Project Planning, Scheduling and Control: Assignment 2

D. U. Singer Hospital Products Corp.

Code for Course:	MBL405-5
Assignment Number:	02
Student number:	750-163-3
Group Code Number:	BOT1000

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Question 1: Construct the nine elements of the plan identified

i. Statement of Objectives

Main Objectives

- Compilation of a project plan (up to the start of production) for the development of a long term antiseptic. The scope of the project will be limited to when the production process can be turned over to manufacturing. This is specifically measured by the manufacturing operation being capable of producing a 95% yield of product (fully packaged) at a level of 80% of the full production goal of 10 million litres per year.
- Determination of an appropriate end date for the project.

Additional Requirements

- Ensure that appropriate regulatory documentation is submitted and approved.
- Development of the packaging design.
- Ensure that manufacturing is carried out in accordance with corporate policies and standards.
- Ensure that current FDA, EPA and OSHA regulations are met.
- Ensure that internal specifications by the manufacturing department are met.

ii. Work Breakdown Structure

The work breakdown structure shows how the various activities in the project have been assigned to six different phases. These are namely: -

- Requirements Specification
- Develop
- Design
- Procure
- Install
- Test

Responsibilities are then assigned to parties for the activities within the project.

Phase	Activity	Executive Committee	Project Management	Marketing	Packaging Task Force	R & D Group	Corporate Engineering	Hospital Products Manufacturing	Packaged Products Manufacturing	Maintenance	Purchasing
Requirements Specification	a Product Rationale	2	1	3	6	1	6	3	3	6	6
	c Product Specification				4	1	3	4	4		4
Develop	b Develop Formula					1	3	4			
	d Regulatory Documentation					1	3	4			
	e Develop Packaging Concept				1	1	3	4	1		4
	g Develop Processing System					1	1	1			
	h Develop Packaging System				1	1	1		1		4
Design	f Design Packaging				1	4	4		4		4
Procure	i Study Facilities Requirements					3	1	4	4		
	j Capital Equipment List					4	1				4
	k Procurement of Process Equipment					5	5	5			1
	l Procurement of Packaging Equipment				5		5		5		1
	m Procure Facilities						5	5	5	5	1
Install	n Install Process Equipment					4	3	1		3	5
	o Install Packaging Equipment				4		3		1	3	5
	p Install Facilities						1	1	1	1	5
	q Written Procedures				1	1	1	1	1	1	
Test	r Pilot Test	2	1		5	1	1	1	1	1	

Key

1 - Actual Responsibility
2 - General Supervision and Review
3 - Must be consulted
4 - May be consulted
5 - Must be notified
6 - Approval Required

Figure 1: Work Breakdown Structure for Antiseptic Development Project

iii. An activity on node (PERT) network

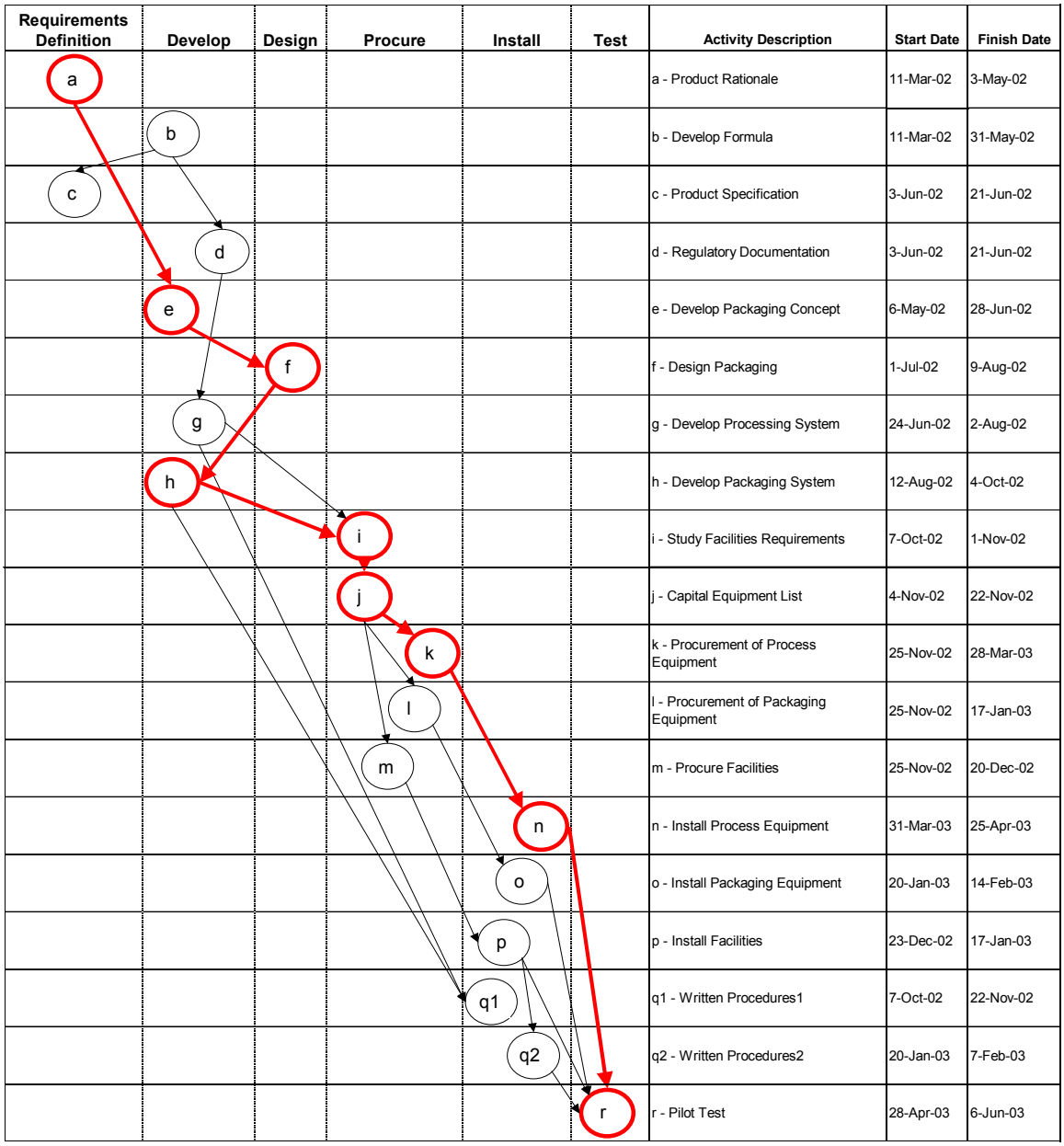


Figure 2: PERT Diagram

Please also refer to the “PERT Chart” contained in the attached project plan. In the above figure the critical path is highlighted in red. The calculation of which path is the critical path is determined in the next question.

iv. A determination of the critical path(s) and the duration along the path.

