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Project Man. 412 Assignment 3

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Executive Summary

This report...

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Chapter 1

Project Performance Review

1.1. Introduction

This chapter will

1.2. General Status Review

the status of the project

1.3. Budget Analysis & Review

the budget of the project...

1.4. Schedule Analysis & Review

The project has been divided into twelve milestones, each with associated deliverables. This division can be seen in Tab. ?? below:

INSERT MILESTONE & VARIANCE TABLE (2 tables 1 actual days other EV-PV)

Chapter 2

Resource Strategy & Development Review

2.1. Introduction

This chapter will discuss the resource strategy used in the project, where this strategy succeeded or had to be adapted. It will also review the steps taken to develop resources and the efficacy thereof. Lastly it will use the aforementioned review to make recommendations for future projects.

2.2. Resource Strategy Review

At the start of the project, the team came to a decision on the resource strategy for the project, which prioritized saving cost and time, as the team believed these factors posed the greatest threat to the non-completion of the project. The team confirmed this by generating a prioritized risk register, which identified all possible risks to the project in order of highest to lowest priority. Analyzing the results of the risk register, the team concluded the highest priority risk (being a combination of the most likely risks to occur and the risks with the greatest negative impact on the project) were mostly related to going over the planned budget or the planned completion time for the project. This realisation led to the initial resource strategy.

The strategy was first tested in the ‘demo’ run of Sim4Projects. The general strategy for hiring resources was to attempt to acquire at least one of each type of resource (at different phases in the project), by bidding slightly above the standard amount for the specified resource. In general, the team chose resources with attributes such as high skill level, experience, and work ethic, as it was believed that these would contribute to increased efficiency on tasks. To ensure that high quality resources were bid for that still allowed the project to remain within budget, at the start of the planning process an analysis was performed to determine the highest allowable hiring cost for each resource type to remain within the overall project budget, based on assigning each resource type to the associated task and estimating the duration of each task. Thereafter, when bidding for resources, the bidding amount was maintained below this allowable amount, which allowed the team to select specific resources to satisfy this requirement.

The strategy for bidding on resources for period 1 was relatively basic, the team decided to bid slightly above the standard amount for each required type of resource, hoping to secure at least one Marketing Manager, Junior Marketing Specialist and Engineer, while also bidding on a Project Manager, but for the standard amount (with the expectation that they would likely not be acquired).

The team noticed that the resources with the highest cost were Project Managers, and so the team made a decision not to hire a Project Manager, but to rather hire an additional Engineer to assign to the project management tasks. This was because there were no engineering tasks in the first period, but it was predicted that Engineers would become in high demand from period 2 onwards, and so the team wanted to secure a high quality Engineer for the rest of the periods without losing money in period 1 by not assigning the hired Engineer to any task. It was predicted that this strategy would save cost (as Engineers cost less than Project Managers) and improve efficiency in the future (by having a high quality Engineer available for engineering tasks and to cover other).

NOT COMPLETE?

2.3. Resource Strategy Adaptation Review

The team had a good strategy for bidding and hiring resources, as explained in Sec. 2.3. The team quickly realised that the resources were limited to 9 resources per category, leading to high amounts of competition between the different teams. Thus, it was essential to identify the resources on the critical path and bid on these early. For most part of the project the strategy went according to the project plan. It was not always possible to follow the strategy due to the limited resources, and the team had to deviate from this strategy in order to succeed. The team had to over bid on some resources, as seen in Fig. 2.1, such as the second engineer in order to secure them as their absence would have negatively influenced the critical path.

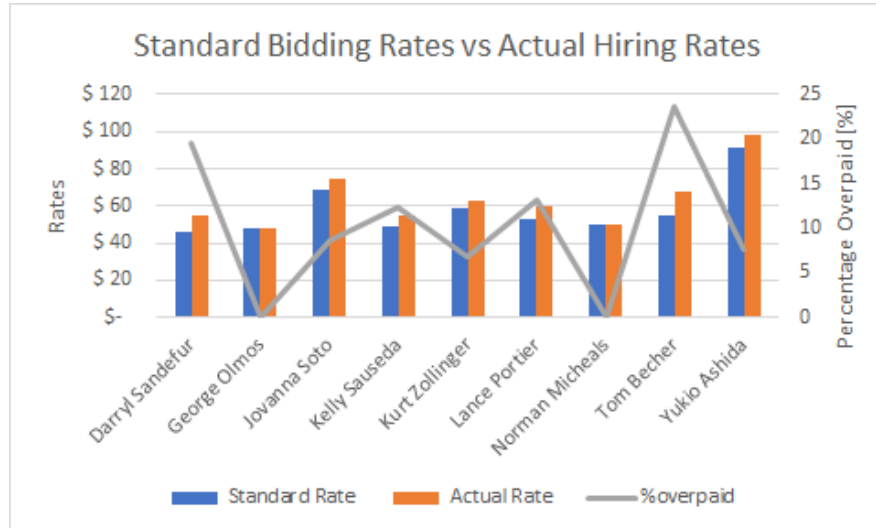


Figure 2.1: Standard and Actual Resource Rates

During the bidding run of period 5, the original strategy was to hire an Operations Specialist. Unfortunately the resource pool did not have any Operation Specialists left. The team had to implement a mitigation plan as the tasks that required an Operations Specialist were on the critical path. This risk and management plan is outlined in C.1.

