EMGT 5220

Engineering Project Management

Proposal to setup Additive Manufacturing Centers

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1. LETTER OF TRANSMITTAL

March 10th, 2019

Dear Professor Cullinane,

Subject: Proposal to Setup 3 Additive Manufacturing Centers

The objective of this proposal is to give the reader an overview of the project to be undertaken, which is to setup three new Additive Manufacturing centers at hospitals in Massachusetts so that the demand for customized medical implants can be met. The need for customized knee and hip implants has been rapidly rising and by setting up these manufacturing centers some of the demand can be met. These customized implants will be more effective in satisfying the patient needs and the lost cost of self-producing them make this project viable in the long run

The cost of the project is estimated to be $3,278,705 which includes an operating cost of $1,596,645 per year and is expected to be completed in 76 days. The project is estimated to produce around 4000 units per year on demand and if these units are sold at roughly $600, the turnover can be estimated at $2,400,000 which easily covers the operating cost and has the potential to return the investment within 4 years. The advantage of these manufacturing centers is that the implants are locally produced, which leads to significantly lesser costs than purchasing them from a vendor. As of today, the cost of purchasing a custom-made knee or hip implant from a vendor is around $4000-5000, which is extremely high compared to a cost of $600. Another advantage is that according to the specific patient needs, these implants can be altered in design with input from the doctors and still be produced at low costs. With careful planning and effective implementation and execution, this project has the potential to easily offset its high initial cost while being extremely useful not only for the hospitals these manufacturing centers are setup in but also to all hospitals in Massachusetts. With effective and low-cost shipping to be setup, which is a part of this project, these manufacturing centers can also be used to cater to the demands of other hospitals. This would lead to increased effectiveness and quick returns on the initial investment. This project will also lead to better and easily available healthcare, which is the primary goal of this project.

Sincerely,
Krishna Yashwanth Tummala

2. PROJECT OBJECTIVES

- The primary objective of the project is to manufacture customized knee and hip implants.
- The secondary objective of this project is to provide affordable and easily available healthcare to patients requiring knee and hip implants.
- The tertiary objective of the project is to be profitable upon operation to provide return on the investment and be able raise money to setup more AM centers.
- This project also aims at being able to complete the setup process in the given timeframe. And make it operational and functioning smoothly according to the projected numbers for costs and sales numbers.
- This project aims to setup an effective system in place so that the workflow is smooth, starting from the doctor's input tailored to the patient and ending at delivering the implant in the specified condition at the specified time.

3. CRITICAL SUCCESS FACTORS

The critical success factors for the project are given below,

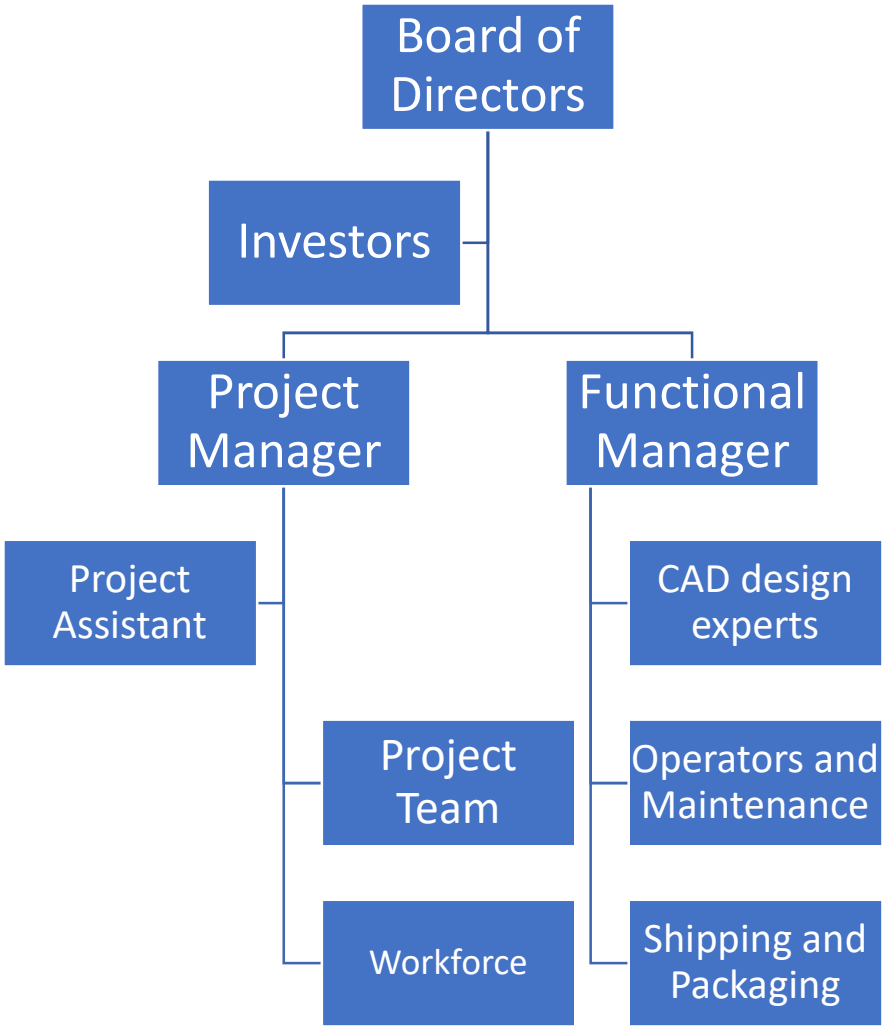
- To complete the project within the budget and within a reasonable deviation from the projected date of completion.
- To find the necessary and timely funding so that the progress of the project is not stifled due to this.
- The demand for hip and knee implants ideally remains the same.
- Support and input from the hospitals at which these Additive manufacturing centers are being setup at.
- To find and employ the necessary and qualified workforce to design, manufacture and then deliver the implants.
- Approval and support from all the relevant authorities who need to be informed of the project.
- To provide knee and hip implants at comparatively very low prices than competitors in the market.
- No new technology is invented that drastically changes the market for medical implants.
- To market and provide the necessary information about the project and its benefits to the consumer.

4. ASSUMPTIONS

- The demand and the market for knee and hip implants will remain the same for the foreseeable future.
- We have the support and the backing of the host hospitals for the project.
- Some assumptions which were used while forming the financial plan are:
- The wage for the PM includes the wage for the project assistant.
- All the employees except the functional manager, the operators, the designers and the shipping team are under temporary contract until the end of their role.
- The wages for the shipping team are show as a separate cost because they are independent contractors.
- All values for costs have been assumed from the research paper which is available upon request.
- All wages have been assumed from the 2011 report by the Bureau of Labor Statistics.
- All days mentioned are work days. No employee is expected to work on a holiday.
- The board of directors mentioned in the project are assumed to be the board of Northeastern University, the organization of the author of this proposal.

5. PROJECT ORGANIZATION

Since the project differs from the general area of expertise of the board of directors and the project is unalike most they have undertaken before, it would make sense to use a pure project organization. This way, most of the decision-making power lies with the PM who is experienced in setting up AM centers. He or she can delegate this authority accordingly when the need arises, and it also allows the project to be flexible.



The Board of directors and the Investors form the major stakeholders and have the authority to veto an action, but the Project manager will have most of the authority when making decisions regarding the project. The functional manager will be responsible for ensuring efficient operation of the project after the setup phase.