Potential Paths	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q1	q2	r	Total
Path 1	40				40	30		40	20	15	90			20					30	325
Path 2		60		15					20	15	90			20					30	250
Path 3	40				40	30		40	20	15		40			20				30	275
Path 4	40				40	30		40	20	15			20			20		15	30	270
Path 5		60		15					20	15		40			20				30	200
Path 6		60		15					20	15			20			20		15	30	195

Figure 3: Potential Paths

The above figure shows 6 potential paths and the timings in days for each of the paths. The critical path is path no.1. This is the point at which the path is the longest. The critical path is also highlighted in red in the “Gantt Chart” and “Pert Chart” in the attached project plan. Certain assumptions were made in compiling the project plan and determining the number of days as well as the appropriate costs. These are

Assumptions

- Eight hour working day
- Five day working week and no work performed on weekends.
- $600 per week rate for each employee is therefore calculated as $15 per hour.
- Materials were allocated at a cost of $500 per unit.

Lastly the version is Project 2000

v. An activity list, early-start schedule, slack list and master schedule. Assume every activity begins at its early start, regardless of resource constraints.

Activity #	Activity	Days	EST	LST	Slack	Predecessor	Successor
1	**Requirements Specification**	**150**	**0**	**0**	**0**		
2	a - Product Rationale	40	0	0	0		7
3	c - Product Specification	15	60	310	250	5	
4	**Develop**	**110**	**0**	**0**	**0**		
5	b - Develop Formula	60	0	45	45	2	6,3
6	d - Regulatory Documentation	15	60	105	45	5	8
7	e - Develop Packaging Concept	40	40	40	0	2	11
8	g - Develop Processing System	30	75	120	45	6	13,22
9	h - Develop Packaging System	40	110	110	0	11	13,22
10	**Design**	**30**	**80**	**80**	**0**		
11	f - Design Packaging	30	80	80	0	7	9
12	**Procure**	**125**	**150**	**150**	**0**		
13	i - Study Facilities Requirements	20	150	150	0	8,9	14
14	j - Capital Equipment List	15	170	170	0	13	15,16,17
15	k - Procurement of Process Equipment	90	185	185	0	14	19
16	l - Procurement of Packaging Equipment	40	185	235	50	14	20
17	m - Procure Facilities	20	185	240	55	14	21
18	**Install**	**145**	**275**	**305**	**30**		
19	n - Install Process Equipment	20	275	275	0	15	25
20	o - Install Packaging Equipment	20	225	275	50	16	25
21	p - Install Facilities	20	205	260	55	17	23,25
22	q1 - Written Procedures	35	150	290	140	8,9	
23	q2 - Written Procedures	15	225	280	55	21	25
24	**Test**	**30**	**295**	**295**	**0**		
25	r - Pilot Test	30	295	295	0	23,19,20,21	
	Total Project Time	**325**					

Figure 4: Activity List, Early Start List, Slack List and Master Schedule

Please also see the “Gantt Chart” in the attached project plan for this information.

vi. A period labor requirements table for each group and the project as a whole. Include bar graphs to illustrate the labour load.

Labour Requirement

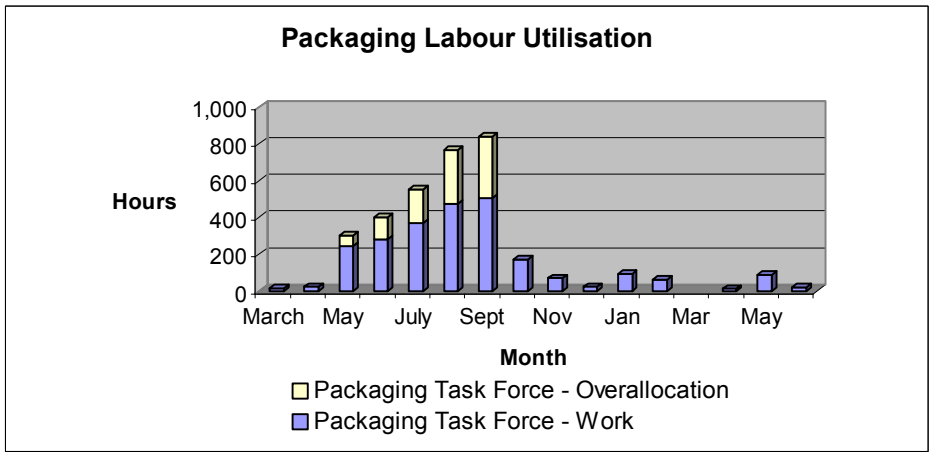
	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June	Total
Packaging Task Force	15	22	243	280	368	472	504	172	69	22	93	60		12	88	20	**2,440**
R & D Group	340	499	441	1,000	613	187	168	260	114	10	50	29	13	100	176	40	**4,040**
Corporate Engineering	55	81	144	440	460	180	168	716	233	132	273	109	17	176	176	40	**3,400**
H - P Manufacturing	35	51	74	240	368	32		228	144	110	220	49	25	328	176	40	**2,120**
Pack Prod Manuf	30	44	166	200	92	148	168	336	211	122	423	220		24	176	40	**2,400**
Maintenance								152	138	170	420	120	8	176	176	40	**1,400**
Purchasing			40	80	92	58	42	8	161	460	235	82	64	38			**1,360**
Total	**475**	**697**	**1,108**	**2,240**	**1,993**	**1,077**	**1,050**	**1,872**	**1,070**	**1,026**	**1,714**	**669**	**127**	**854**	**968**	**220**	**17,160**

