**4**

**Small enterprise technology upgrading program (set-up)**

**Expansion of woodworks kiln dried products**

**Ex post evaluation**

In Partial Fulfillment of the Requirements in

ECON 118 - Project Evaluation Methods

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APRIL 2013

**CHAPTER 1**

**INTRODUCTION**

 Along with [stone](http://en.wikipedia.org/wiki/Rock_%28geology%29), [mud](http://en.wikipedia.org/wiki/Mud) and animal parts, wood was one of the first materials worked by [early humans](http://en.wikipedia.org/wiki/Early_human) (en.wikipedia.com). Woodworking is the process of building, making or carving something using [wood](http://en.wikipedia.org/wiki/Wood).Historically, woodworkers relied upon the woods native to their region, until transportation and trade innovations made more exotic woods available to the craftsman. Woods are typically sorted into three basic types: hardwoods that were characterized by tight grain and derived from broadleaf trees, softwoods from [coniferous](http://en.wikipedia.org/wiki/Pinophyta) trees, and man-made materials such as [plywood](http://en.wikipedia.org/wiki/Plywood).Typically [furniture](http://en.wikipedia.org/wiki/Furniture) such as tables and chairs is made using solid stock, and cabinet/fixture makers employ the use of [plywood](http://en.wikipedia.org/wiki/Plywood) and other man made panel products.

1. **Project Profile**

***Nature of the Project and Location***

Woodworks Kiln Dried Products is a furniture making enterprise that had been in operation for almost twenty (20) years. It started its operation by producing panel doors, sala sets and dining sets. It is located in Bajenting Drive, Estrada 5th, Digos City and is about 1.5 kilometers away from the national highway. The location of production site is accessible to any type of vehicle and it is suitable for the production process since it is quite far from the city proper, away from possible disturbances.In 2007, the enterprise proposed an expansion project which entails anacquisition of new wood-working equipmentssuch as cold press and spindle machines. The 5 spindle GS-523 can do the functions of a dowel, plainer and a molder while the cold press is used to connect the smaller bits of woods. In materializing the expansion project, the proprietor accessedfinancing from the Department of Science and Technology (DOST) XI which provided wood-working facilities under its Small Enterprise Technology Upgrading Program (SET-UP).

***Beneficiaries***

Through the expansion project, the enterprise has been able to cater the growing demand of its major client namely, the Citi Hardware Davao and expand its market and establish more linkages within the region and nationwide. This also benefits its workers from the increase in their productivity and acquired skills, as well as improved standard of living from increases in their wage rates.

***Financial Requirements***

The total investment cost of Woodworks expansion project is worth Php10,114,318.00. The proprietor’s equity is accounted at 90.11% of the total project cost. The remaining 9.89% is sourced from the DOST-XI through its SET UP financial assistance.

***Proponent Agency***

Small Enterprise Technology Upgrading Program (SET UP) of the DOST XI is a nationwide strategy to encourage and assist SME’s in adoptingtechnological innovations and improve their operations thus boosting their productivity and competitiveness. The program enables firms to address their technical problems through technology transfer and technological interventions through better product quality, human resources development, cost minimization and waste management, and other operation related activities. With this technology intervention, Woodworks aimed at improving quality of materials for finished products, reduce drying time of lumber, improving acceptability of its products in the market, improve its sales and generate employment.

1. **Background**

One of the potential investment areas in the Davao region is the wood-processing technologies. With its thickly forested area, plantation tree farms such as Mahogany, Gemelina,Falcatta and Rubber is able to supply wood to big and smallwood processing plants in the region. This plant processes woodwork products such as moldings, lumber, door panels, door jams and wood chips.However, small scale enterprises face the problem of the adoption of needed equipment and/or technology in order to improve its product quality and productivity.With the technology interventions of the DOST XI through SET UP,this has expanded small enterprise such as Woodworks which specializes in panel doors and moldings which contributes to the livelihood impact in the immediate community and in the region economy.

 Moreover, the technology upgrading of Woodworks supports the wood industry clustering of the Davao Regional Development Plan (2011-2016) which involves the adoption of environment-friendly and cost-effective technology for the production of wood and its by-products.

1. **Rationale**

A feasibility study was conducted to assess the technical, financial and economic evaluation on one of the beneficiaries of SET-UP Program of DOST-XI which is the Woodworks Kiln Dried Enterprise. This evaluation aims to provide the standard procedures of the Investment Coordinating Council (ICC) in assessing these developments. The technical and financial aspects of this evaluation were collected using a primary data that is composed of a set of questionnaires that were being asked on the owners.