The team decided to bid on two Junior Marketing Specialists and assign these resources, in parallel, to the tasks that were planned for the Operation Specialist. There was little competition for these resources and thus the decision was made to make the bids on the standard rate for each resource, George Olmos (\$48,00) and Norman Micheals (\$50,00). Both resources were hired at these rates. In period 6 the resources were assigned to the tasks that were meant for the Operation Specialist. The Junior Marketing Specialists were 90% effective in the tasks handed to them.

For period 7, the group decided that Tom Becher, one of the hired Engineers, would be sufficient to finish the task that were initially planned for the Operation Specialist and him. He did not finish within the estimated time, although he was almost 70% efficient. This meant that the task may have been too much for one resource to manage. The critical path was influenced and the overall budget. The manufacturing tasks that were initially planned for the Operation Specialist was divided between the two hired Engineers. They both were effective in the tasks that were handed to them and showed acceptable efficiency.

In this same period, the team had noticed that the two Junior Product Designers had not been fired two phases earlier as planned and had been incurring unallocated resource penalties. This oversight was rectified by removing the two resources as originally planned. The rest of the project, in terms of resources, went as planned. The critical path was definitely influenced by the fact that team could not hire an Operations Specialist. It also had a great effect

on the budget, as more expensive resources had to be assigned to tasks that were budgeted for the operations specialist. The unallocated resource penalties also contributed to the fact that the project ended over budget.

2.4. Resource Development Review

In the project plan compiled for this project, it was decided that no resource training would take place. Therefore it is unknown how much benefit it would have yielded to send resources to training.

2.5. Recommendations for Future Resource Strategy

For future projects a deeper analysis of the resource pool must be done before the start of the project. This will ensure that the team have great understanding of the number and quality of resources available within the resource pool. Tasks must also be identified which require a very specific resource. This will allow the team to decide on a strategy in which they will hire these resource early to ensure they secure the resources.

Chapter 3

Risk Management Review

3.1. Introduction

This chapter will review both the risks that have occurred during this project as well as the effectiveness of the response strategies deployed for these risks.

3.2. Risk Management Strategy Review

Chapter 4

Real Life Group Review

4.1. Introduction

Individual reviews found in appendices

4.2. Lessons Learned

4.3. Theory Application Review

4.4. Multi-Disciplinary Aspect Review

Appendix A

Updated MS Project File

The full updated MS Project sheet can be found on the following pages. Note that the image can be zoomed in to read details of the various tasks.