6. IMPLEMENTATION PLAN

The implementation plan is to give an idea of how the project is planned to be executed. It consists of the IDEF0 model, the Work Breakdown Structure, Responsibility chart, the Scheduling plan and the plan for the Allocation of resources.

6.1 IDEFO

The IDEF0 is used here as a tool that will help us to view the project and help us understand the system, that will be set in place. The IDEF0 model also gives us the information regarding the workflows, their directions and the level of responsibility each participating person has.

Viewpoint: Plan to set up and operate three Additive Manufacturing (AM) centers.

Purpose: To successfully plan, setup and operate three AM centers at Brigham and Women's Faulkner Hospital, Carney Hospital and Tufts medical center respectively. The Board of Directors and the investors are the major stakeholders and are responsible for making decisions on changes to the plan and funding. The Project manager (PM) is responsible for making most decisions regarding the project with help from an assistant. The functional manager, who will be hired by the hiring team once the project is ending, will take over this responsibility once the setup process in complete and the system is in place and will be responsible for audits and helping the work flow smoothly.

The IDEF0 model for this project is presented in Appendix A.

6.2 Work Breakdown Structure

The Work breakdown structure for the project helps us in understanding the decentralization of authority and the task involved in the project. It also serves as the backbone for forming most of the other implementation plans.

The WBS for the project is presented in Appendix B.

From the WBS it is clear that the primary objective of the project is to setup and operate 3 AM centers. The project is divided into three main subprojects which consist of further subprojects.

The three main subprojects involved are Funding, Setup execution and Operation of the facilities. The funding mainly involves the PM, the board of directors and the investors. This subproject consists of three subprojects which are presenting the project plan to the board and the investors, getting their approval for funding and the project plan, getting access to the funds according to requirements and placing them on hold. The entire subproject is expected to be completed in 16 days with most of the time, about 7 days, being devoted to discussions between the board and the PM regarding the feasibility of the project.

The setup execution is where the project plan really takes control. The project team, the PM and the workforce are the major stakeholders. The first task is to get the team on board with the plan and make their roles clear, this is estimated to take about 2 days. This is important as the team must understand what they are going to be involved in and the importance of it. The execution consists of 4 major subprojects, each estimated to be completed in about 15 days. They are renovating the work sites, which the renovation team will work on under the supervision of the project team. The hiring of the operations team who will be responsible for the operation of the facilities will be the responsibility of the project team who will need approval from the PM to finalize the hire. The installers, who will be contracted or provided by the printer vendor, will work on installation of the printers under the supervision of the project team, this task is estimated to be completed in 14 days. The project team and the PM will be responsible for completing setup of the AM centers with supports from the operational team and the renovation team, this task is expected to be completed in 14 days. The last major subproject is the testing of the plants, even though this task is expected to be completed in 7 days, its success is paramount because at this point changes will have to be made quickly. The operational team will be majorly responsible for this under supervision and support from the PM and the project team. The entire setup is expected to be completed in 72 days and a further 4 days to start operating the facility at full efficiency.

6.3 Responsibility Chart

The Responsibility charts serves to provide as a guideline for the stakeholders to understand what responsibility and authority they possess. It also serves as a tool to understand who is responsible, and how much, for each part of the project.

WBS		Responsibility						
Subproject	**Task**	**Board of Directors and Investors**	**Project Manager**	**Project Team**	**Workforce**	**Functional Manager**	**Designers and Operators**	**Shipping**
Funding	**A1**	**Δ,▪**	*					
	A2	□	▪					
	A3	*	*	**Δ**				
Project Execution	**B1**		*	□				
	B2	**Δ**	□	*				
	B3	**Δ**	□	*	*			
	B4	**Δ**	□	*				
	B5	**Δ,□**	*	*	*		□,▪	
	B6	**Δ**	*	▪	*	▪	▪	
	B7	**Δ**	*	*	▪	▪		
Operation of Facility	**C1**	**Δ**	□	**Δ**	**Δ**	*	▪	▪
	C2	**Δ**	**Δ**			*	*	*
	C3	**Δ,□**				*	▪	▪
	C4	**Δ,□**	**Δ**			*	▪	

LEGEND:

* = Responsible

Δ = Inform

☐ = Approval

▪ = Support

6.4 Scheduling

6.4.1 Gantt Chart

The Gantt chart gives us an idea of the schedule of the project and the timeframe for each task to be accomplished. The Gantt chart for the project is shown in Appendix C.

The project is mostly likely estimated to be completed in 76 days. The project manager and the project team will be the most responsible and involved during in the project during the duration.

The project team is expected to hire and contract service providers and the operational team, who will become major stakeholders in the operation of the plants. The service providers include the renovation team who are projected to work on two different subprojects, each lasting about two weeks with no overlap. The installers will work on installing the printers at the locations for about 2 weeks in between the subprojects involving the renovation team.

The operations team consists of 3 operators, 3 designers a functional manager and the shipping team. They gradually become more involved as the project goes on and take over once the facilities are setup. The project team and the PM are expected to be involved in multiple subprojects along the course of the project and are projected to work overtime for a combined 6 hours, which can be avoided if the tasks are planned in advance.

6.4.2 PERT Analysis

As can be seen in Appendix D, the critical path is A1-A2-B1-B2'-B3-B6-B7-C1-C2.

B2' is a part of B2 and will be completed simultaneously. Similarly, for C1 and C2 the same principle applies.

From the PERT analysis, it can be seen that the expected duration of the critical path is **69** days. The sum of the variances on the critical path is **12.0549**

For an expected time of 69 days and variance of 12.0549, we test the probability of completion in 76 days.

The Standard normal Z value is calculated to be 2.016, for which the probability is 97.778%.

Similarly, the probability of completion in 72 days is 80.511%.

6.5 Resource Allocation

The stakeholders of the project are:

- The board of directors and investors
- One project manager and one project assistant
- The project team consists of three people with their expertise spanning over the scope of the project
- One functional manager
- Three CAD Design experts
- Three operators experienced with the maintenance of the printers
- The shipping team which will be contracted, but not involved in the setup
- The workforce, which consists the renovation team with a total of 12 personnel split equally between the three worksites. The workforce also consists of three personnel who will be responsible for the installation of the printers under the supervision of the project manager.

The total number of quantifiable personnel involved is 27 without counting the shipping team which is estimated to be 10 personnel strong.

Stakeholder	Total hours
Project Manager	443
Project Team	369
Board of Directors	62
Investors	40
Renovation Team	182
Installers	84
Functional Manager	172
Operator	116
Designer	88
Shipping Team	32

The project manager is responsible for making most of the decisions during the project. This authority is sometimes delegated to the project team, who must keep the PM informed. More detailed tables are presented in Appendix E.

7. FINANCIAL PLAN

The expenses for the project are presented in the below table. More detailed tables are presented in Appendix F.