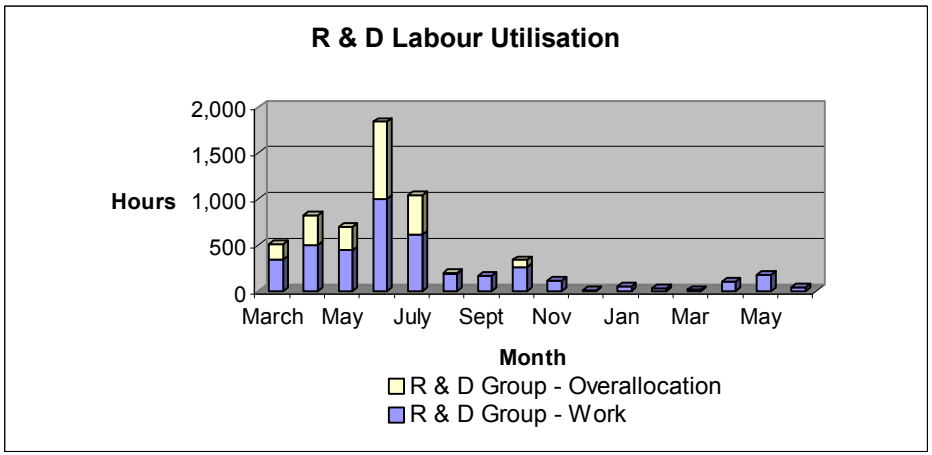
Overallocated

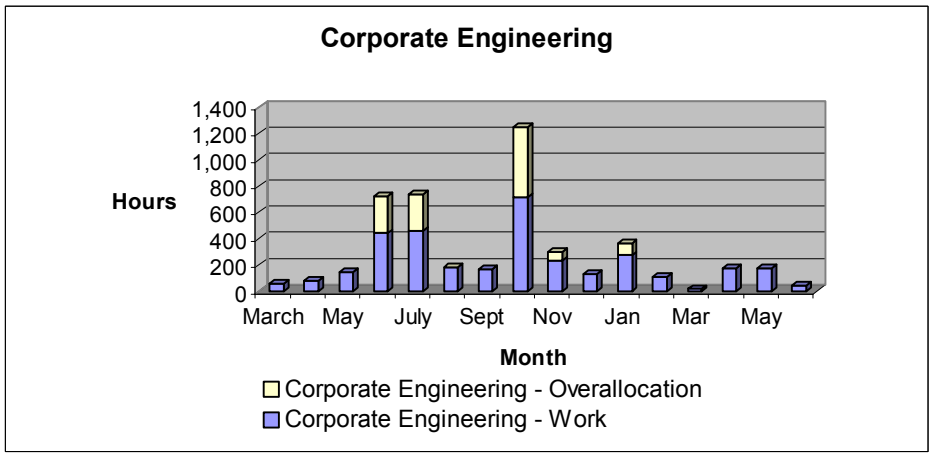
	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June	Total
Packaging Task Force			59	120	184	296	336										**995**
R & D Group	172	323	257	840	429	11		76									**2,108**
Corporate Engineering				280	276	4		532	65		89						**1,246**
H - P Manufacturing				80	184			44			36			152			**496**
Pack Prod Manuf				40				152	43		239	60					**534**
Maintenance											236						**236**
Purchasing										284	51						**335**
Total	**172**	**323**	**316**	**1,360**	**1,073**	**311**	**336**	**804**	**108**	**284**	**651**	**60**	**0**	**152**	**0**	**0**	**5,951**

Figure 5: Labour Requirement by group by period

This information can also be seen in the project plan under “Resource Usage”







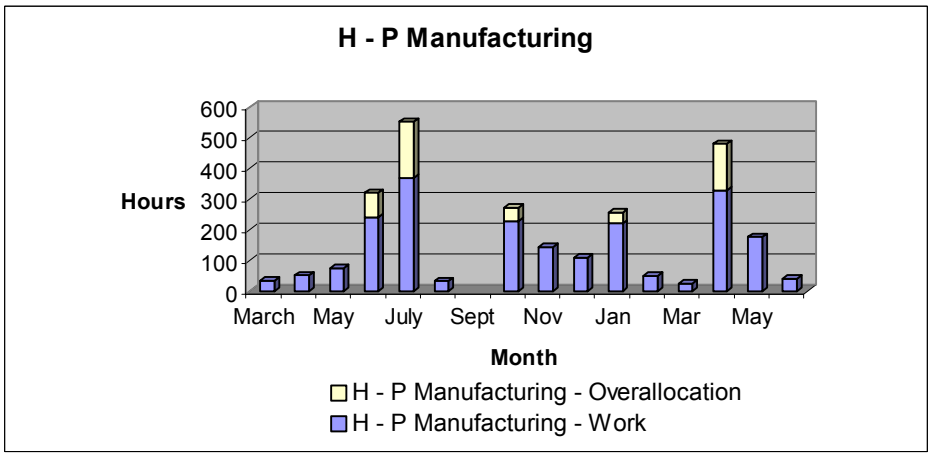
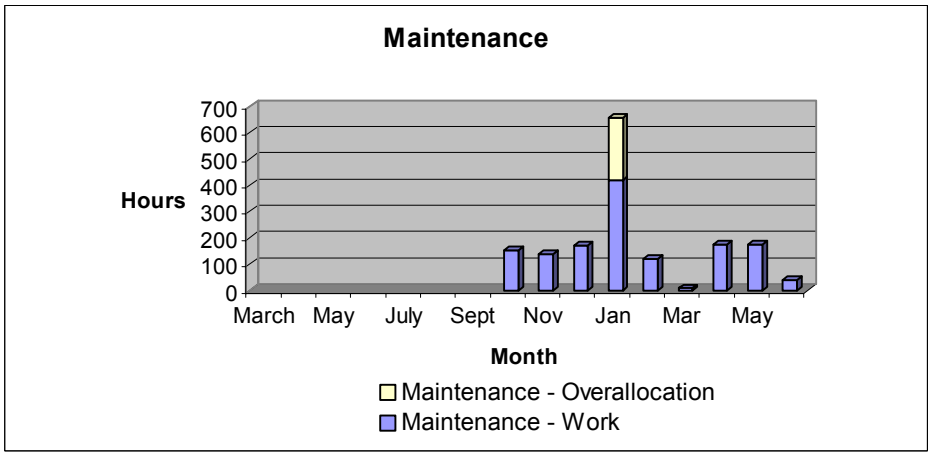


Figure 6: Labour Utilisation Graphs

Similar Graphs can also be viewed under the “Resource Graph” section of the project plan.