ID	Task Name	Duration	Start	Finish	Resource Names	Baseline Cost	Baseline Estimated Duration	Actual Cost
1	Market Assessment	29.26 days	Wed 21-03-31	Tue 21-05-11		\$32,844.00	25.5 days	\$37,452.80
2	Evaluate market	6.69 days	Wed 21-03-31	Thu 21-04-08	Kurt Zollinger,Yukio Ashida	\$7,728.00	6 days	\$8,563.20
3	Develop Business opportunity	8.06 days	Thu 21-04-08	Tue 21-04-20	Kurt Zollinger,Yukio Ashida	\$9,016.00	7 days	\$10,316.80
4	Customer preference study	12.13 days	Tue 21-04-20	Fri 21-05-07	Kurt Zollinger,Yukio Ashida	\$13,524.00	10.5 days	\$15,526.40
5	Business evaluation (NPV, etc.)	2.38 days	Fri 21-05-07	Tue 21-05-11	Kurt Zollinger,Yukio Ashida	\$2,576.00	2 days	\$3,046.40
6	Procurement	85.58 days	Wed 21-09-01	Wed 21-12-29		\$14,200.00	65.63 days	\$17,978.32
7	Identify vendors	4.5 days	Wed 21-09-01	Tue 21-09-07	George Olmos,Norman Micheal	\$2,800.00	7 days	\$3,528.00
8	Develop and Issue RFQ	3.88 days	Wed 21-09-01	Wed 21-09-15	George Olmos,Norman Micheal	\$2,400.00	6 days	\$3,041.92
9	Issue sample (production equivalent)	7.5 days	Tue 21-09-21	Fri 21-10-01	Jovanna Soto	\$3,000.00	5 days	\$4,500.00
10	Assess RFQ responses and select vendors	6.06 days	Tue 21-12-21	Wed 21-12-29	Jovanna Soto,Tom Bechur	\$6,000.00	10 days	\$6,908.40
11	Supplier Quality	57.14 days	Fri 21-10-01	Tue 21-12-21		\$16,960.00	38 days	\$22,828.20
12	Perform supplier process capability	17.13 days	Fri 21-10-01	Tue 21-10-26	Tom Bechur	\$6,608.00	7 days	\$9,250.20
13	Approve sample parts	10.13 days	Wed 21-10-27	Wed 21-11-10	Jovanna Soto	\$4,352.00	8 days	\$6,078.00
14	Qualify Supplier	12.5 days	Fri 21-12-03	Tue 21-12-21	Jovanna Soto	\$6,000.00	10 days	\$7,500.00
15	Design	54.89 days	Tue 21-05-11	Tue 21-07-27		\$22,344.00	46.5 days	\$34,021.68
16	Design and development plan	3.88 days	Tue 21-05-11	Mon 21-05-17	Kelly Sauseda,Lance Portier	\$2,352.00	3 days	\$3,585.12
17	Design specs.	13.75 days	Mon 21-05-17	Fri 21-06-04	Kelly Sauseda,Lance Portier	\$8,624.00	11 days	\$12,705.00
18	Identify testing requirements	6.25 days	Fri 21-06-04	Mon 21-06-14	Kelly Sauseda,Lance Portier	\$3,920.00	5 days	\$5,775.00
19	Risk analysis	7.06 days	Mon 21-06-14	Wed 21-06-23	Kelly Sauseda,Lance Portier	\$3,920.00	5 days	\$6,523.44
20	Design labeling	3.25 days	Mon 21-07-19	Thu 21-07-22	Kelly Sauseda,Lance Portier	\$1,960.00	2.5 days	\$3,003.00
21	Approve design	2.63 days	Thu 21-07-22	Tue 21-07-27	Kelly Sauseda,Lance Portier	\$1,568.00	2 days	\$2,430.12
22	Engineering	101.02 days	Tue 21-07-27	Wed 21-12-15		\$31,228.00	72.63 days	\$38,626.64
23	Initial engineering specs.	2.88 days	Tue 21-07-27	Fri 21-07-30	Tom Bechur,Darryl Sandefur	\$2,460.00	2.5 days	\$2,828.16
24	Design verification activities	4.19 days	Mon 21-08-09	Fri 21-08-13	Tom Bechur,Darryl Sandefur	\$3,444.00	3.5 days	\$4,114.58
25	Verification design review	2.31 days	Fri 21-08-13	Tue 21-08-17	Tom Bechur,Darryl Sandefur	\$1,968.00	2 days	\$2,268.42
26	Release pre-production specifications	6 days	Tue 21-08-17	Wed 21-08-25	Tom Bechur,Darryl Sandefur	\$4,920.00	5 days	\$5,892.00
27	Build functional model	11.25 days	Wed 21-09-01	Thu 21-09-16	Tom Bechur,Darryl Sandefur	\$8,856.00	9 days	\$11,047.50
28	Design validation activities	3.06 days	Tue 21-10-26	Tue 21-11-16	Darryl Sandefur,Jovanna Soto	\$2,200.00	5 days	\$3,188.52
29	Validation design review	4.75 days	Fri 21-11-19	Thu 21-11-25	Tom Bechur	\$1,968.00	2 days	\$2,565.00
30	Approve model design	5.13 days	Thu 21-11-25	Fri 21-12-03	Darryl Sandefur	\$1,968.00	2 days	\$2,267.46
31	Design transfer activities	8.25 days	Fri 21-12-03	Wed 21-12-15	Tom Bechur	\$3,444.00	3.5 days	\$4,455.00
32	Engineering Quality	78.65 days	Wed 21-09-01	Mon 21-12-20		\$21,472.00	53.63 days	\$26,158.40
33	Evaluate design specifications	14.88 days	Wed 21-09-01	Tue 21-09-21	Jovanna Soto	\$6,000.00	10 days	\$8,928.00
34	Develop testing protocol for prototype	10.25 days	Tue 21-09-21	Wed 21-10-06	Darryl Sandefur	\$3,520.00	8 days	\$4,530.50
35	Test prototype	12.75 days	Tue 21-10-26	Fri 21-11-12	Darryl Sandefur	\$6,000.00	10 days	\$5,635.50
36	Evaluate results of tests and identify weaknesses	7.38 days	Fri 21-11-19	Tue 21-11-30	Jovanna Soto	\$3,600.00	6 days	\$4,428.00
37	Product release meetings	3.38 days	Wed 21-12-15	Mon 21-12-20	Yukio Ashida	\$2,352.00	3 days	\$2,636.40
38	Manufacturing	68.52 days	Tue 21-10-26	Mon 22-01-31		\$22,600.00	66.5 days	\$35,153.32
39	Process engineering plan	17.63 days	Tue 21-10-26	Fri 21-11-19	Tom Bechur	\$6,000.00	15 days	\$9,520.20
40	Develop production plan	8.25 days	Fri 21-12-03	Wed 21-12-15	Darryl Sandefur	\$2,400.00	6 days	\$3,646.50
41	Develop production control plan	11.13 days	Tue 21-12-21	Wed 22-01-05	Darryl Sandefur	\$3,400.00	8.5 days	\$4,919.46
42	Approve production parts	3.31 days	Wed 22-01-05	Mon 22-01-10	Darryl Sandefur,Tom Bechur	\$2,000.00	5 days	\$3,250.42
43	Contracting for deliveries	5.13 days	Mon 22-01-10	Tue 22-01-18	Darryl Sandefur,Tom Bechur	\$3,200.00	8 days	\$5,037.66
44	Submit production purchase order	1.31 days	Tue 22-01-18	Wed 22-01-19	Darryl Sandefur,Tom Bechur	\$800.00	2 days	\$1,286.42
45	Production pilot test	3.19 days	Wed 22-01-19	Mon 22-01-24	Tom Bechur,Darryl Sandefur	\$2,000.00	5 days	\$3,132.58
46	Debugging production system	2.44 days	Mon 22-01-24	Thu 22-01-27	Darryl Sandefur,Tom Bechur	\$1,600.00	4 days	\$2,396.08
47	Production release	2 days	Thu 22-01-27	Mon 22-01-31	Darryl Sandefur,Tom Bechur	\$1,200.00	3 days	\$1,964.00
48	Commercialization	194.49 days	Tue 21-05-11	Mon 22-02-07		\$49,784.00	164.13 days	\$56,487.80
49	Develop preliminary marketing plan	2.81 days	Tue 21-05-11	Fri 21-05-14	Kurt Zollinger,Yukio Ashida	\$3,220.00	2.5 days	\$3,596.80
50	Develop marketing program	8.44 days	Fri 21-05-14	Wed 21-05-26	Kurt Zollinger,Yukio Ashida	\$9,660.00	7.5 days	\$10,803.20
51	Train sales team	24.88 days	Fri 21-06-04	Thu 21-07-08	Kurt Zollinger	\$11,088.00	22 days	\$12,440.00
52	Advertising campaign	31.38 days	Fri 21-06-04	Mon 21-07-19	Yukio Ashida	\$21,952.00	28 days	\$24,476.40