Resource	Comments	Gross Value ($)	Requirement
Project Payroll	Wages	142520	Primary
Regular Payroll	Staff wages (per year)	387600	Tertiary
Equipment	Cost of 3 printers, design computers, shipping (One time)	1539540	Primary
Production Cost	Raw material, Electricity. (per year)	509,990	Secondary
Transportation Cost	Shipping (per year)	28985	Secondary
Maintenance Cost	Per year	200000	Secondary
Operating cost	Cost for production at the hospitals	470070	Secondary
Total Budget		3278705	

The total budget of the project is estimated to be $3,278,705. The funds can be classified as primary, secondary and tertiary according to when they are required. This is a bottom up budget plan with the inputs for the budget coming from the parties most responsible and involved in the subproject. The primary funds are recommended to be released by day 13 so that the printers can be purchased, and the members of the project team can be compensated. The secondary funds are recommended to be released by day 50, so that the testing of the plant can be started when the setup is complete. This task also lies on the critical path. The tertiary funds are recommended for release once the plant is setup and fully functional. The projected sales data from Appendix F suggests that if the plant runs successfully, the investment is projected to pay off in 3 years.

8. MONITORING AND CONTROL

Since this is a high-level finance project, sponsored by investors, it is important to carefully monitor the use of funds and ensure the project is completed by the projected date. To ensure this, the project manager needs to take careful steps to monitor the project and the cash flow.

The PM is responsible for timely audits and progress reports which are to be submitted to the board of directors and the investors for review and information. Although it would be ideal to have these reports every week, it may also hinder the PM's ability to function effectively. To make up for this, major points in the timeline have been chosen to ensure the investors are regularly up to date with the flow of the project. These points have been presented in the table below.

During the project itself, the PM is responsible for making any changes that are needed in the project plan, these changes must be approved by the board. Every task of the project will be carefully monitored by the PM with regular feedback and progress reports from the various team involved in the project. For all tasks longer than a week, weekly progress reports must be formed for data which will serve as important tools for monitoring and controlling the project.

Having the data is not enough, it is important to setup control path so that the insight provided by the date can be put to good use. This can be accomplished by ensuring constantly open communication channel and by providing a sense of importance towards the project and reminder of who has the authority to make decisions.

Report Name	Day due (from start)	Responsibility	Comments	Due to
Financial Report 1	18	PM	Where the funds have been placed for access	Board of Directors, Investors
Hiring Report	24	Project Team	Report of operation team hire progress	PM
Progress Report	27	Project Team	Progress report for renovation work	PM
Spending and Progress 1	32	PM	Purchase report for printers, invoices, report of progress	Board of Directors, Investors
Progress Report	42	Project Team	Report of progress in the installation of printers	PM, Board of directors, Investors
Contract report	50	Project Team	Report of contract details with the shipping company	PM
Progress Report	57	Project Team	Report of progress in setting up the AM centers	PM, Board of directors, Investors
Progress Report	65	PM	Report of progression of project after completing setup of AM centers	Board of Directors, Investors
Project Report	80	PM	Project report including projected vs real dates of task completion, use of the budget	Board of Directors, Investors

9. RISK ASSESSMENT

Some potential areas of risk and how to avoid them:

- Delay in release of funds to the project team. This can be avoided by pre-informing the bank about the transaction when the approval has been obtained.
- To ensure no discrepancy occurs in negotiations with the printer vendor, it is recommended that a member of the project team personally visit the vendor before purchase. It is also advisable to add insurance on shipping or ensure that the shipping is of the highest quality to avoid damage to the printers.
- The renovations team is responsible for remodeling, however since this is a medical facility, constant attention is a must to ensure the remodeling is accurate and according to requirements. To ensure this, a member of the project team or the PM must check in with the progress of the renovations everyday across all three sites.
- The hiring process can be tenuous and to be successful, it is recommended that the job postings are posted across many platforms as soon as the team is on board with the project.
- During the final leg of the project, which begins with completing the setup of the AM, team morale and energy maybe suffering. To ensure this doesn't hinder the progress of the project, a team outing is proposed to celebrate the success of the project so far and to recognize the best performer to motivate others to get over the hurdle while giving it their best.
- The testing process is one the most important process. To ensure nothing can go wrong during this phase, it is advised to pay extra close attention while completing all tasks prior to this. If none of the sub-projects before the testing go wrong, there is a very high chance that the testing will be completed successfully.

10. SUMMARY

By looking at the projected numbers, it can be concluded that the project has the characteristics needed to be a successful project.

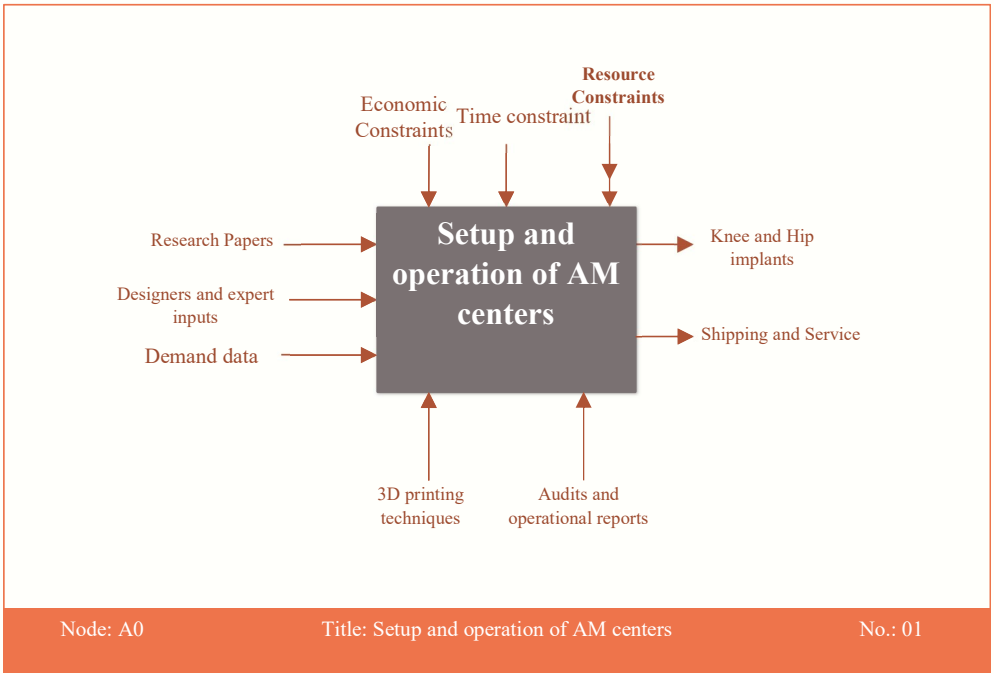
Since this is a very technologically driven and market dependent project, if enough precautions are taken and the markets remain favorable, the project has a lot of potential to be successful. If the necessary precautions and strategies are employed by the project and functional managers, the project has a very high chance to be successful.