1. **Objectives of the Evaluation**

 The main objective of this study is to evaluate the feasibility of one of the beneficiaries under the SET-UP program of DOST-XI.

 Specifically, this paper wants to achieve the following:

1. To determine the benefits and costs of the DOST-XI SET-UP program in the Woodworks Kiln Dried Products enterprise.
2. To know the impact of the technology intervention in the enterprise.
3. **Significance of the Evaluation**

 The formulation of this feasibility study involves an analysis on the technical, financial, and economic indicators of project evaluation to determine the overall outcome of the SET-UP program to its beneficiary. The result of the developments of the following indicators is therefore essential to both the DOST-XI and to its SET-UP beneficiaries as it provides relevant information and broader view regarding to the success and further challenges of the program/project. This will aid the DOST-XI, the program’s stakeholders, and policymakers alike in formulating plans for a more effective implementation and assistance to its beneficiaries and to the future.

In addition, future beneficiaries that want to avail the technology transfer of the DOST-XI thru SET UP will be given insights and help future investors to provide access to this government program.

**CHAPTER 2**

**TECHNICAL EVALUATION**

**Objectives**

1. To determine if the project is technically feasible, workable and that its operations and maintenance can be locally sustained; and
2. To know if the technology-transfer is cost effective.
3. **Production Plant Lay-out**

The production site has a floor area of 600 square meters and is 20 meters away from the proprietor’s residential house.The office of the business is situated beside the working area. The office serves as the receiving area where business transactions are carried out with its customers and walk-in clients. The working area meanwhile houses the machineries and equipment used in the operation. It is where all the production processes is undertaken.

1. **Products**

Woodworks specialize on producing panel doors and moldings. The panel doors are made of the famous hardwood Philippine Mahogany. These panel doors come into four (4) designs like Deena, Acacia, Clarisse and Coventry. Coventry is the simplest design while the artistic and therefore more expensive are those with hand carved designs categorized into Deena, Acacia and Clarisse. Panel doors with these designs are only available exclusively for Citi Hardware since the latter are the ones who conceptualized these designs. Woodworks also market plain doors. The different types of panel doorscomes alsointo three (3) different sizes such as 0.80 x 210, 0.90 x 210, and 1.0 x 210, which are also the regular sizes for plain doors.

1. **Technology Package**

 The technological interventions made by the SET UP program involves technical and funding assistance in the establishment of a 20-board foot capacity Kiln Lumber Dryer, process upgrading, productivity development, and quality improvement of the wood-working facilities. Below are the descriptions of the machineries/equipmentsprovided under SET UP technology assistance of DOST XI.

* *5Spindle MoulderGS-523*(*wood shaper)* - is a heavy-duty spindle sticking up through a large table, into which shaped tooling is fitted(usually in a cutterblock). Thewood is then guided against a vertical supporting fencewhere the workpieceis guided to control the horizontal depth of cut.Themachine is fit for hard wood working, qualified for **big size and mass production** (like cutting and engraving on Mahogany for panel doors and molding) with the vacuum holding way and**dust collector**. It is one of the most versatile machines in woodworking and can be used for moldings, rebates and curved work, as well as for planing curved surfaces. It has a power outage continued carving, with power failure recovery and time prediction function.For much profile work, the spindle moulder is convenient for speed, ease of use and quality of finish.
* *Cold press machine*- this hydraulic machine is used to glue furniture plates, building partitions, doors, (that is, within the frame and glue thin plywood) and in a variety of wood-based panel (such as plywood, block board, MDF, particleboard). Surface pressure posts a variety of decorative material (such as decorative paper, decorative fabric, fireproof melamine plate, metal foil, and thin man-made and natural woodwith natural veneer parquet). It can also be used as a veneer drying leveling, leveling color decorative wood chips.
* *Milling Machine* - a machine that uses a multi-toothed milling cutter to remove metal from the workpiece surface in order to create flat and angular surfaces and grooves.
* *Wide-Belt Sander* - isa machine suitable for calibrating, sanding integrated materials (board, chipboard etc.). Fault display makes maintenance and repair easy.When fault happens,the machine will be powered off, brake the table fall and protect workpieces from being damaged.