ID	Task Name	Duration	Start	Finish	Resource Names	Baseline Cost	Baseline Estimated Duration	Actual Cost
53	Show functional model at trade show	3.25 days	Mon 21-11-01	Thu 21-11-04	Yukio Ashida	\$2,352.00	3 days	\$2,535.00
54	Product launch	3.38 days	Wed 22-02-02	Mon 22-02-07	Yukio Ashida	\$1,512.00	3 days	\$2,636.40
55	Project Management	220.37 days	Wed 21-03-31	Wed 22-02-02		\$83,236.00	182.63 days	\$110,998.50
56	Project Management Period 1	18.06 days	Wed 21-03-31	Mon 21-04-26	Tom Bechur,Darryl Sandefur	\$12,300.00	12.5 days	\$17,734.92
57	Project Management Period 2	10.06 days	Tue 21-05-11	Tue 21-05-25	Tom Bechur,Darryl Sandefur	\$6,888.00	7 days	\$9,878.92
58	Project Management Period 3	10.13 days	Fri 21-06-04	Fri 21-06-18	Tom Bechur,Darryl Sandefur	\$6,888.00	7 days	\$9,947.66
59	Project Management Period 4	14.63 days	Mon 21-07-19	Mon 21-08-09	Yukio Ashida	\$10,192.00	13 days	\$11,411.40
60	Project Management Period 5	17 days	Mon 21-08-09	Wed 21-09-01	Yukio Ashida	\$11,760.00	15 days	\$13,260.00
61	Project Management Period 6	10.25 days	Wed 21-09-01	Wed 21-09-15	Yukio Ashida	\$7,056.00	9 days	\$7,995.00
62	Project Management Period 7	12.5 days	Tue 21-09-21	Fri 21-10-08	Yukio Ashida	\$8,624.00	11 days	\$9,750.00
63	Project Management Period 8	3.38 days	Tue 21-10-26	Fri 21-10-29	Yukio Ashida	\$2,352.00	3 days	\$2,636.40
64	Project Management Period 9	4.63 days	Fri 21-11-19	Thu 21-11-25	Yukio Ashida	\$3,136.00	4 days	\$3,611.40
65	Project Management Period 10	5.63 days	Fri 21-12-03	Fri 21-12-10	Yukio Ashida	\$3,920.00	5 days	\$4,391.40
66	Project Management Period 11	14.75 days	Tue 21-12-21	Tue 22-01-11	Yukio Ashida	\$5,720.00	13 days	\$11,505.00
67	Project Management Period 12	11.38 days	Tue 22-01-18	Wed 22-02-02	Yukio Ashida	\$4,400.00	10 days	\$8,876.40
68	Milestones	194.49 days	Tue 21-05-11	Mon 22-02-07		\$0.00	164.13 days	\$15,421.75
69	Milestone 1	0 days	Tue 21-05-11	Tue 21-05-11	Period 1 Managerial Action Cos	\$0.00	0 days	\$40.00
70	Milestone 2	0 days	Fri 21-06-04	Fri 21-06-04	Period 2 Managerial Action Cos	\$0.00	0 days	\$360.00
71	Milestone 3	0 days	Mon 21-07-19	Mon 21-07-19	Period 3 Managerial Action Cos	\$0.00	0 days	\$60.00
72	Milestone 4	0 days	Mon 21-08-09	Mon 21-08-09	Period 4 Managerial Action Cos	\$0.00	0 days	\$663.75
73	Milestone 5	0 days	Wed 21-09-01	Wed 21-09-01	Period 5 Managerial Action Cos	\$0.00	0 days	\$4,851.00
74	Milestone 6	0 days	Tue 21-09-21	Tue 21-09-21	Period 6 Managerial Action Cos	\$0.00	0 days	\$4,638.00
75	Milestone 7	0 days	Tue 21-10-26	Tue 21-10-26	Period 7 Managerial Action Cos	\$0.00	0 days	\$4,449.00
76	Milestone 8	0 days	Fri 21-11-19	Fri 21-11-19	Period 8 Managerial Action Cos	\$0.00	0 days	\$40.00
77	Milestone 9	0 days	Fri 21-12-03	Fri 21-12-03	Period 9 Managerial Action Cos	\$0.00	0 days	\$240.00
78	Milestone 10	0 days	Tue 21-12-21	Tue 21-12-21	Period 10 Managerial Action Cc	\$0.00	0 days	\$40.00
79	Milestone 11	0 days	Tue 22-01-18	Tue 22-01-18	Period 11 Managerial Action Cc	\$0.00	0 days	\$40.00
80	Milestone 12	0 days	Mon 22-02-07	Mon 22-02-07	Period 12 Managerial Action Cc	\$0.00	0 days	\$0.00