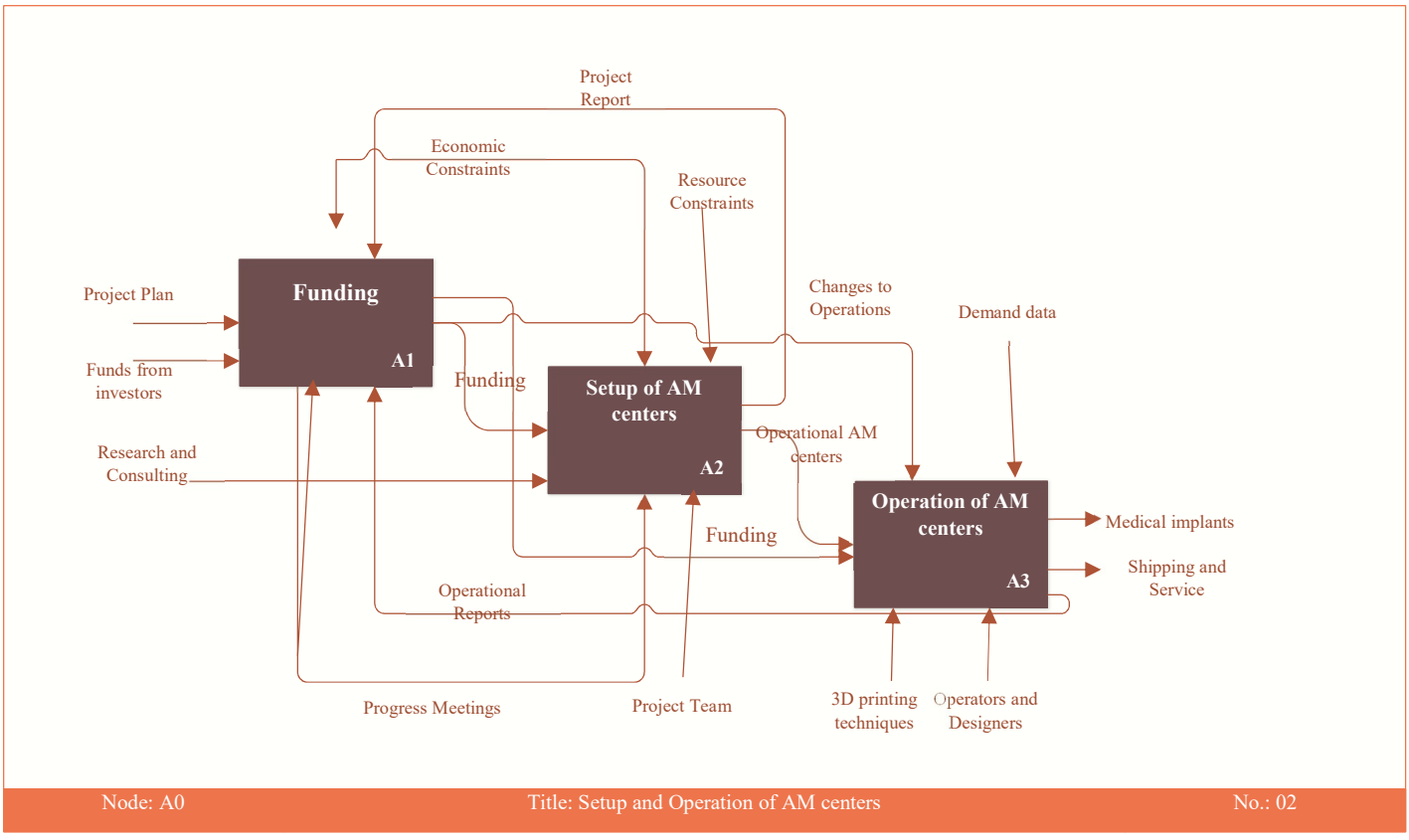
The critical success factors for the project include that the markets remain favorable, the technology is largely unchanged and that the project is delivered successfully within the budget. What makes this project extremely attractive is that, normally implants cost anywhere from $2000-$9000 and by promising to sell our implants at a price cap of $1000, the patient will naturally choose the cheaper option when there is no compromise in quality.

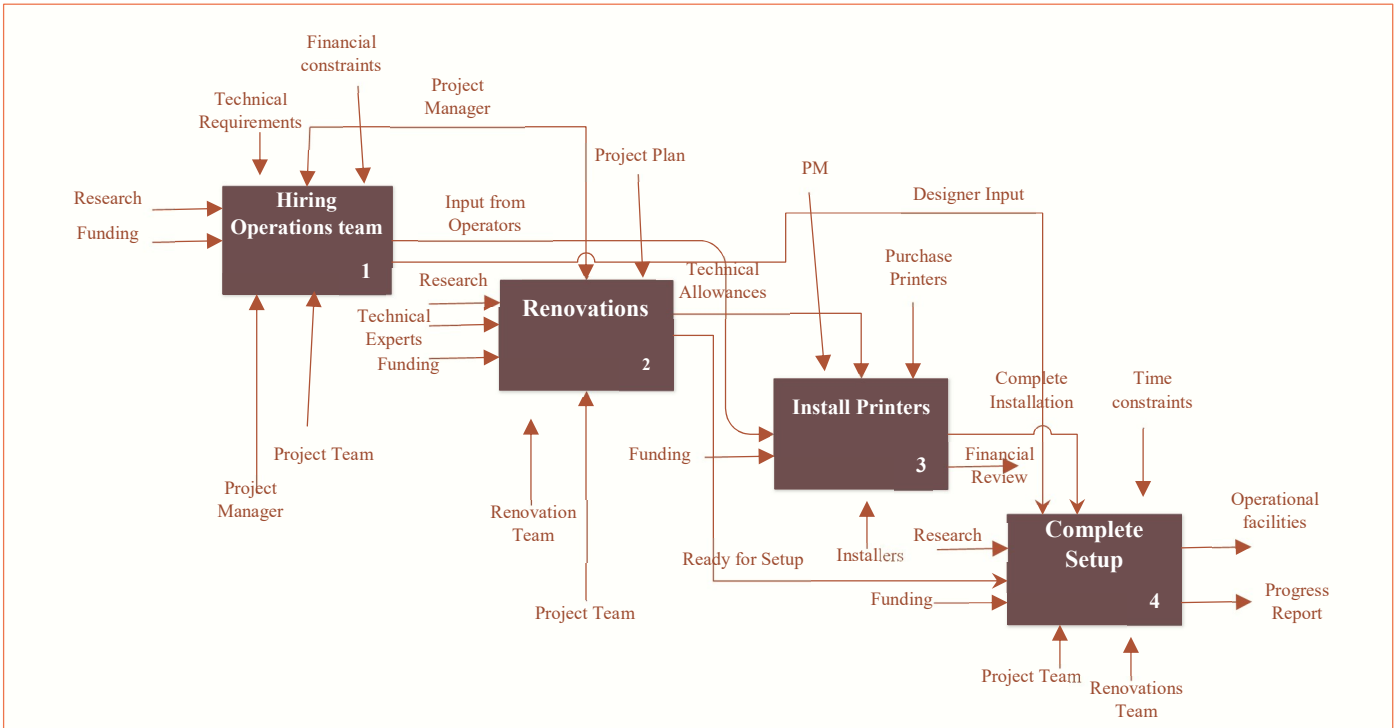
Since the project is a relatively new venture for the organization, it would further enhance public reputation as this is project aimed at providing affordable healthcare. It would also diversify the project portfolio and add expertise and data to future projects in similar fields.

Due to the low operating costs and the high profit margin, it is recommended that this project is carefully considered as it has a lot of potential to pay off in multiple fields.