***Advantages***

The kiln dryer contributed to the increase in the production of panel doors and moldingsas it minimize the drying time of lumbers. Woodworks is able to produce up to 100 panel doors and 500moldings per week from its 20 units per product item produced prior to the SET UP program. Theseincreased the volume of productionand improved the quality of both products, meeting the escalating demand in the market. It also expandedits business as it utilizes a 30,000-board foot of mahogany lumbers in just 18 days compared before without the machine which consumes only 2,500-board foot a month for the furniture items. The spindle moulder or engraving machine also provides easy programming of 12 engrave designs for the panel doors which are the most saleable in the market.The project status and output impact of the technology can be summarized into the following:

* Enhanced quality of raw material for finished furniture products
* Increased in volume of kiln dried lumber produced
* New markets served and lesser rejections of the products sold.
* Lesser rejects and back jobs on repairing cracks.
* Increased in sales and income.
1. **Physical Resource Requirements**

***Location of Raw Materials***

Woodworks main source of lumber is the Philippine Mahogany. It is sourced from the Mahogany tree plantation from South Cotabatodelivered regularlyonce a weekto Digos City where the production site operates.

***Machineries and Equipment***

Table 1 presents the existing machineries of Woodworks Kiln Enterprise. The table shows the total cost of fixed assets acquired during the start of the business.

|  |
| --- |
|  Table 1. Existing machineries of Woodworks Kiln Enterprise (in Php). |
| **Items** | **Unit Cost** | **Total Cost** |
| Land |  |  200,000.00  |
| Building (production) |  40,000.00  |  40,000.00  |
| Building (office) |  50,000.00  |  50,000.00  |
| Kiln dryer |  216,667.00  |  216,667.00  |
| Full Sizing |  173,333.00  |  173,333.00  |
| Jointer |  104,000.00  |  104,000.00  |
| Table Saw |  52,000.00  |  52,000.00  |
| Plainer |  169,000.00  |  169,000.00  |
| Sander-Power Tools |  8,667.00  |  8,667.00  |
| Widebelt Sander |  270,000.00  |  270,000.00  |
| Horizontal Boring Machine |  112,500.00  |  112,500.00  |
| Spindle Single End Tenoner |  128,700.00  |  128,700.00  |
| Office Equipment |  42,500.00  |  42,500.00  |
| Furniture and Fixtures |  15,000.00  |  15,000.00  |
| **Total** |   |  **1,582,367.00**  |

In Table 2, the additional fixed assets acquired from the Woodwork’s expansion project are shown including the DOST SET UP funding assistance.

|  |
| --- |
| Table 2. List of additional machineries acquired under SET UP program (in Php).  |
| **Items** | **Unit Cost** | **DOST SET UP** | **Total Cost** |
| 5 Spindle |  100,000.00  |  1,000,000.00  |  1,100,000.00  |
| Blade |  35,000.00  |  |  35,000.00  |
| Cold Press |  90,000.00  |   |  90,000.00  |
| **Total** |   |   |  **1,225,000.00**  |

 ***DirectRaw Material Requirements***

Table 3 presents the lumber and other material requirements for panel doors and moldings production from year 1 to year 3. The estimated cost per wood in board feet (bd. ft.) and other needed raw materials assumed to increase annually at 5%.

|  |
| --- |
| Table 3. Material requirements in the production from year 1 to 3, in (bd. ft.). |
| **Items** | **Year 1** | **Year 2** | **Year 3** |
| Mahogany lumber (bd. ft.) |   |   |   |
|  | 0.80x210 and 0.90x210 | 4,092,000.00 | 4,296,600.00 | 4,511,430.00 |
|  | 1.0x210 | 778,800.00 | 817,740.00 | 858,627.00 |
| Gemilina lumber (bd. ft.) | 323,712.00 | 356,083.20 | 391,691.52 |
|  | Glue (kilo) |  |  |  |
|  | Composing | 166,080.00 | 174,384.00 | 183,103.20 |
|  | Assembling | 35,280.00 | 37,044.00 | 38,896.20 |
|  | Sand Paper (roll) | 84,000.00 | 88,200.00 | 92,610.00 |
| **Total** | **5,479,872.00** | **5,770,051.20** | **6,076,357.92** |

***Direct Labor Requirement***

Woodworks have 11 multi skilled workers and 7 semi-skilled workers to carry out the production. The expansion project does not require of hiring additional worker since the current labor force is still enough to carry out the operation. The additional equipment acquired also helps simplify and minimize the burden of workers.