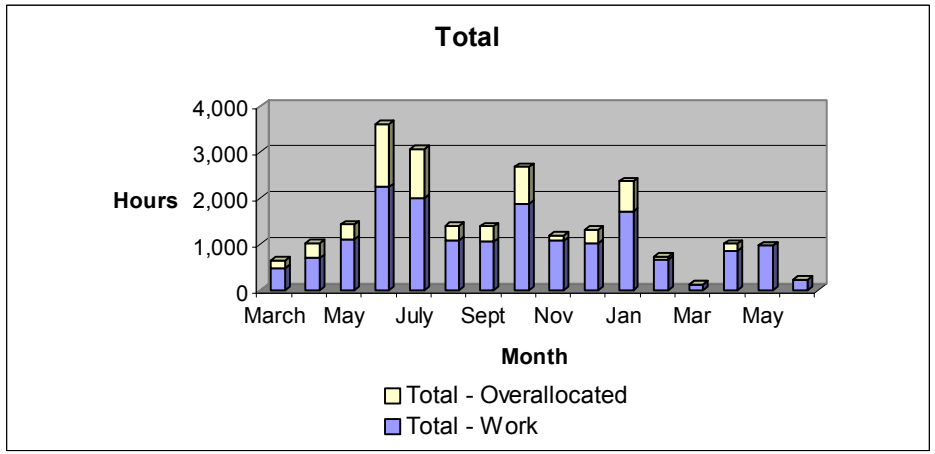


Figure 7: Labour Utilisation Graphs Cont.d

vii. A cumulative labour requirements table table for each group and the project as a whole. Include line graphs to illustrate the cumulative loads.

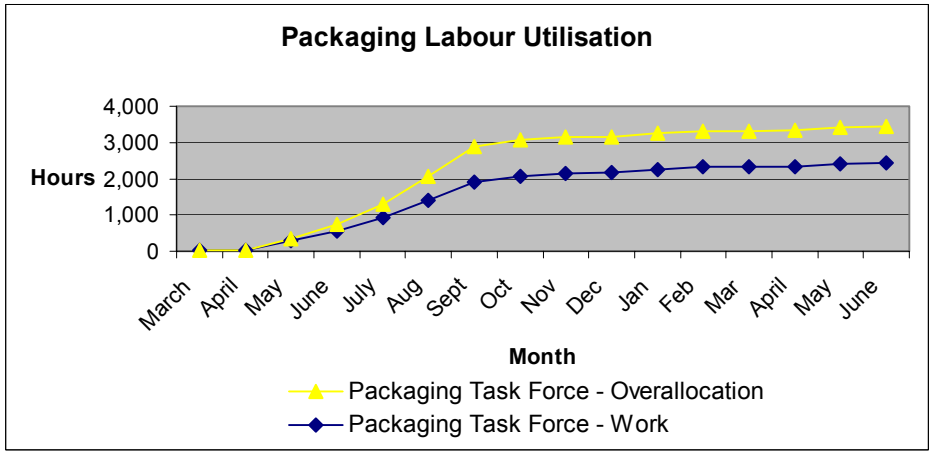
Labour Requirement

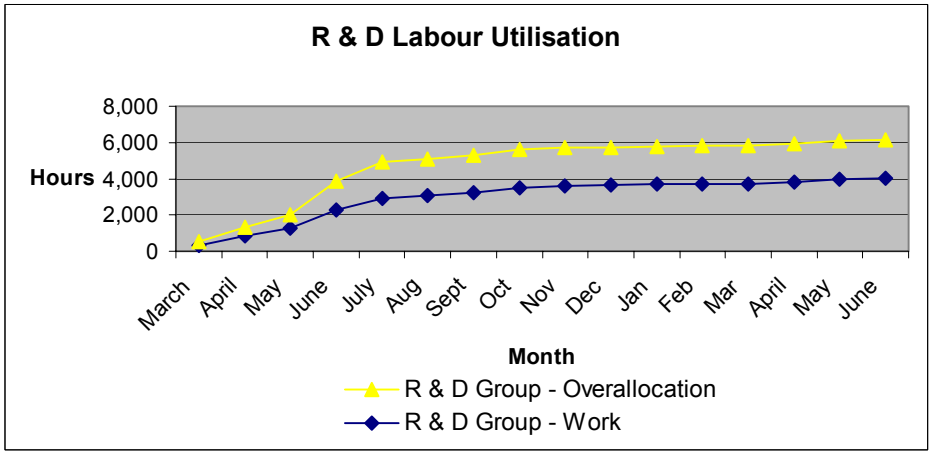
	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June
Packaging Task Force	15	37	280	560	928	1,400	1,904	2,076	2,145	2,167	2,260	2,320	2,320	2,332	2,420	2,440
R & D Group	340	839	1,280	2,280	2,893	3,080	3,248	3,508	3,622	3,632	3,682	3,711	3,724	3,824	4,000	4,040
Corporate Engineering	55	136	280	720	1,180	1,360	1,528	2,244	2,477	2,609	2,882	2,991	3,008	3,184	3,360	3,400
H - P Manufacturing	35	86	160	400	768	800	800	1,028	1,172	1,282	1,502	1,551	1,576	1,904	2,080	2,120
Pack Prod Manuf	30	74	240	440	532	680	848	1,184	1,395	1,517	1,940	2,160	2,160	2,184	2,360	2,400
Maintenance		0	0	0	0	0	0	152	290	460	880	1,000	1,008	1,184	1,360	1,400
Purchasing		0	40	120	212	270	312	320	481	941	1,176	1,258	1,322	1,360	1,360	1,360
Total	**475**	**1,172**	**2,280**	**4,520**	**6,513**	**7,590**	**8,640**	**10,512**	**11,582**	**12,608**	**14,322**	**14,991**	**15,118**	**15,972**	**16,940**	**17,160**

