.) Establish action plans (if applicable)



## PROCESS

The team utilised the Function / Cost Analysis methodology to determine potential improvements within the design, based on the consolidated cost of each functional requirement.

## INVESTIGATION AREAS

The following areas of the Learning Facility were selected for this VE study:

Conference Building
Administrative Building
Cafeteria Building
Library Building
Atrium Area
Covered Walkway, Central Courtyard & College Courtyards
College Wings
Child Development Centre
Gymnasium
Plant Room
Warehouse
External Works



## FUNCTION / COST ANALYSIS

For each area type the functional requirements were established with the purpose of testing the design against functional conformance to actual requirements.

The first step is to analyse each area by listing all the cost drivers for the design, determining the functions performed and indicate what these functions would cost.

Cost Estimate:		US\$ in 1000	2 701														
High Order Function:		Manage Administration		Project / Stage: Learning Facility / Preliminary Design													
Functions (Verb and Noun)																	
				Accommodate Vehicles	Communicate Events	Control Environment	Enhance Aesthetics / Appearance	Establish Separate Identity	Maintain Buildings	Promote Company / Institution	Manage Access	Secure Assets	Accommodate Support Services	Assure Hygiene	Enhance Safety	Support Structure	
Sub-Elements	% of Cost	Cost														Comments	
Safe, Store Room etc.	6.9%	187										187					
Super-Structure	30.4%	820														820	Including Lightwells and Balconies
Roofing	11.8%	320														320	
Doors, Screens and Windows	1.9%	50						16		13					21		
Fittings, Handrails, and Metal Work	1.0%	26													26		
Finishes, painting and Decorating	1.8%	48				48											
Sanitary Facilities & Fixtures	2.7%	73												53		20	
Roads & Carports	1.0%	27	12												15		
Elevators	0.3%	9													9		
Office Furniture and Partitions	6.3%	170				21							89			60	
Intercom System	3.8%	102		90											12		
HVAC System	19.5%	527			500											27	
Maintenance Workshop / Systems	6.4%	172							62							110	
Access Control System	6.3%	170									138				32		
	100.0%	2 701	12	90	500	69	16	62	13	138	187	89	53	115	1357	0	0

You would need to utilise the work breakdown structure (WBS) that lists all the elements and cost drivers for the design of the selected area.

The process of Redundancy Analysis (another tool of the Value Methodology) is applied to obtain an overall function / cost relationship perspective of the whole design, including all the areas.

This example shows such an overview of the Function / Cost relationship of a Learning Facility