Table 4 below shows the labor requirement of Woodworks with its corresponding cost. Labor cost is assumed to increase 5% annually.

|  |
| --- |
| Table 4. Labor requirement of the production with corresponding cost (in Php). |
| **Items** | **Year 1** | **Year 2** | **Year 3** |
| Multi-Skilled | 774,144.00 | 812,851.20 | 853,493.76 |
| Semi-Skilled | 272,160.00 | 285,768.00 | 300,056.40 |
| Service fee for Carving | 1,571,400.00 | 1,649,970.00 | 1,732,468.50 |
| **Total** | **2,617,704.00** | **2,748,589.20** | **2,886,018.66** |

***Utilities***

Table 5 shows the utilities expenses incurred in the operation of the business. Utilities expense includes fuel (wood) and electricity where costs are assume to increase by 5% annually.

|  |
| --- |
| Table 5. Estimated fuel and electricity costs from year 1 to year 3. |
| **Items** | **Year 1** | **Year 2** | **Year 3** |
|  Fuel (wood)  |  40,800.00  |  42,840.00  |  44,982.00  |
|  Electricity  |  144,000.00  |  151,200.00  |  158,760.00  |
|  Total  |  184,800.00  |  194,040.00  |  203,742.00  |

1. **Process**

Below are the process involve in making panel doors and moldings. Figure 1shows the process in producing panel doors while Figure 2 shows how moldings are made.

Figure 1.Process in making panel doors.

Band Saw

Full Sizing and Planing

Wood Shaper

Panel Making

4 sides 4 Spindle moulder

Cutting

Sanding

Assembly Table

Composing of Panels

TECHNOLOGY PROCESS

EQUIPMENT/RAW MATERIALS

Kiln Drying

Kiln Dryer

**PANEL DOORS**

Wood Boring

Final Assembling

Assembled Door Press

Boring Machine

(Optional) Sand paper by hand

**Panel Doors**

Figure 2.Process in making of moldings.

4 sides 4 Spindle moulder

Finger Jointing

4 sides 4 Spindle moulder

Moulding

Cold Press

Planing

(Optional) Sand paper by hand

Gluing

TECHNOLOGY PROCESS

EQUIPMENT/RAW MATERIALS

Kiln Drying

Kiln Dryer

**Moldings**

Cutting

Finishing

Cold press

Radial Arm

**Moldings**

1. **Market Flow**

Woodworks have two major buyers, the Citi Hardware Davao in Davao City and the Cebu Builders, in Cebu City. It also caters limited orders within the area and its walk-in clients. However, the majority of its products are sold to its primary client, the Citi Hardware Davao, including its store branches nationwide. The client demands 400 panel doors and 500 moldings a month where Woodworks intends to meet the quota for both furniture items. With the use of the machines, the business is able tomarket competitively to Citi Hardware Davao.

1. **Yield of Production**

Production is done per week (6 days). For panel doors, there are 100units produced while 500 units for moldings. Each panel door ranges from Php3,000.00 to Php7,000.00, averaging to Php5,000.00 per unit depending on the design and size of the door. For moldings, price ranges from Php40.00 to Php140.00 with a mean price of Php90.00 which is also based on its size.

1. **Environmental Impact of the Technology**

Sawdust and noise have become an environmental problem and nuisance to both the workers and residents who live close in wood manufacturing plants. However,the operation of machineries/equipment during production is not a disturbance considering its distance from the city proper. Cut-offs, scraps and other wood wastes are also utilized as alternative firewood in heating the kiln dryer.

**CHAPTER 3**

**FINANCIAL EVALUATION**

**Objective**

To assess the financial viability and capability of the project.

1. **Total Project Cost**

Table 6 shows the total investment cost of Woodwork’s expansion project amounted to Php10,114,318.00, with respect total fixed assets and types of working capital identified in the technical evaluation under the DOST XI SET UP program. The 9.89% of the total cost which is Php1,000,000.00 is sourced from the DOST XI on loan scheme under the SET UP program. The remaining 90.11% or Php9,114,318.00of the total cost is the proprietor’s equity.