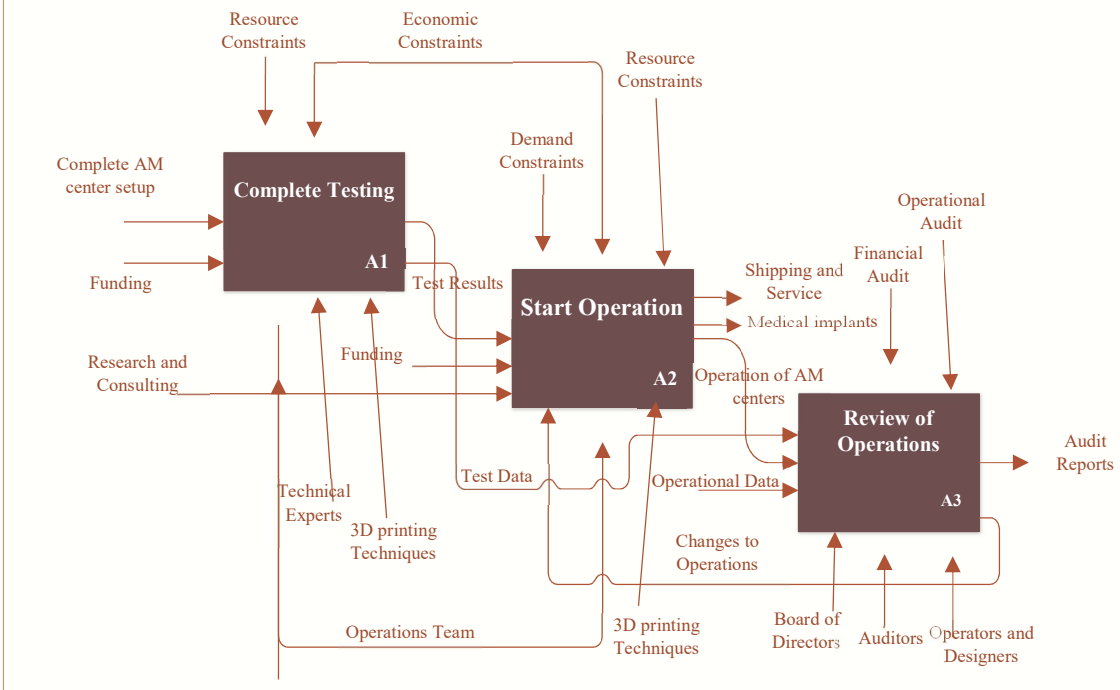
Appendix A


Economic Constraints
Time constraint
Resource Constraints
Research Papers
Designers and expert inputs
Demand data
Setup and operation of AM centers
Knee and Hip implants
Shipping and Service
3D printing techniques
Audits and operational reports
Node: A0
Title: Setup and operation of AM centers
No.: 01

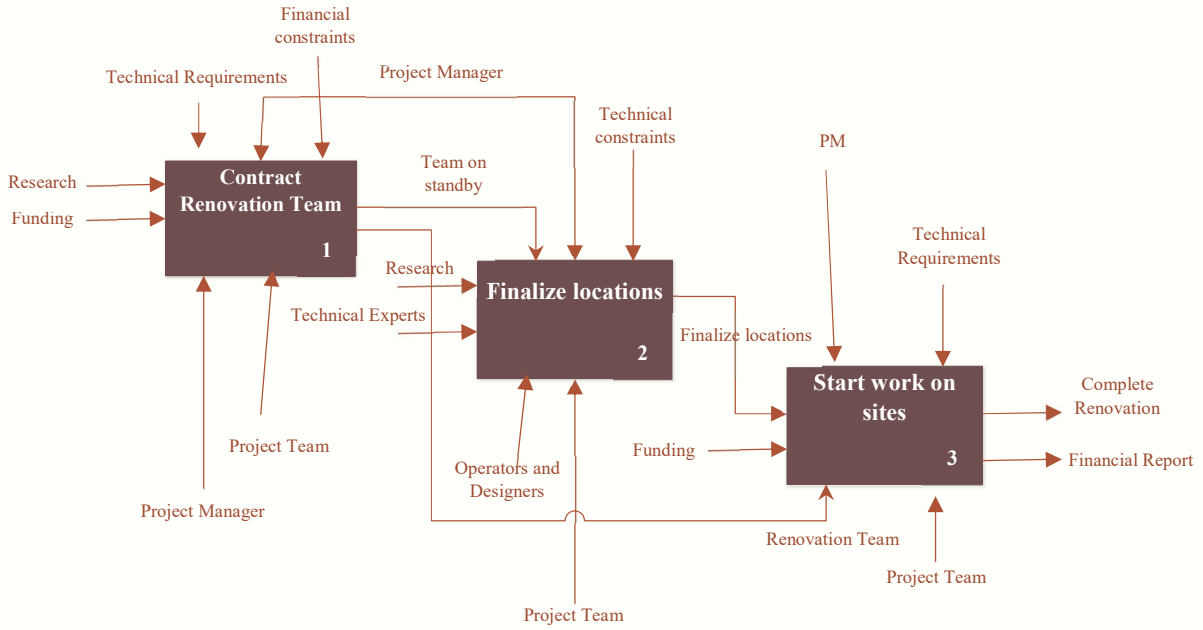

Project Report
Economic Constraints
Resource Constraints
Project Plan
Funds from investors
Funding
A1
Funding
Setup of AM centers
A2
Changes to Operations
Demand data
Operational AM centers
Research and Consulting
Operation of AM centers
A3
Medical implants
Shipping and Service
Funding
Operational Reports
Progress Meetings
Project Team
3D printing techniques
Operators and Designers
Node: A0
Title: Setup and Operation of AM centers
No.: 02



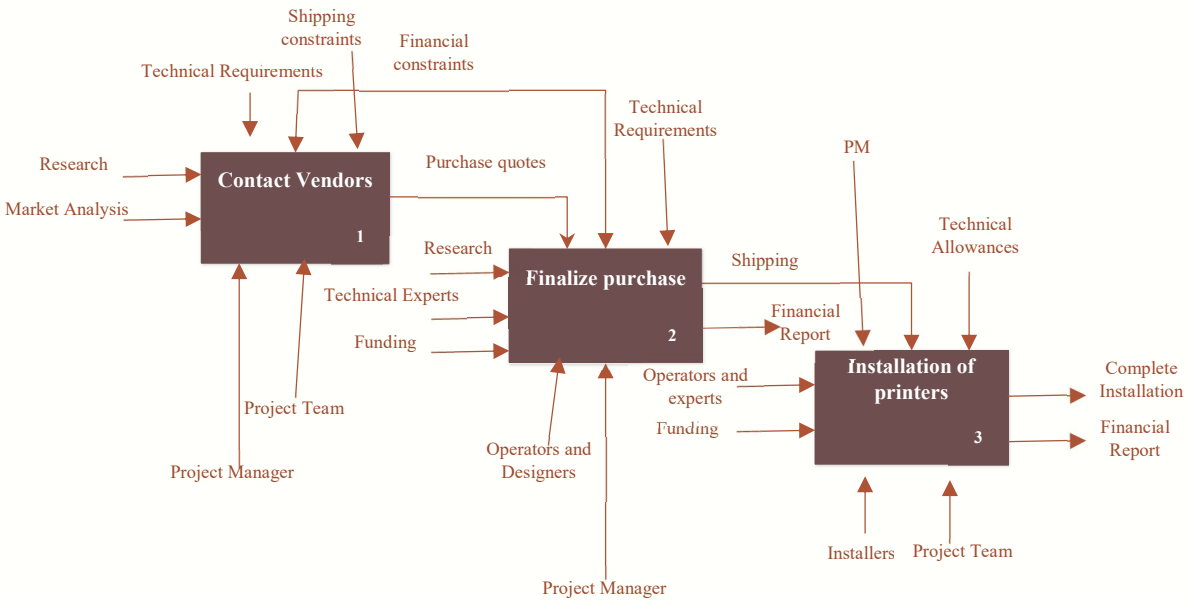
Node: A2 | Title: Setup of AM centers | No.: 03