Appendix B

Individual Reviews

This appendix contains the individual reviews of all group members.

B.1. Andre David Valkenburg 21670838

This project has been quite different to all of the other projects that I have completed throughout the course of my studies. As a chemical engineering student, the majority of the projects that I have had to complete were focused on understanding complex scientific concepts, analysing and interpreting experimental data and designing process equipment and plants. This project has introduced me to a completely different dimension of engineering.

It was the first time that I have had to work with such a large group of people. All of the students possessed different skills and knowledge. It was interesting, and quite challenging, to work on the project with all of these students. It required good communication skills. Additionally, all of the students had vastly different schedules. It required good communication and planning to work on the project as a team.

It was also the first time that I was formally introduced to the concept of managing a project. I realized that managing a major project from initiation to termination is no easy task. It required extensive planning. The long duration of the project also taught me the importance of keeping all of the information regarding the project and progress organized. I learned that major projects often go astray and that it is the project manager's job to ensure that the team can adapt to these challenges. The project manager can only fulfill his or her duty by consistently reviewing the state of the project and communicating with their team. Furthermore, the project manager is held responsible should the project fail, be delayed or go over budget. This introduced me to another important concept in project management: risk management. I learned the importance of being well prepared for possible risks that might affect the success of a project.

As was expected, I have identified a few mistakes that I have made throughout the project. I realized how easy it is to shift accountability while working on a project with many other individuals. I realized that everybody involved with a project has to keep themselves accountable for their own individual tasks in order for the project to ultimately be a success. I also realized that my communication skills weren't always good enough during meetings. I also did not always manage my time correctly. This caused unnecessary stress to reach certain deadlines that could, at times, have been avoided.

If I could repeat the project, I would be more outspoken about my opinion regarding certain topics. I would manage my time better to ensure that I do not have to rush any tasks to reach deadlines.

I think that our team performed well. We had an acceptable level of communication throughout the duration of the assignment. We could have communicated better. I think we made the assignment a bit harder than it had to be by not always splitting the work evenly. We also did not know each other's strengths and weaknesses. This information could have ensured that each task would be completed by the most capable individual. I think we performed well.

I learned a lot throughout the duration of the assignment. I have definitely learned valuable skills that will help me with future complex projects. I think that the project has also prepared me for industry, where working in teams on major projects is commonplace. I also identified personal weaknesses that I should work on. I will look back at the project as a success.

B.2. Bianca Kendall 21682410

This project was my first experience working in and with a multidisciplinary team, and it was an enlightening experience. I learned that every group member has something of value to add to a discussion or to solve a problem. It was interesting and useful to collaborate as a team on certain tasks, where each team member's different perspectives could clearly be seen, and all applied together to produce a successful outcome. I found it especially interesting to collaborate on identifying risks as a team, as each member identified risks relating to their discipline which would not otherwise have been thought. The other difference working with this team is that it was a larger group than I have worked with in the past. I learned, for myself, that this makes communication slightly more challenging, especially due to the limited meetings that could happen in person (due to COVID precautions). Going forward I would prioritize effective communication prior to each project decision being made or task being started. I would dedicate more time to meetings and hopefully having more meetings in person, as I believe people are able to contribute more to the discussion when in a face-to-face situation.

One of the biggest things I would improve in myself when working in a team such as this one (multidisciplinary and more than 5 members), is to have more communication with individuals in the team. I found that the more people present in meetings/discussions, the fewer contributions to decision-making and brainstorming occurred (myself included). I think in future I could add more value to the project if I could collaborate with individual members of the team on certain tasks. I also think it could be useful for each member in the team to work more closely with another member on a task, as I believe this can be more constructive. I think closely working with individuals in this manner allows one to get to know people in the team better (which I believe can boost team morale) and can then assist with identifying the strengths and weaknesses of each member. Then, by assigning tasks to individual members which suits their strengths and skill sets best, the quality of the task may be optimized. I think in the future it could be especially useful to assign tasks to members that have experience in that type of task from their specific discipline (for example if a member has a lot of past experience in research, it may be useful to assign them to a task that uses this skill).