## REDUNDANCY ANALYSIS

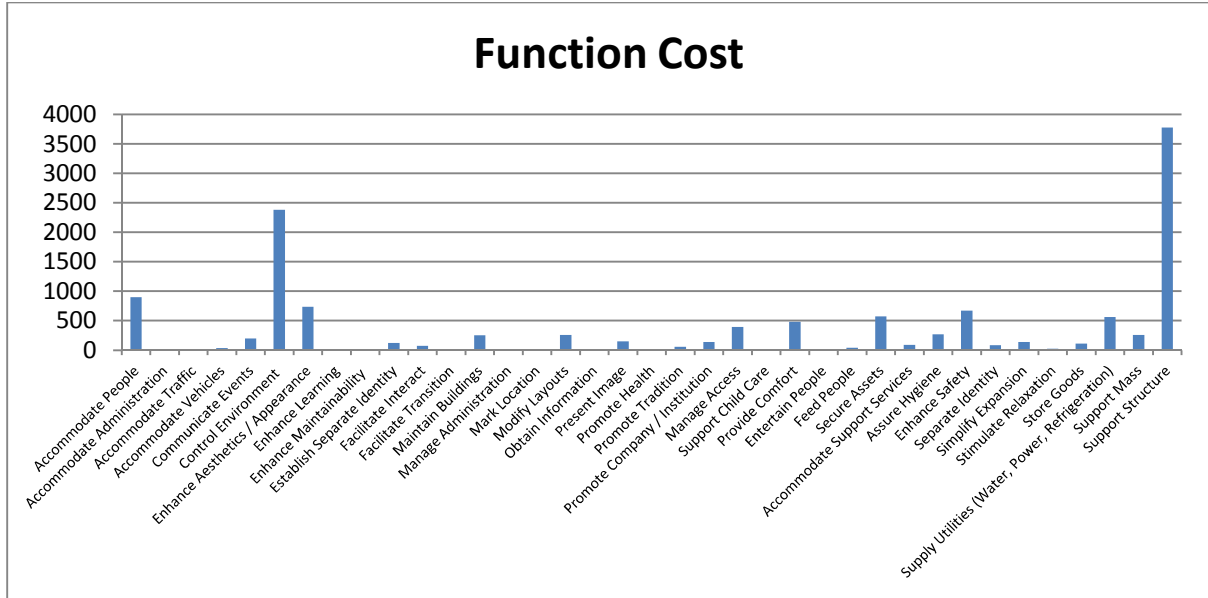
Value Engineering																											
XYZ Learning Facility		Functional Dimension Summary Matrix												Date:													
Numbers in US\$1000														Elements													
Functional Definition	Conference Building	Administrative Building	Cafeteria Building	Library Building	Atrium Area	Covered Walkway, Central Courtyard & College Courtyards	College Wings	Child Development Centre	Gymnasium	Plant Room	Warehouse	External Works		Total Cost per Function	%												
Accommodate People							900							900	7.05%												
Accommodate Administration		B												0	0.00%												
Accommodate Traffic												B		0	0.00%												
Accommodate Vehicles		12											25	37	0.29%												
Communicate Events	40	90	30	24	16									200	1.57%												
Control Environment	640	500	127	50	56		836	44	30	12	20	67		2382	18.65%												
Enhance Aesthetics / Appearance	206	69	48	45	30	76	130	30	25			78		737	5.77%												
Enhance Learning							B							0	0.00%												
Enhance Maintainability														0	0.00%												
Establish Separate Identity	23	16	5	5	8		49	8	8					122	0.95%												
Facilitate Interact	20		15		25	12								72	0.56%												
Facilitate Transition														0	0.00%												
Maintain Buildings	24	62	13	13	10	5	74	5	12	24	8			250	1.96%												
Manage Administration														0	0.00%												
Mark Location														0	0.00%												
Modify Layouts	198						58							256	2.00%												
Obtain Information														0	0.00%												
Present Image	75					16						56		147	1.15%												
Promote Health									B					0	0.00%												
Promote Tradition						16						39		55	0.43%												
Promote Company / Institution	28	13	5			24						68		138	1.08%												
Manage Access	62	138		5	12	23	154							394	3.08%												
Support Child Care								B						0	0.00%												
Provide Comfort	149		60				269							478	3.74%												
Entertain People	B													0	0.00%												
Feed People			42											42	0.33%												
Secure Assets	30	187	5	71	5		250			6	20			574	4.49%												
Accommodate Support Services		89												89	0.70%												
Assure Hygiene	40	53	20	10	9	10	95	10	15	3	5			270	2.11%												
Enhance Safety	123	115	43	9	14	20	234			84		31		673	5.27%												
Separate Identity							87							87	0.68%												
Simplify Expansion							112					26		138	1.08%												
Stimulate Relaxation				25										25	0.20%												
Store Goods											111			111	0.87%												
Supply Utilities (Water, Power, Refrigeration)										560				560	4.38%												
Support Mass												260		260	2.04%												
Support Structure	1240	1357	350	205	50	20	234	50	120	50	102			3778	29.57%												
Transfer Knowledge							B							0	0.00%												
Check:	2898.00	2701.00	763.00	462.00	235.00	222.00	3482.00	147.00	210.00	739.00	266.00	650.00	0.00	12775.00	1.00												

This process will allow determining the total project cost for each area of investigation and the functions performed, additionally exposing possible duplication of functions and / or highlighting inappropriate function / cost relationships, high overall cost.

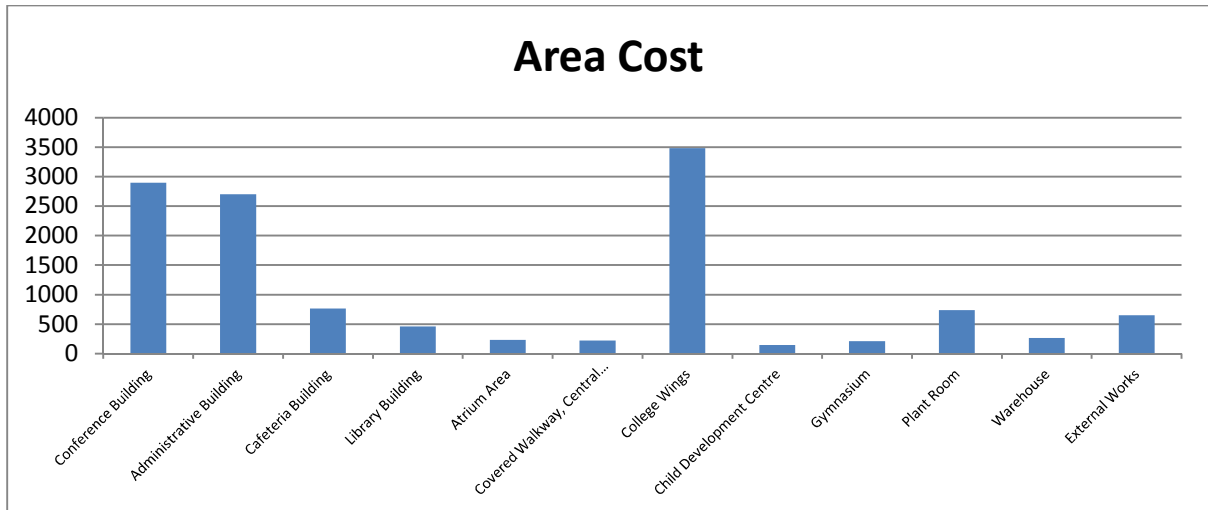


## VISUAL REPRESENTATION OF THE FUNCTION COST AND AREA COST

Another visual picture of the design could be a graph on the overall function cost of the project:



Or determine the overall costs of each area



With this “overview of the function / cost relationship for each area and overall facility the team could then investigate specific areas where the cost could be excessive. This would allow for alternative ways of performing the functional requirements at a reduced cost.