Node: A3 | Title: Operation of AM centers | No.: 04

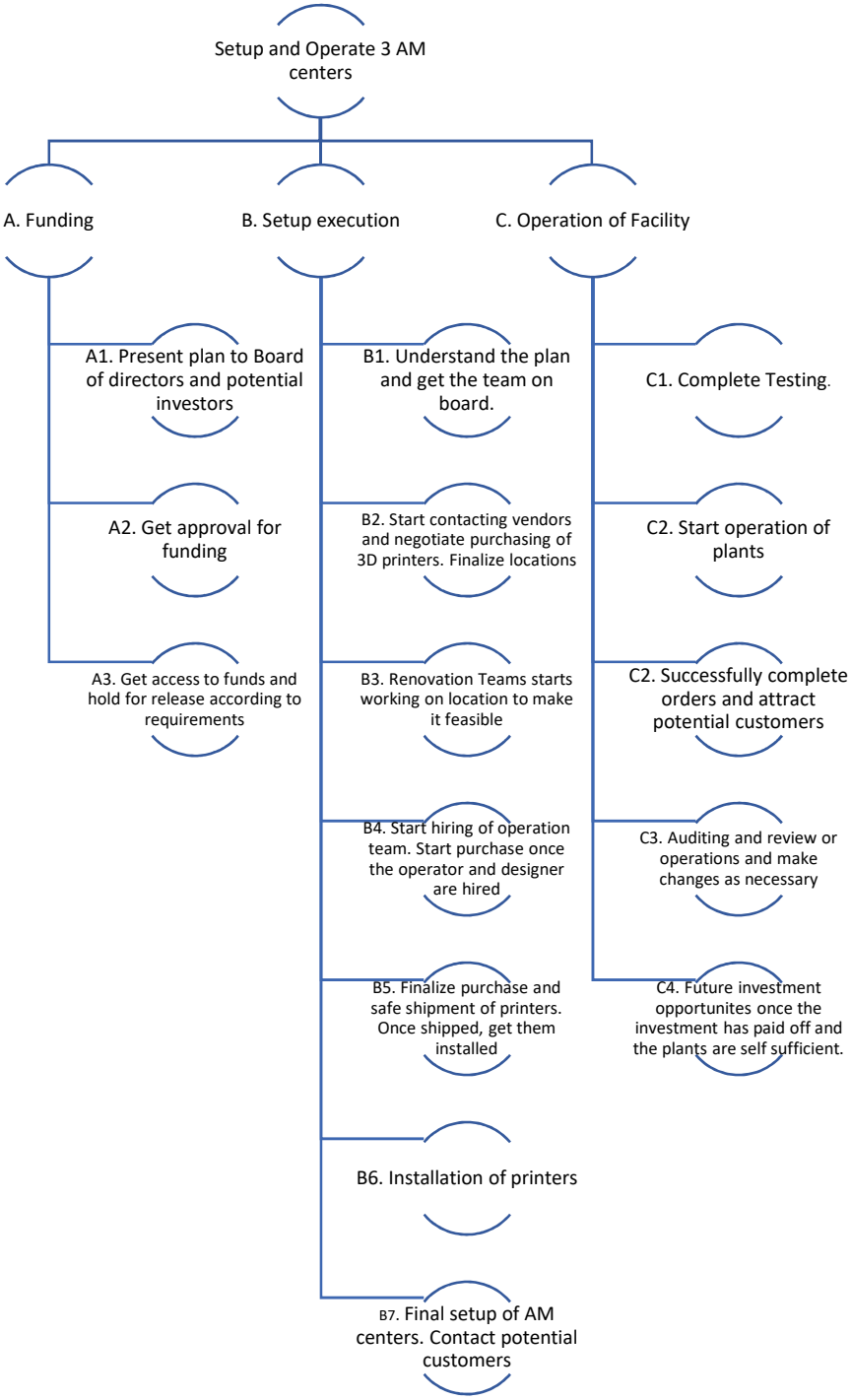


Node: A22 Title: Renovations No.: 05

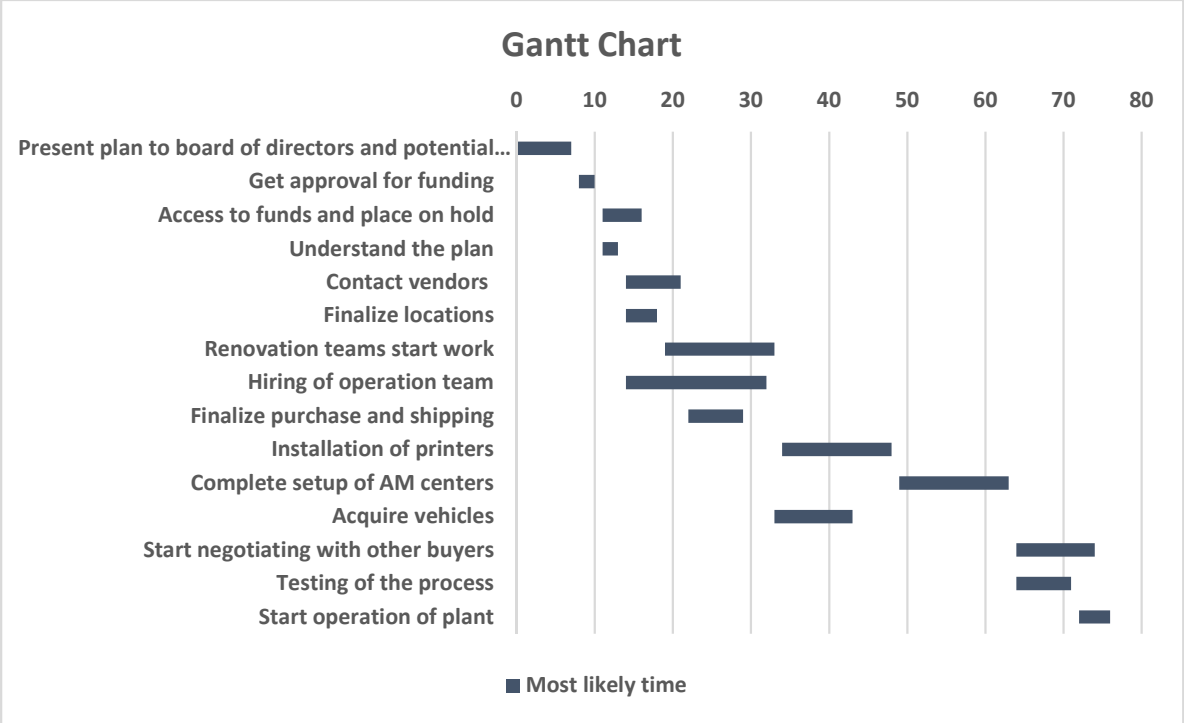


Node: A23 Title: Installation of printers No.: 06

Appendix B


Setup and Operate 3 AM centers
A. Funding
B. Setup execution
C. Operation of Facility
A1. Present plan to Board of directors and potential investors
A2. Get approval for funding
A3. Get access to funds and hold for release according to requirements
B1. Understand the plan and get the team on board.
B2. Start contacting vendors and negotiate purchasing of 3D printers. Finalize locations
B3. Renovation Teams starts working on location to make it feasible
B4. Start hiring of operation team. Start purchase once the operator and designer are hired
B5. Finalize purchase and safe shipment of printers. Once shipped, get them installed
B6. Installation of printers
B7. Final setup of AM centers. Contact potential customers
C1. Complete Testing.
C2. Start operation of plants
C2. Successfully complete orders and attract potential customers
C3. Auditing and review or operations and make changes as necessary
C4. Future investment opportunites once the investment has paid off and the plants are self sufficient.