Table 6. Total investment cost of Woodwork’s expansion project under DOST-SET UP program.

|  |  |  |  |
| --- | --- | --- | --- |
| **Items** | **Proponent's** | **DOST** | **Total** |
| **Equity** | **SET UP** |
|  **Fixed Assets:**  |  |  |  |
|  |  5 Spindle GS 523  |  100,000.00  |  1,000,000.00  |  |
|  |  Blade  | 35,000.00 |  |  |
|  |  Cold Press Machine  |  90,000.00  |  |  |
|  **Total Fixed Assets**  |  **225,000.00**  | **1,000,000.00** |  **1,225,000.00**  |
|  Working Capital  |  |  |  |
|  |  Direct materials  | 5,479,872.00 |  |  5,479,872.00  |
|  |  Direct labor  |  2,617,704.00  |  |  2,617,704.00  |
|  |  Manufacturing Overhead  |  324,000.00  |  |  324,000.00  |
|  |  Selling and Admin. Exp.  |  467,742.00  |  |  467,742.00  |
|  **Total Working Capital**  |  **8,889,318.00**  |  |  **8,889,318.00**  |
|  **Total Investment Cost**  |  **9,114,318.00**  |  **1,000,000.00**  |  **10,114,318.00**  |

1. **Estimation of CostsandRevenues**

***Revenue Streams***

Based from the technical evaluation, the main income source generated from the project comes from per unit of panel doors and moldings produced per week.The annual total sales earned by Woodworks are assumed to increase by 5% as an offshoot from the technology intervention under SET UP program. See Table 7 below.

Table 7.Total items produced/week with unit price (in Php).

|  |  |  |
| --- | --- | --- |
| **Item** | **Average Unit Price (Php)** | **Unit Produced/week** |
| Panel door | 5000.00 | 100 |
| Moldings | 90.00 | 500 |

 ***Costs Streams***

While for the project’s operating cost items, the following sources of expenditures are also assumed to increase by 5% yearly as the effect of inflation. See Table8 below.

Table 8.Annual rate of increase by type of cost.

|  |  |
| --- | --- |
| **Type of cost** | **Annual rate of increase (%)** |
| Raw materials | 5 |
| Labor | 5 |
| Overhead  | 5 |
| Selling/Administrative | 5 |

The loan scheme of the DOST XI under SET UP program (without interest rate) is payable within 3 years of operation where the beneficiary has been able to meet its debt obligation.

**CHAPTER 4**

**ECONOMIC EVALUATION**

**Objectives**

1. To ascertain the project’s desirability in terms of its net contribution to the economic and social welfare of the community/municipality as a whole.
2. **Procedures**

As identifiedin the technical evaluation,the project may require the use of existing facilities prior to the appraisal of the project. The cost of such facilities are “sunk costs” and thus are not included in the total investment cost, provided that these facilities have no alternative use, and their use in the project involves no opportunity cost.Thesecosts are incurred on the project prior to the preparation of the feasibility study. Since these expenses have already been incurred, they are no longer subject to investment decision-making. As such, this component of project cost should not be included in the analysis.

1. **Benefit-Cost Analysis**

The Benefit-Cost analysis is a process of estimating and comparing monetary values of project’s benefit and costs and determines the economic viability and capacity of an existing project if it should be extended.

 In estimating the economic desirabilityof theproject, the indicators used are the net present value (NPV) andthe economic internal rate of return (EIRR), based on the computation of the project’s benefit and cost streams identified in the financial evaluation.The NPV is the discounted net economic benefit accruing to the project. The decision rule is to accept the project where the NPV is greater than zero.On the other hand, the EIRRis defined as the discount rate which equates the NPV of the benefits and costs of the project to zero. The decision rule is to accept projects where the NPV is greater than zero, and where the EIRR exceeds the NPV of the cost of capital; otherwise, the project is rejected.

 A benefit-cost ratio (BCR) is also an indicator used in the formal discipline of [cost-benefit analysis](http://en.wikipedia.org/wiki/Cost-benefit_analysis) where the higher the computed BCR, the better the investment. All benefits and costs are expressed in discounted [present values](http://en.wikipedia.org/wiki/Present_value).

The social discount rate (SDR) is used to discount the stream of economic costs and benefits to their present values. It is the rate at which the social value of project costs and benefits decline over time. The SDR is also used as the hurdle rate for any government project’s EIRR. SDR currently used is 15%.

1. **Economic Viability Indicators**

Table 9 below shows the economic viability indicators or commonly known as the benefit-cost analysis. The computations for the following indicators are presented in the Annexes.

|  |
| --- |
| Table 9. Economic viability indicators of the Woodwork's expansion project under DOST XI SET UP. |
| **Indicators** |   |
| Economic Net Present Value (ENPV) | **Php 49,095,966** |
| Economic Internal Rate of Return (EIRR) | **46.9%** |
| Benefit-Cost Ratio (BCR) | **2.1** |

1. **Conclusions and Recommendations**

Basedon the results in the financial evaluation, the project is financially viable since incremental revenues are greater than the investment costs.The project has an economic net present value (ENPV) of at least Php49,095,966.00which is greater than zero. This indicates that the net benefit generated from the project is economically acceptable for Woodworks Kiln Enterprise.