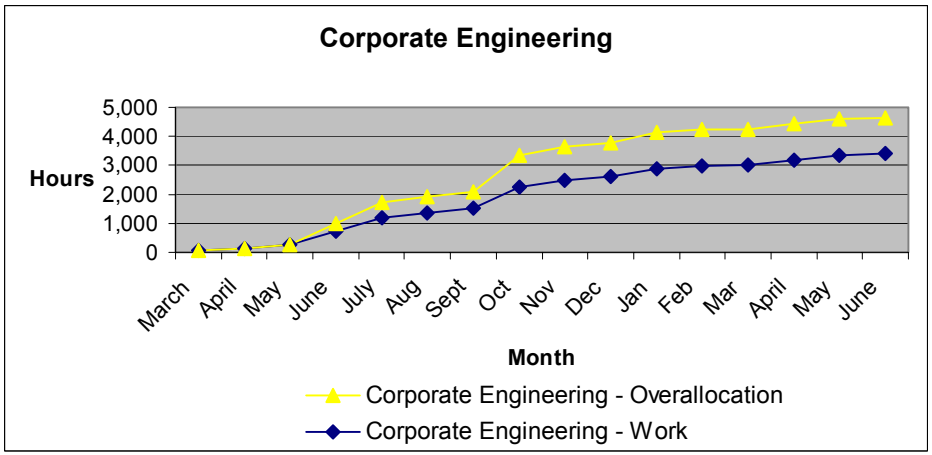
Overallocated

	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June
Packaging Task Force		0	59	179	363	659	995	995	995	995	995	995	995	995	995	995
R & D Group	172	495	752	1,592	2,021	2,032	2,032	2,108	2,108	2,108	2,108	2,108	2,108	2,108	2,108	2,108
Corporate Engineering		0	0	280	556	560	560	1,092	1,157	1,157	1,246	1,246	1,246	1,246	1,246	1,246
H - P Manufacturing		0	0	80	264	264	264	308	308	308	344	344	344	496	496	496
Pack Prod Manuf		0	0	40	40	40	40	192	235	235	474	534	534	534	534	534
Maintenance		0	0	0	0	0	0	0	0	0	236	236	236	236	236	236
Purchasing		0	0	0	0	0	0	0	0	284	335	335	335	335	335	335
Total	**172**	**495**	**811**	**2,171**	**3,244**	**3,555**	**3,891**	**4,695**	**4,803**	**5,088**	**5,739**	**5,799**	**5,799**	**5,951**	**5,951**	**5,951**

Figure 8: Cumulative labour requirement by group by period







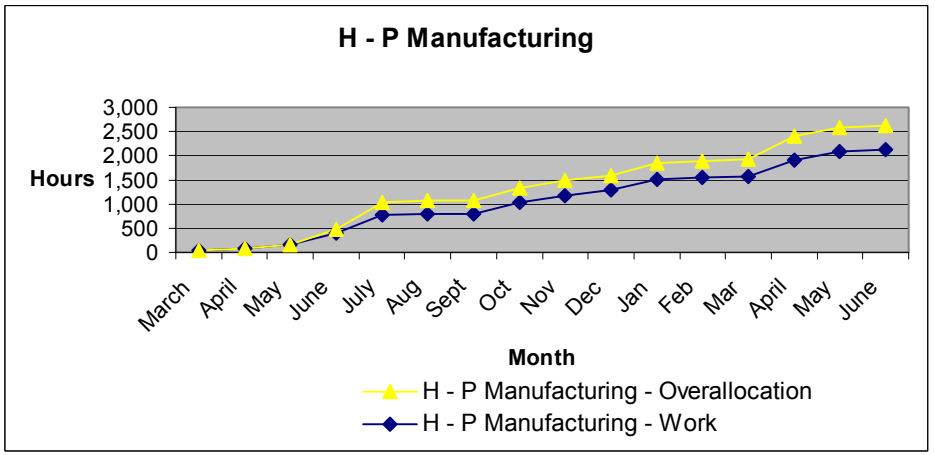
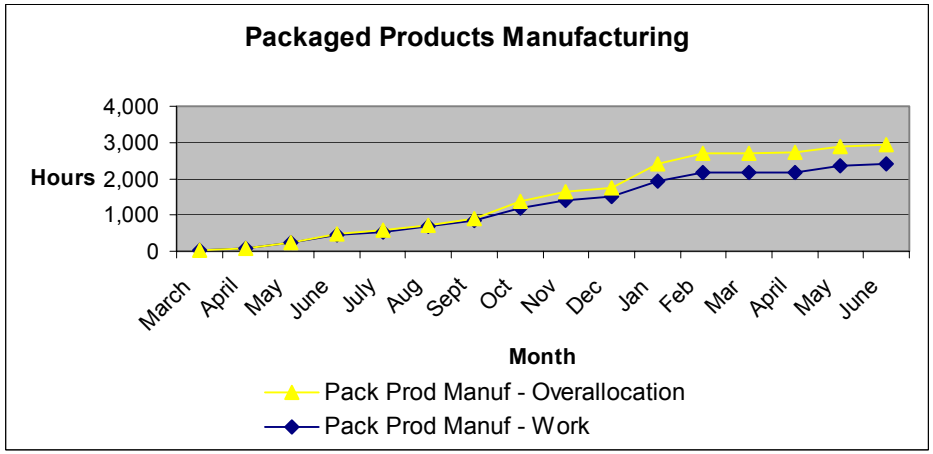
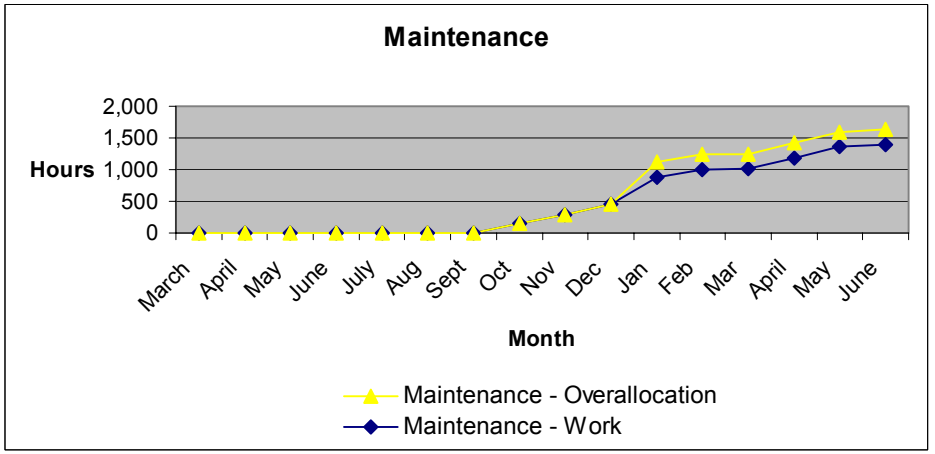
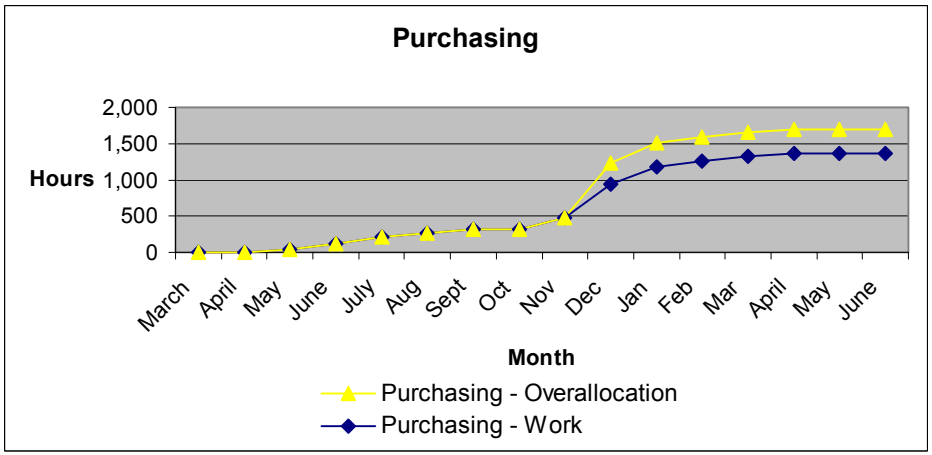