## RECOMMENDATIONS

From here the team can propose alternative / recommendation that would enhance better functionality and / or optimised cost for selected elements / cost drivers.

The method usually applied is a detailed “Theme sheet” for recommendation to detail the proposed change to the current design.

<b>LEARNING FACILITY PROJECT Value Engineering Proposal</b>	
<b>ELEMENT:</b> Hot / Cold Taps	Proposal No: P0012
<b>FUNCTION:</b> Assure Hygiene	Date: 12 <sup>th</sup> June 201X
<p><u>Present:</u></p> <p>The design specifies hot / cold taps in all the ablution facilities allowing for hot and cold water usage.</p> <p>To provide hot water through a tap one geyser for each facility is included.</p> <p>Cost per Taps: 120 taps @ US\$150.00 = US\$18 000.00            Geyser: 12 Geysers @ US\$800.00 = US\$8 000.00</p>	<p><u>Proposed:</u></p> <p>Install single taps in all the ablution facilities (application for cold water only).</p> <p>Have for each ablution facility one (1) electrical instant water heater installed.</p> <p>Cost per Tap: 120 Taps @ US\$80.00 = US\$9 600.00            Instant Heater: 12 Heaters @ US\$200.00 = US\$2.400.00</p>
Present Cost: US@26 000.00	Proposed Cost: US\$12 000.00
<p><u>Comments, Benefits and Recommendations:</u></p> <p>The Learning Facility has 12 Ablution facilities (excluding Student Accommodation)            Number of Taps included in the current design: 120 taps.</p> <p>Another benefit will be a reduction in electricity, allowing for a reduction in operational cost.</p>	
<p><u>Cost Impact / Improvement:</u></p> <p>CAPEX improvement of US\$14 000.00 or 53.8%            OPEX improvement are estimated US\$7 200.00 per annum</p>	



## LEARNING FACILITY PROJECT Value Engineering Proposal

ELEMENT: Window Glass

Proposal No: P0016

FUNCTION: Control Environment

Date: 12<sup>th</sup> June 201X

Present:

The current specifications recommend Conventional Glass for all the windows in the Facility.

Total m<sup>2</sup>: 2684m<sup>2</sup>  
Cost per m<sup>2</sup>: US\$24.50  
Total Cost: US\$65 758.00

Proposed:

Install Solar 'e' + Intruderproof Glass for the Administration Building, College Wing and the Conference Centre.

Total m<sup>2</sup>: 2684m<sup>2</sup>  
Cost per m<sup>2</sup>: US\$94.00  
Total Cost: US\$254 980.00

Present Cost: US\$65 758.00

Proposed Cost: US\$254 980.00

Difference in CAPEX is: +US\$189 222.00

Because the Intruderproof Glass insulates better the HVAC system can be reduced (Potential savings is US\$7 000.00)

However there is a substantial saving in operational cost by reduced energy consumption: US\$23 000.00 per annum.

It seems that this proposal is not cost effective when comparing only CAPEX but has fundamental benefits for the Learning Facility in respect of:

**Ergonomics:**

HVAC experts inform us that any building with this type of glazing would "be a very nice building in which to work and learn", reflecting on the reduced noise intrusion from the adjacent Freeway, and the inerrant temperature stability such a building would possess.

**Current Security**

It is currently the Learning Facility Security practice to install burglar proofing on all ground floor glazing, subject to the Security Departmental approval. This would not be required and would produce a saving of US\$27 000.00 in CAPEX.

**Energy efficiency:**

Renewable energy policy, talks of energy efficiency as well as renewable energy is part of the Learning Facility Management Mission statement and reflects the value for what the Learning Facility stands for. Increasing the "insulation" properties of all buildings & making non conforming buildings liable to retrospective modification will also reduce the energy bill for the institution. (US\$23 000.00).

**Lower Maintenance:**

HVAC experts also inform us that a reduction of Plant Maintenance can be expected due to the inherent thermal stability the building would possess. This will result in a more efficient Plant operation.

**Life Cycle Calculation:**

As per the Life Cycle Calculation the payback period is 8 years and considering that the Learning Facility has a anticipated Life Cycle of >40 years it is recommend that the extra CAPEX will benefit in future reduced CAPEX and better functional performance of the Facility





## CONCLUSION

For this application we utilised the Value Engineering Process of Function / Cost Analysis and the Redundancy Analysis methodology to allow for a quick overview of the total design, inviting questions from the team on how we could possibly improve the design and present proposals and recommendations.

The savings exceeded the expectation, not only on the CAPEX but on OPEX savings and Revenue optimisation for the organisation.