As well as learning from my experience working in a team, I also learned a lot about project management in practice. Being able to apply the concepts learned in theory, to a simulated 'real-life' project, was very insightful. Learning to use MS Project was especially valuable, and I found it is a very useful tool which I will make use of in the future. I learned the importance of making informed and carefully planned decisions when hiring and assigning resources to tasks. At the beginning of the project, I undervalued the importance of assigning specific resources to the task that most suits their skill sets, because I believed it was more important to prioritize saving time and cost. But, after the first few sets of results we realized the importance of functionality for the longevity of the team and project. I also learned the importance of making good decisions at the beginning of the project, through careful planning, since I found that small mistakes made at the beginning of the project can carry through until the end. At the start of the project, I thought that planning and decision-making was purely intuitive, but after applying the concepts learned in the theory classes to the project, my opinion changed, as I saw the noticeable improvement by using the project management tools that were taught. Lastly, I learned that project management is not an easy duty, it requires a lot of dedicated time, detailed work to be done, consistent effort and adaptability. I realized that a good project manager is vital for the success of the final product.

B.3. Emile Visser 21595240

In retrospect, this project has been different from any I have participated in my academic career, not necessarily with respect to content, but to scope. I have not participated in a project that has required this level of consistent, planned and prolonged co-operation between group members. The long-term nature of this project has taught me valuable lessons along with giving me critical exposure in the project management discipline.

This project has run the gamut of project management, from theory and foundational constructs to praxis and tools. This experience has both given me the opportunity to apply concepts taught in this module and increased my confidence in my ability to use the methods to plan, track and analyse projects. As a simulacrum of a real project, it has given me a framework to tackle future projects in academia and beyond.

Completing a project of this scale has strengthened my resolve when approaching large and daunting assignments, something that will prove useful in the next semester when I am faced with my skripsie. The truth found in the words of Decartes has therefore made itself clear to me: “Divide each difficulty into as many parts as is feasible and necessary to resolve it.”

Another enlightening experience has been that of risk management and mitigation. I have been able to see first-hand that identifying risks early mitigates consequences and ensures rapid management strategy deployment.

The mistakes I made personally during this project also serve as valuable lessons for the future, the foremost being that I did not ensure an adequate time buffer for assignments, leading to unnecessary crunch and stress. I was also too stubborn at times, causing me to waste time on a problem that a fellow group member could have assisted with.

If in the future a similar opportunity presents itself, the things I would do differently would include taking more advantage of the differing skill sets of my group members, given that I have a tendency to shoulder more weight than I can handle. I would also conduct more research into similar projects to better anticipate common pitfalls and mistakes.

Working as a multi-disciplinary group has opened my eyes to the value of differing perspectives and approaches. Different sets of eyes can identify both mistakes and risks that others may be blind to, unconsciously or otherwise. Individuals with different academic backgrounds have different skill sets and perform differently when assigned to different tasks. Being in a group with an entwined outcome also serves as a motivating factor, a valuable asset.

Future projects can leverage these advantages of a multi-disciplinary team by ensuring that team composition is diverse and that the strengths and weaknesses are critically examined to make the team self-reinforcing, each team member’s strength covers another’s weakness. Tasks should also be analysed to determine which discipline would be the most effective when assigned.

B.4. Leon Erasmus 20737661

B.5. Philip Kleynhans 21169713

B.6. Rorisang Lekholoane 21192057

This project has been a real eye opener for me and has forced me on multiple occasions to reflect back on past group projects that I have been part of and think of things that I could have done differently then and the ones that could help me do well in the current project. The project was different in that we had to work in groups made up of students from different engineering departments, it's already challenging enough working with student from the same department because of groups having different people with different personal commitments, working with people from different departments with different timetables does not make working together as a group any easier. I have learnt that I have to improve my communication skills in order to better communicate my ideas to my fellow group mates as I have come to realize the importance of communication between groupmates, not to say I did not realize the significance of good communication in group projects, I did, but this project has magnified that fact for me and I am now tasked to improve my communication skills.

As mentioned that working with students from different departments with different timetables made it difficult to set up meetings at a time convenient for everyone, I have learnt that I need to better manage my time and make allowance for meetings with my group. I did attend the meetings but at the cost of missing my other classes. Working in group environment one has to be open to take advice from group mates in order to improve the quality of one's work, I have learnt to appreciate that my group mates are better at some skills than me and for the good of the team I needed to be willing to take any advice I got and apply it to the satisfaction of the whole group. I was lucky enough to be in a group in which all members were willing to work and were always prepared with good attitudes towards the work.

I have learned a lot from project management as a module and this group has helped me take the theory out of the classroom and apply it in real life with the simulated project and the real-life project. Important skills were learned during the project, from my group mates and from general participation in the project. I have learned that planning ahead is really important and have learned to be a project manager in my life as a student generally, with the modules being the tasks I have to complete.

If I was to work in multi-disciplinary team in the future, one of the things I would do differently is to communicate my ideas more with my groupmates, even though we were restricted by COVID during this project and I feel like communication would help a lot in knowing the skills of each individual in the group and as well as exchanging ideas on how to go about certain tasks in our project, I feel like we were denied the opportunity by the current pandemic that is why in future project I feel like better communication between groupmates is one aspect I would change.

One skill that would be of value to me that I noted on this project is presenting information in a professional manner, anyone can do the calculations but what is even more important is presenting your finding or calculations in clear , concise and professional manner, this is a skill I have lacked for the entire length of my academic career and I am definitely noting how my fellow group mates are doing everything and this is one skill that is of great value for me.