Figure 9: Line Charts for Cumulative Labour Requirements







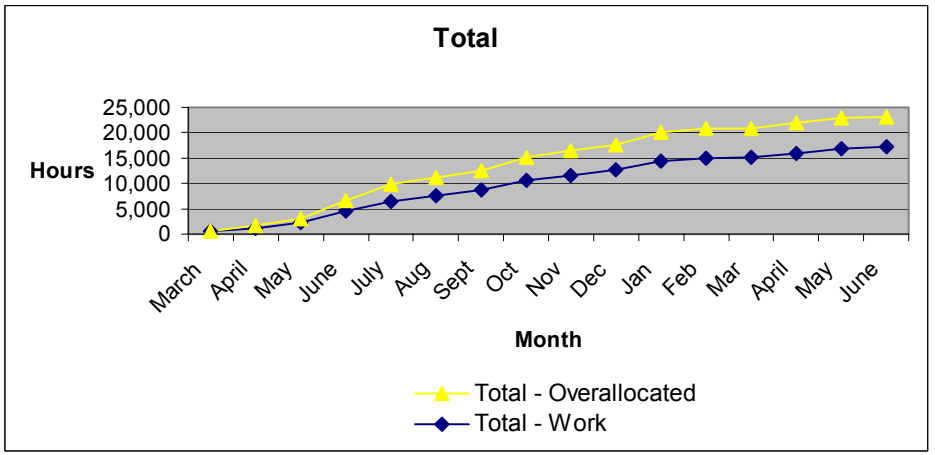


Figure 10: Line Charts for Cumulative Labour Requirements Cont.d

viii. A schedule based on the leveling of labour requirements that could be achieved without lengthening project duration by more than 14% in calendar days.

The objective of the resource leveling exercise is to minimise the period-by-period variations in resource loading. This should mean that the labour hours as well as cost become more evenly distributed across the periods. The initial project length according to my calculations is 325 days. A 14% adjustment means that the length of the project can extend to 370 days. I have therefore revised my initial plan to show the effect after leveling as shown in the attached Microsoft project plans. The plan also shows the move from the original baseline. This information can also be seen by choosing the "Resource Usage" view in the MS Project Plan – adjusted.

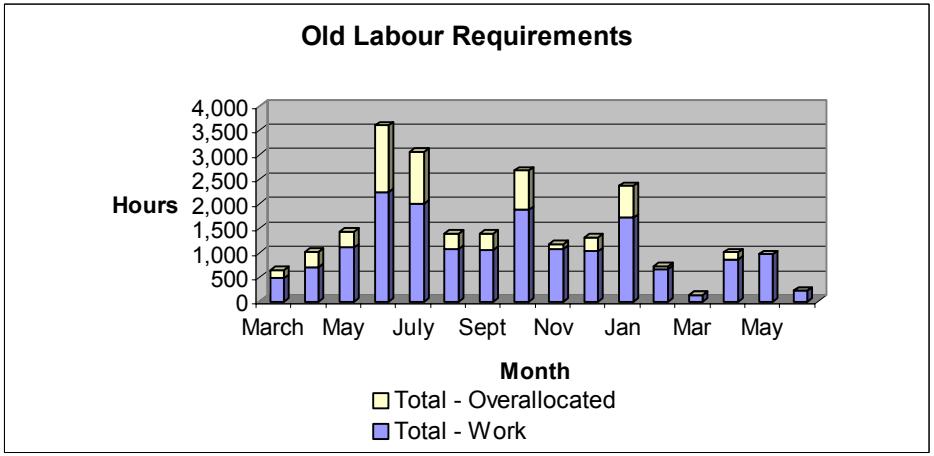
Labour Requirements

	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April
Packaging Task Force	15	22	243	240	368	472	504	136		68	72			18
R & D Group	180	264	196	160	200	373	392	891	504	324	138	9	9	10
Corporate Engineering	15	22	83	80	127	207	224	387	336	692	290	9	9	54
H - P Manufacturing	15	22	43	40	17	29	28	189	336	284	158	9	9	36
Pack Prod Manuf	30	44	166	160	92	148	168	72		272	228			44
Maintenance										136	144			26
Purchasing			40	40	92	58	42	48			56	62	65	386
Total	**255**	**374**	**771**	**720**	**896**	**1,287**	**1,358**	**1,723**	**1,176**	**1,776**	**1,086**	**89**	**93**	**574**

Overallocation

	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April
Packaging Task Force			59	80	184	296	336							
R & D Group	12	88	12		16	197	224	707	336	148				
Corporate Engineering						31	56	203	168	516	106			
H - P Manufacturing								5	168	108				
Pack Prod Manuf										96	44			
Maintenance														
Purchasing														210
Total	**12**	**88**	**71**	**80**	**200**	**524**	**616**	**915**	**672**	**868**	**150**	**0**	**0**	**210**
Variance	243	286	700	640	696	763	742	808	504	908	936	89	93	363