On the other hand, the economic internal rate of return (EIRR) is equal to 46.9% which is higher than the 15% standard hurdle rate required for government projects. This means that the minimum rate of return of the project indicates a high social welfare impact to the community and in Digos City as a whole.Thus, the project is economically desirable to the society.

Moreover, the benefit-cost ratio of the project is equal to 2.1. This indicates that in every peso cost of the project, there is a 2.1 pesos benefit to the business and to the society. Since the benefit is greater than the cost, Woodworks expansion project is economically feasible.

With the foregoing results of this feasibility study, it is recommended that wood processing business of Woodworks Kiln Enterprise should be enhance and strengthen so as to have a continuous benefits not only in the community but also on the growth particularly in the local government/municipality.

**ANNEXES**

**Economic Net Present Value Computation**

Table 10 shows the computed total incremental revenue andcosts, net economic benefits, discount factor and net present value of economic benefits from year 2007-2012 from the feasibility study.

Table 10. Total incremental revenue and total costs, net economic benefits, discount factor and net present value from year 2007-2012.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Year** | **Total Incremental Revenues** | **Total Costs** | **Net Economic Benefits** | **DF @ 15%** | **NPV1 @ 15%** | **DF @ 25%** | **NPV2 @ 25%** |
| 2007 | - | 10,114,318 | (10,114,318) | 1.00 | (10,114,318) | 1.00 | (10,114,318) |
| 2008 | 26,160,000 | 10,333,784 | 15,826,216 | 0.87 | 13,761,927 | 0.80 | 12,660,973 |
| 2009 | 27,468,000 | 10,800,473 | 16,667,527 | 0.76 | 12,603,045 | 0.64 | 10,667,217 |
| 2010 | 28,841,400 | 11,290,497 | 17,550,903 | 0.66 | 11,540,004 | 0.51 | 8,986,062 |
| 2011 | 30,283,470 | 10,805,022 | 19,478,448 | 0.57 | 11,136,866 | 0.41 | 7,978,372 |
| 2012 | 31,797,644 | 11,345,273 | 20,452,370 | 0.50 | 10,168,443 | 0.33 | 6,701,833 |
| **Total** | **144,550,514** | **64,689,367** | **79,861,146** |  | **49,095,966** |  | **36,880,139** |

**Economic Internal Rate of Return (EIRR) Computation**

 Given:

 R1 = 15%

 R2 = 25%

 NPV1 = 49,095,966

 NPV2 = 36,880,139

 Initial Investment (NPV = 0) = 10,114,318

The exact value of EIRR is derived through interpolation method where;

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$$\frac{25-EIRR}{25-15} =\frac{36,880,139-10,114,318}{36,880,139-49,095,966}$$

 **EIRR (%) = 46.910773670411**

**Benefit-Cost Ratio Computation**

Table 11 shows the discounted revenues and costs from year 2007-2012.

Table 11. Total incremental revenues and costs discounted at 15%.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Year** | **Total Incremental Revenues** | **Total Costs** | **DF @ 15%** | **NPV Revenue** | **NPV Cost** |
| 2007 | - | 10,114,318 | 1.00 |  | 10,114,318 |
| 2008 | 26,160,000 | 10,333,784 | 0.87 | 22,747,826 | 8,985,899 |
| 2009 | 27,468,000 | 10,800,473 | 0.76 | 20,769,754 | 8,166,709 |
| 2010 | 28,841,400 | 11,290,497 | 0.66 | 18,963,689 | 7,423,685 |
| 2011 | 30,283,470 | 10,805,022 | 0.57 | 17,314,672 | 6,177,806 |
| 2012 | 31,797,644 | 11,345,273 | 0.50 | 15,809,049 | 5,640,606 |
| **TOTAL** | **144,550,514** | **64,689,367** |  | **95,604,990** | **46,509,024** |

Given that discounted total revenues and total costs are derived, the formula for calculating BCR is shown as;



Hence,

$BCR=\frac{85,604,990}{46,509,024}$

 **BCR = 2.0556224**