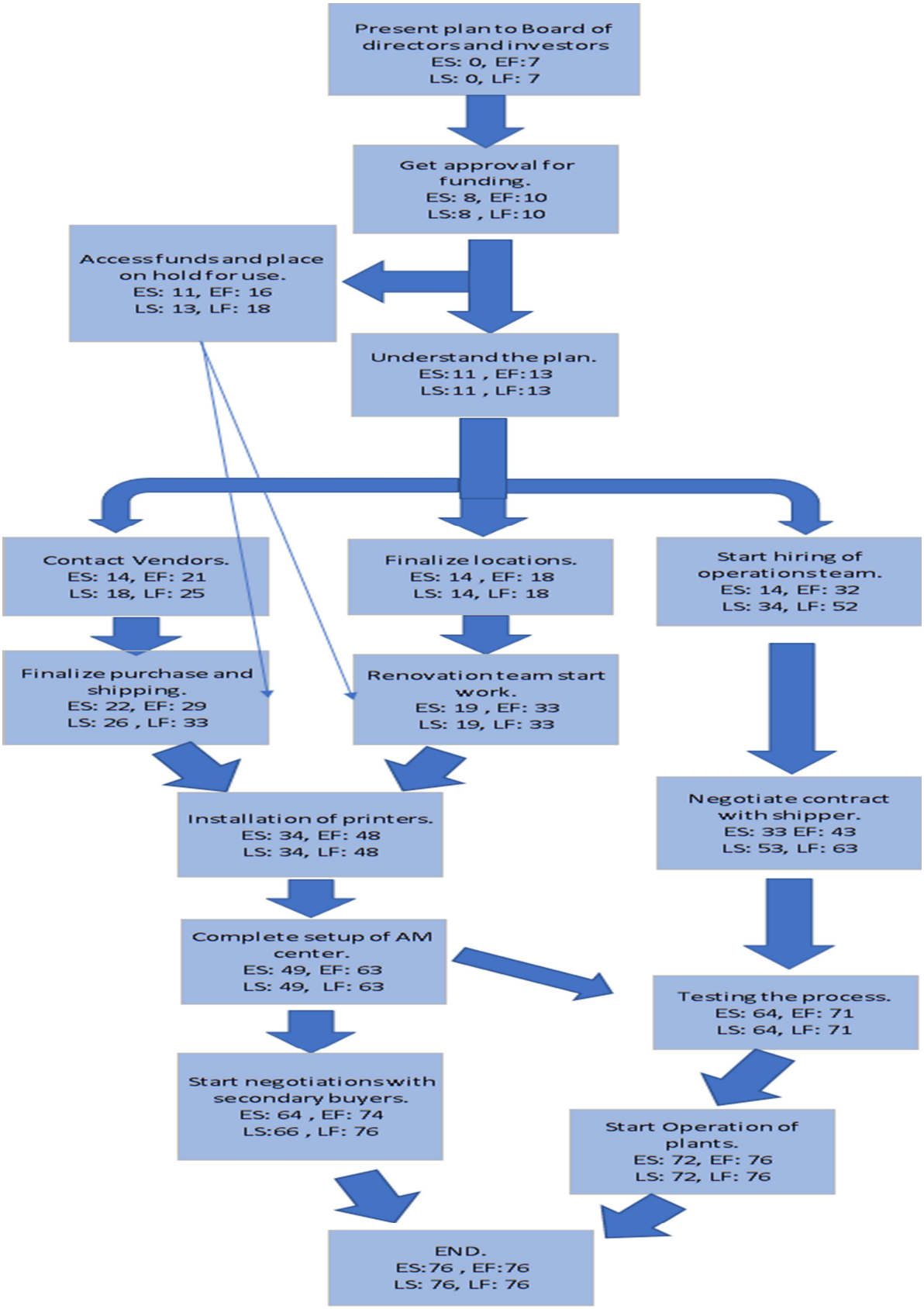
Appendix C



Task	Start Date	Task Duration
Present plan to board of directors and potential investors	0	7
Get approval for funding	8	2
Access to funds and place on hold	11	5
Understand the plan	11	2
Contact vendors	14	7
Finalize locations	14	4
Renovation teams start work	19	14
Hiring of operation team	14	18
Finalize purchase and shipping	22	7
Installation of printers	34	14
Complete setup of AM centers	49	14
Acquire vehicles	33	10
Start negotiating with other buyers	64	10
Testing of the process	64	7
Start operation of plant	72	4

Appendix D

Task	Most likely time	Preceding Task	Optimistic Time	Pessimistic Time	Expected Time	Variance	Standard Deviation
A1. Present plan to board of directors and potential investors	7		4	9	6.8333333	0.6944444	0.83333333
A2. Get approval for funding	2	Presenting proposal	1	7	2.6666667	1	1
A3. Access to funds and place on hold	5	Get approval	4	7	5.1666667	0.25	0.5
B1. Understand the plan	2	Get approval	2	4	2.3333333	0.1111111	0.33333333
B2. Contact vendors	7	Understand the plan	5	14	7.8333333	2.25	1.5
B2'. Finalize locations	4	Understand the plan	3	7	3.6666667	0.4444444	0.66666667
B3. Renovation and modelling teams start work	14	Finalize location	10	21	14.5	3.3611111	1.83333333
B4. Hiring of operation team	18	Understand the plan	14	28	19	5.4444444	2.33333333
B5. Finalize purchase and shipping	7	Contact vendor	5	10	7.1666667	0.6944444	0.83333333
B6. Installation of printers	14	Renovation, hiring	10	21	14.5	3.3611111	1.83333333
B7. Complete setup of AM centers	14	Installation	7	14	12.833333	1.3611111	1.16666667
B7'. Acquire vehicles	10		7	14	10.166667	1.3611111	1.16666667
B7". Start negotiating with other buyers	10	Complete installation	7	21	14	5.4444444	2.33333333
C1. Testing of the process	7	Complete installation	3	10	6.8333333	1.3611111	1.16666667
C2. Start operation of plant	4	Testing	3	5	4	0.111111	0.333333