Figure 11: Adjusted Labour Requirements



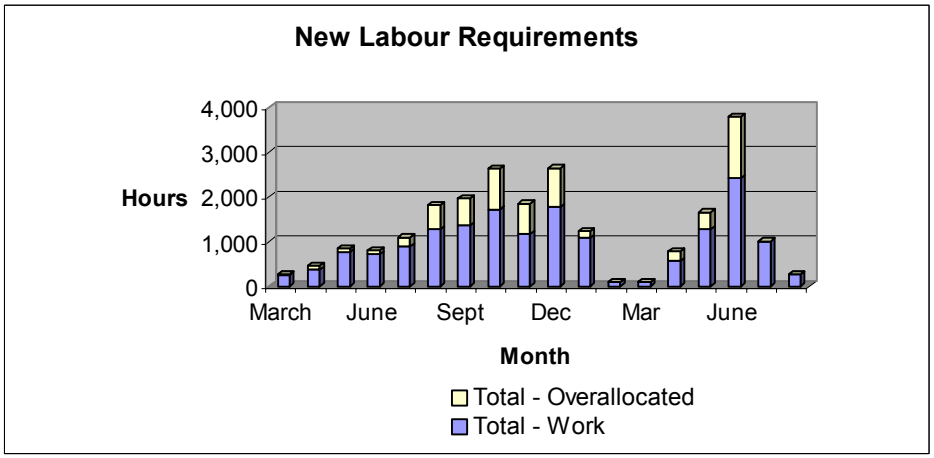


Figure 12: Resource leveling adjusted labour requirements

ix. A cash flow requirement graph for the project when leveled, assuming that charges are uniformly distributed throughout the activity

	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April
Packaging Task Force	225	330	3,645	3,600	5,520	7,080	7,560	2,040		1,020	1,080			270
Material and Other Direct Charges			2,000	2,000	1,642	650	175	33		1,700	4,022	8,889	9,333	101,278
R & D Group	2,700	3,960	2,940	2,400	3,000	5,600	5,880	13,360	7,560	4,860	2,073	133	140	147
Corporate Engineering	225	330	1,245	1,200	1,900	3,100	3,360	5,800	5,040	10,380	4,353	133	140	807
H - P Manufacturing	225	330	645	600	260	440	420	2,840	5,040	4,260	2,373	133	140	537
Pack Prod Manuf	450	660	2,490	2,400	1,380	2,220	2,520	1,080		4,080	3,420			660
Maintenance										2,040	2,160			390
Purchasing			600	600	1,380	870	630	720			833	933	980	5,797
Total Cost	**3,825**	**5,610**	**13,565**	**12,800**	**15,082**	**19,960**	**20,545**	**25,873**	**17,640**	**28,340**	**20,316**	**10,222**	**10,733**	**109,884**
Total Material Cost	**0**	**0**	**2,000**	**2,000**	**1,642**	**650**	**175**	**33**	**0**	**1,700**	**4,022**	**8,889**	**9,333**	**101,278**
Total Labour Cost	**3,825**	**5,610**	**11,565**	**10,800**	**13,440**	**19,310**	**20,370**	**25,840**	**17,640**	**26,640**	**16,293**	**1,333**	**1,400**	**8,607**

	May	June	July	Aug	Total
Packaging Task Force	330	2,160	1,380	360	**36,600**
Material and Other Direct Charges	112,778	15,000			**259,500**
R & D Group	147	2,220	2,760	720	**60,600**
Corporate Engineering	2,937	6,570	2,760	720	**51,000**
H - P Manufacturing	2,607	7,470	2,760	720	**31,800**
Pack Prod Manuf	2,790	8,370	2,760	720	**36,000**
Maintenance	4,710	8,220	2,760	720	**21,000**
Purchasing	5,707	1,350			**20,400**
Total Cost	**132,004**	**51,360**	**15,180**	**3,960**	**516,900**
Total Material Cost	**112,778**	**15,000**	**0**	**0**	**259,500**
Total Labour Cost	**19,227**	**36,360**	**15,180**	**3,960**	**257,400**