In future projects, communication with my group mates would help to better acknowledge the strengths and weaknesses of my group mates and this will help in assigning tasks that people are more comfortable with and this will improve the performance of the group.

Appendix C

Updated Prioritized Risk Registers

The Updated Prioritized Risk Registers can be found on the following pages. Note that the tables can be zoomed in to read details of the various tasks.

Risk	Area Impacted	Impact	Prob	Score	Consequences	Mitigation	Response
Budget cuts	Financial	High	High	16	Project cost may overrun	Add contingency, ensure adequate overhead	Cut costs, review hiring strategy
Going over budget	Financial	Very high	Medium	15	Project may be terminated	Proper planning	Cut costs
Going over time	Financial	Very High	Medium	15	Project may be terminated	Proper planning	Assign more resources
Covid-19 lockdown restrictions	Resources	Medium	Very High	15	Project tasks may be delayed	Define contingency for operating under lockdown conditions	Operate as far as possible under lockdown conditions
Resources contracting Covid-19	Resources	High	Medium	12	Project may be delayed or risk the health of employees	Ensure correct Covid-19 measures are followed.	Infected or exposed individuals must self-isolate
Project purpose not well defined	Financial	Very High	Low	10	Project may be delayed or terminated	Define proper project objectives	Revise project objectives
Scope creep	Financial	Very High	Low	10	Project may be delayed or going over budget	Proper definition of scope	Deviate as little as possible from baseline plan
Cost estimating errors	Financial	Medium	Medium	9	Project may be delayed.	Ensure estimations are done properly, use more accurate methods	Revise and recalculate estimations
Task duration estimate errors	Financial	Medium	Medium	9	Project may go over budget.	Ensure correct project planning.	Redefine project schedule
Bid unsuccessful	Resources	Medium	medium	9	Project may be delayed.	Redundant and reasonable bids	Reassign resources
Design errors	Technical	Medium	Medium	9	Project delays	Add contingency (on time and money)	Assign more designers
Manufacturing errors	Technical	Medium	Medium	9	Project may be delayed	Add contingency (on time and money)	Assign more operations specialists
Material supply delays	Procurement	High	Low	8	Project may be delayed or go over budget	Vet suppliers	Consider alternative supplier
Resource resignation	Resources	High	Low	8	Project may be delayed	Ensure resources receive an appropriate offer	Offer a better package, hire replacement resource
Resources on critical path unavailable	Resources	High	Low	8	Project Delays, Bench cost for other resources	Redundant resources on critical path	Assign another resource to path, review hiring strategy
Ineffective resource assignment	Resources	Low	High	8	Resource not functional to fullest potential	Hire effective resources for each task	Assign more effective resources
Labour strikes	Resource	Very High	Very Low	8	Resources unavailable, project may be delayed	Ensuring employees work under proper conditions, Contingency fund.	Negotiate with employees.
Resource mismanagement	Financial, Legal	High	Low	8	Project may be delayed	Hire manager with good reputation	Replace manager
Financial mismanagement	Financial, Legal	High	Low	8	Project may be delayed or budget overrun.	Hire manager with good reputation	Replace manager
Resource not available for hire	Resources	Medium	Low	6	Project delay	Good hiring strategy, regular review	Reassign resources
Unplanned work that must be accommodated	Financial	High	Very Low	4	Project may be delayed or go over budget.	Contingency funds.	Hire additional resources.
Team conflict	Resources	Low	Low	4	Task delays, cohesion loss	Pre-emptive Managerial actions	Review planned managerial actions
Resource unavailability due to lockdown restrictions	Resources	Low	Low	4	Project may be delayed.	Proper planning	Assign another resource, review hiring strategy
Sick Leave	Resources	Low	Low	4	Project delay	Proper planning for resources	Assign another resource, review hiring strategy
Maternity Leave	Resources	High	Very Low	4	Project may be delayed	Proper planning for resources	Assign another resource, review hiring strategy
Injury at work	Resources	Medium	Very Low	3	Extra costs, task delays	Proper safety protocols	Have emergency protocols, reassign resources
Unskilled Resource	Resources	Low	Low	2	Task delays	Vet hires	Review training strategy
Managerial actions ineffective	Resources	Very Low	Low	2	Inefficient spending	No mitigation	Review planned managerial actions