Present plan to Board of directors and investors
ES: 0, EF: 7
LS: 0, LF: 7
Get approval for funding.
ES: 8, EF: 10
LS: 8 , LF: 10
Access funds and place on hold for use.
ES: 11, EF: 16
LS: 13, LF: 18
Understand the plan.
ES: 11 , EF: 13
LS: 11 , LF: 13
Contact Vendors.
ES: 14, EF: 21
LS: 18, LF: 25
Finalize locations.
ES: 14 , EF: 18
LS: 14, LF: 18
Start hiring of operations team.
ES: 14, EF: 32
LS: 34, LF: 52
Finalize purchase and shipping.
ES: 22, EF: 29
LS: 26 , LF: 33
Renovation team start work.
ES: 19 , EF: 33
LS: 19, LF: 33
Installation of printers.
ES: 34, EF: 48
LS: 34, LF: 48
Negotiate contract with shipper.
ES: 33 EF: 43
LS: 53, LF: 63
Complete setup of AM center.
ES: 49, EF: 63
LS: 49, LF: 63
Testing the process.
ES: 64, EF: 71
LS: 64, LF: 71
Start negotiations with secondary buyers.
ES: 64 , EF: 74
LS: 66 , LF: 76
Start Operation of plants.
ES: 72, EF: 76
LS: 72, LF: 76
END.
ES: 76 , EF: 76
LS: 76, LF: 76

	Task	Early Start	Early Finish	Late Start	Late Finish	Slack
A1	**Present plan to board of directors and potential investors**	**0**	**7**	**0**	**7**	**0**
A2	**Get approval for funding**	**8**	**10**	**8**	**10**	**0**
A3	**Access to funds and place on hold**	**11**	**16**	**13**	**18**	**2**
B1	**Understand the plan**	**11**	**13**	**11**	**13**	**0**
B2	**Contact vendors**	**14**	**21**	**18**	**25**	**4**
B2’	**Finalize locations**	**14**	**18**	**14**	**18**	**0**
B3	**Renovation teams start work**	**19**	**33**	**19**	**33**	**0**
B4	**Hiring of operation team**	**14**	**32**	**34**	**52**	**20**
B5	**Finalize purchase and shipping**	**22**	**29**	**26**	**33**	**4**
B6	**Installation of printers**	**34**	**48**	**34**	**48**	**0**
B7	**Complete setup of AM centers**	**49**	**63**	**49**	**63**	**0**
B7’	**Acquire vehicles**	**33**	**43**	**53**	**63**	**20**
B7”	**Start negotiating with other buyers**	**64**	**74**	**66**	**76**	**2**
C1	**Testing of the process**	**64**	**71**	**64**	**71**	**0**
C2	**Start operation of plant**	**72**	**76**	**72**	**76**	**0**

As can be seen, the Critical path is A1-A2-B1-B2’-B3-B6-B7-C1-C2.

B2’ is a part of B2 and will be completed simultaneously. Similarly, for C1 and C2 the same principle applies.

From the PERT analysis, it can be seen that the expected duration of the critical path is **69** days. The sum of the variances on the critical path is **12.0549**

For an expected time of 69 days and variance of 12.0549, we test the probability of completion in 76 days.

The Standard normal Z value is calculated to be 2.016, for which the probability is 97.778%.

Similarly, the probability of completion in 72 days is 80.511%.

Appendix E

Resource Name	Task / Funding	Start Day	Finish Day	Work hours
Board of Directors	A1	0	7	14
Investors		0	7	14
Project Manager		0	7	56
Board of Directors	A2	8	10	4
Investors		8	10	4
Project Manager		8	10	16
Project Manager	A3	11	16	8
Investors		11	16	18
Project Execution				
Project Manager	B1	11	13	16
Project Team		11	13	16
Project Manager	B2	14	21	21
Project Team		14	21	35
Project Manager	B2’	14	18	16
Project Team		14	18	16
Renovation Team	B3	19	33	112
Project Team		19	33	28
Project Manager		19	33	28
Project Team	B4	14	32	54
Project Manager		14	32	72
Project Manager	B5	22	29	14
Project Team		22	29	14
Project Manager	B6	34	48	28
Project Team		34	48	42
Installers		34	48	84
Functional Manager		34	48	28
Operators		34	48	28
Project Manager	B7	49	63	28
Project Team		49	63	28
Renovation Team		49	63	70
Functional Manager		49	63	56
Project Manager	B7’	33	43	40
Project Team		33	43	40
Project Manager	B7”	64	74	60
Project Team		64	74	60
Board of Directors		64	74	40
Start Operation of Facility				
Project Manager	C1	64	71	28
Project Team		64	71	28

Designers		64	71	56
Operators		64	71	56
Functional Manager		64	71	56
Board of Directors	C2	72	76	4
Investors		72	76	4
Project Manager		72	76	12
Project Team		72	76	8
Functional Manager		72	76	32
Operating Team		72	76	32
Shipping Team		72	76	32
			Total	1588

Project Timeline	Stakeholders	Expected work hours	Payable work hours
Day 1 – Day 10	Project Manager	72	72
	Board of Directors	18	0
	Investors	18	0
Day 11 – Day 20	Project Manager	84	80+4
	Project Team	82	80+2
	Renovation Team	8	8
	Investors	18	0
Day 21 – Day 30	Project Manager	77	77
	Project Team	69	69
	Renovation Team	80	80
Day 31 – Day 40	Project Manager	54	54
	Project Team	58	58
	Renovation Team	24	24
	Installers	36	36
	Functional Manager	12	12
	Operators	12	12

Day 41 – Day 50	Project Manager	30	30
	Project Team	38	38
	Installors	48	48
	Functional Manager	20	20
	Operators	16	16
	Renovation Team	5	5
Day 51 – Day 60	Project Manager	20	20
	Project Team	20	20
	Renovation Team	50	50
	Functional Manager	40	40
Day 61 – Day 70	Project Manager	66	66
	Project Team	66	66
	Board of Directors	24	0
	Functional Manager	60	60
	Renovation Team	15	15
	Designers	48	48
	Operators	48	48
Day 71-76	Project Manager	40	40
	Project Team	36	36
	Functional Manager	40	40
	Board of Directors	20	0
	Investors	4	0
	Operators	40	40
	Designers	40	40
	Shipping Team	32	32
	Total	1588	

Appendix F

Stakeholder	Total hours	Normal Payable hours	Overtime	Number of Employees	Wage	Overtime wage	Total payable
Project Manager	443	439	4	1	60	70	26620
Project Team	369	367	2	3	30	35	33240
Board of Directors	62	0	0	0	0	0	0
Investors	40	0	0	0	0	0	0
Renovation Team	182	182	0	12	25	0	54600
Installers	84	84	0	3	25	0	6300
Functional Manager	172	172	0	1	40	45	6880
Operator	116	116	0	3	20	25	6960
Designer	88	88	0	3	30	35	7920
Shipping Team	32	32	0	10	0	0	0
Total payroll							142520

The above table shows the projected project payroll

Implant type	Cost for production	No of units produced (per year)	Estimated selling price	Profit per unit	Expected total profit (per year)
Knee implant	115	2162	600	485	1048570
Hip Implant	240	1848	1000	760	1404480
				Total profit (per year)	2453050
				Operating costs	1086655
				True profit (per year)	1366395

The above table shows the projected sales data

Total Investment	Interest rate (savings account)	Total value of investment (4 years)	Breakeven point(years)
3,278,705	4.50%	3909916.7	2.861484

The above table show the true value of the investment compounded at 4.50% annually. The breakeven point is determined by dividing the projected profit per year from the total value of the investment.