Figure 13: Cash Flow Requirements Table

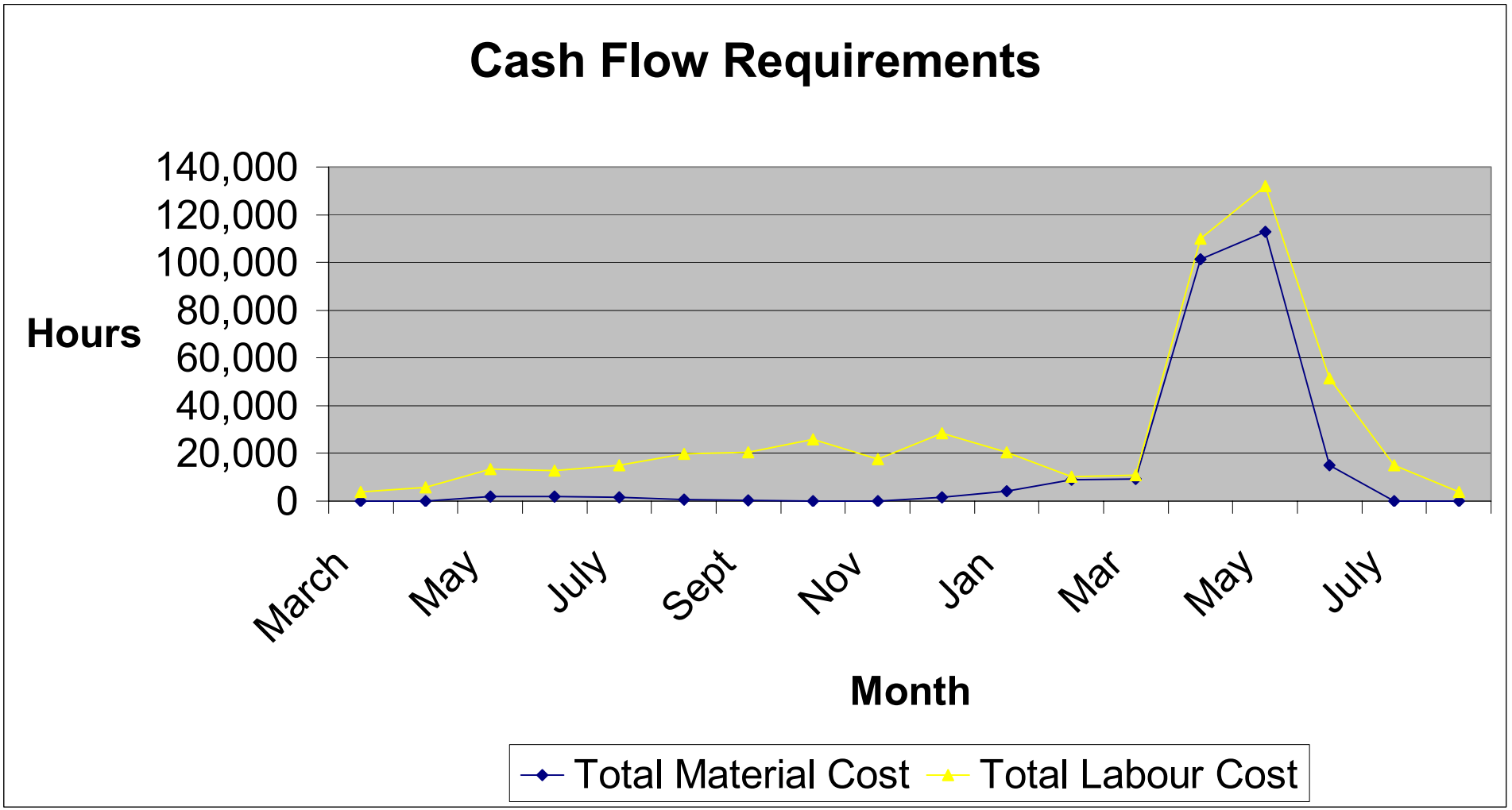


Figure 14: Cash Flow Requirements Graph

Question 2: Analyze the plan for potential problems

The following are potential problems with the plan: -

1. Inappropriate Leadership or Executive Sponsorship

The number one reason for project failure in most instances is lack of executive sponsorship and inappropriate leadership. Having Mike Richards as the Project Leader in my opinion is not appropriate as he is a scientist and probably does not have the appropriate skills. My feeling is that he should be a sub project manager, in other words, act in a supporting role to another project manager and be part of a cross functional team involved in the management of the project.

2. Sequential vs. Parallel running of activities

Activities which may be run in parallel may be run sequentially through bad planning thus tending to increase the overall project completion time.

3. Over allocation or under allocation of Resources

In the initial stages of the project there is heavy over allocation or resources especially for the R& D group. In the later stages there is under utilisation of purchasing department resources.

4. Reliance on outside/third parties

Any delay in regulatory documentation will automatically increase the project timings as there is no slack on this particular activity. The project is also heavily dependant on outside suppliers for equipment requirements and as a result, this too may cause a disruption of the project deadline if the suppliers do no honour orders timeously.

This could also be the case with delays in documentation.

5. Inappropriate costing of labour and materials

The $600 per week costing for all classes of labour is likely to cause an incorrect budget calculation. My feeling is that the costing should include a different rate for each of the different labour groups.

6. Inadequate Project phasing and milestones.

On a long project like this one if activities are not split into phases and milestones with sign-offs for each phase there will be much more room for scope creep.

7. People working in silos

This project is comprised of resources from various different groups within the organisation. Inadequate communication between the groups may also derail the project. For example, manufacturing is highly dependant on an appropriate study being performed of the facilities requirements (activity i). In order for this study to be successful the right level of input is required from R & D. Therefore if R & D does not perform their duties correctly this has a direct impact on manufacturing.

8. Inadequate resource leveling.

There is inadequate leveling which means that there is not a smooth flow of labour costs and resource allocations between the periods.

9. Setting goals too high.

It is quite possible that the goal of producing a 95% yield of product may not be tenable. The impact of this could mean that project running perpetually to get things right. Therefore, this goal needs to be carefully discussed and analyzed to determine the probability of the organisation achieving it.

10. High documentation and regulatory requirements

Although this should contribute to an enhanced product and improved process this may have the impact of slowing the project down.

Question 3: Analyze the plan for opportunities

The following are potential opportunities

1. Existence of Slack

This means that there is room for improvement in terms of resource allocation and potential for project completion time to be reduced.

2. Opportunities for team work, cross skilling and communication across different organisational functions

Being a cross-functional project means that the potential exists for developing cross-skilled employees. This too will assist in the allocation of resources in areas where there are under or over allocations. I believe that for this particular project cross-functional teams should be

built. For example, involvement of manufacturing in the design and development stage of the product will contribute to it's success.

3. Opportunities exist to run tasks in parallel as opposed to running them sequentially.

The obvious impact is an improvement in the project completion time

4. Opportunities exist to develop intellectual property to be developed in the form of formulas etc.

The value being created in developing this product is not purely financial i.e. revenue based. There is an intellectual value being created by design of a formula and increasing the knowledge within the R& D department. Therefore, if the product does not sell well some value has at least been created and this should contribute to the companies success by enabling further product development at a later stage.

Question 4: Should the executive committee approve the plan? Why or why not?

The plan should not be approved until there is an appropriate value proposition or business case which I feel has not been given here. In this particular example a costing has been performed without an adequate look at the benefits of such a project or the projected revenue streams. The benefits can be quantified in more ways than one. There are financial benefits in terms of revenue and then other benefits which add more to the value of the company than the revenues. Examples are research and development efforts as well as improved cross skilling and training of employees which adds to the value of the intellectual property of the company. As difficult as it may be a financial value should be given to all the benefits which may accrue to a project so that it can be established whether it is worthwhile for the project to be considered.

Question 5: What alternatives might the executive committee consider for analysis

The alternatives would be to consider numeric and non-numeric project evaluation models.

Examples of non numeric models are

- The sacred cow
- The operating necessity
- The Competitive necessity
- The product line extension
- Comparative Benefit.

In this particular case I feel a numeric model would be quite suitable as some of the cost information has been provided. What would remain would be to establish the revenue streams from the product as well as any other benefits that may accrue to the company.

Examples of Numeric models are: -

- Payback Period
- Average Rate of return
- Discounted cash flow
- Internal Rate of Return
- Profitability Index.