Table C.1: Updated Prioritized Internal Risk Register

Risk		Area Impacted	Impact	Prob	Score	Consequences	Mitigation	Response
Community strikes	External	High	High	Medium	12	Delays in project supply chain	No mitigation	Implement remote working facilities
	External	High	High	Medium	12	Fines from the occupational health department	Proper mitigation procedures for plant emissions	Frequent emissions checks on site, pay fine
Structural failure	External	Very high	Very high	Low	10	Product destruction, possible loss of life	Ensure good design, develop emergency response	Investigate failure source
	External	Medium	Medium	Medium	9	Company image ruined and could lead to possible community strikes	No mitigation	Hire public relations officer
False rumours about the project online	External	Medium	Medium	Medium	9	Product no longer in service	Explore avenues of improvement	Attempt refit/improvement or decommission
	External	Low	Low	High	8	Reduced demand for product	Explore alternative product uses	Reduce production
Product becomes obsolete early in lifetime	External	High	High	Low	8	Product might operate as it should.	Thorough project testing	Retract product for further testing
	External	Very high	Very high	Very low	5	Product could be deemed unsafe	Test tank material and product	Redesign product with improvements
Economy shift to greener energy sources	Technical	Very high	Very high	Very low	5	Product failure	Proper design, testing, and implementation. Add safety valves.	Implement emergency shutdown procedure
	External	Very high	Very high	low	5	Product failure		
Product not operating within advertised parameters	Technical	Very high	Very high	Very low	5	Product failure		
	External	Very high	Very high	low	5	Product failure		
Tank deformation or failure	Technical	Very high	Very high	Very low	5	Product failure		
	External	Very high	Very high	low	5	Product failure		
Valve control error	Technical	Very high	Very high	Very low	5	Product failure		
	External	Very high	Very high	low	5	Product failure		
Flammable substance ignition	External	High	High	Low	4	Loss of life or injury.	Follow correct codes and standards for flammable substances.	Implement hazard protocols.
	External	High	High	Low	4	Damage to buildings due to fires.		
Substance spillage into the environment	External	high	high	Very Low	4	Loss of productivity for customers.	Follow correct codes and standards for pressurized storage vessels.	Implement hazard protocols.
	External	high	high	Very Low	4	Environmental impacts.	Ensure vessel testing is done correctly.	
Product sensor failure	External	High	High	Very Low	4	Loss of customer's product.	Add redundant sensors	Send technician to replace sensor
	External	High	High	Very Low	4	Loss of control of product,		
Power loss to product	External	High	High	Very Low	4	possible product failure	Add backup generators, design emergency shutdown	Implement emergency shutdown measures
	External	High	High	Low	4	Loss of control of product,	Proper testing of control system before installation	Add emergency shutdown to the system
Pressure limit control system failure	External	Very high	Very high	Low	4	possible product failure	Proper Maintenance	Frequent checks onsite for possible failures
	External	Low	Low	Low	4	Product failure	Proper user interface debugging.	Issue software patch
Failure to the tank support structure due to fatigue	External	Low	Low	Low	4	Process delayed	No mitigation	Adjust product price
	External	Medium	Medium	Very Low	3	Product manufacturing may go over budget	Check weather report before installation	No response
User interface bugs	External	Very low	Very low	Low	2	Installation delayed		
	External	Very low	Very low	Low	2			
Unfavourable exchange rates	External	Very low	Very low	Low	2			
	External	Very low	Very low	Low	2			
Bad weather delaying product installation	External	Very low	Very low	Low	2			
	External	Very low	Very low	Low	2			

Table C.2: Updated Prioritized External Risk Register

Appendix D

Meeting Minutes

The minutes transcribed at the various meeting preceding this report in given on the following pages.

Minutes of the Meeting 1 of Group I-2

Project Management 412

on 12/04/2021 @13h00-13h30 at Chalkboard

1. Attendance

- Present: Andre (AV), Bianca (BK), Emile (EV), Leon (LE), Rorisang (RL)
- Apologies: Philip (PK)

2. Minutes of the previous meeting

N/A

3. Agenda

The following agenda was approved before the meeting:

- Talk through the Gantt chart as prepared by EV.
- Decide on hires and other bidding decisions.
- Discuss assignment 2 format.
- Discuss strategy and approach for assignment 2.
- Brainstorm fictitious product idea to use for assignment 2.

4. Discussion according to agenda

- A. Organized the same strategy for the marketing phase as was done in the demo run.
- B. Discussed replacing the project manager with a marketing manager or engineer. Decided on testing the effectiveness of an engineer in this role by assigning him/her in parallel for the first phase.
- C. Discussed hiring and assigning two junior product designers to speed up execution, since design tasks are budgeted for \$50 / hour.
- D. Discussed switching the project manager role from the engineer to a marketing manager (after phase 1 when engineer must be assigned to other tasks), since this strategy was effective in the demo.
- E. Discussed bidding strategy regarding bidding additional 50 cents to win a bid over a team who might bid the same amount.
- F. Reviewed budget analysis (as prepared by EV) for bidding decisions.
- G. Discussion about having enough space in budget to hire at 30%-40% above the standard rate.
- H. Discussed organizing a collaboration document (eg. google doc) for the 'rough work'.
- I. Discussed the compiling of the final document on LaTeX (EV volunteered to take on this task).
- J. Decided on approach for assignment 2 to be everyone working collaboratively on every task (on the google doc). There was a

discussion about setting short-term deadlines to ensure even contribution by each team member.

- K. Each group member will brainstorm and contribute ideas for the fictitious product on the google doc.
- L. EV will do baseline and share the repository with mpp file (on GitHub) through the MS teams channel, so that every team member has access to the Gantt chart and its continuous updates.
- M. Final bidding decisions were made and submitted at the meeting for bid 1 (due 12/04/2021 @ 20h00). Bidding decisions were as follows:



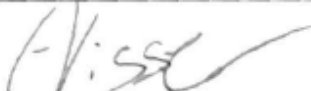
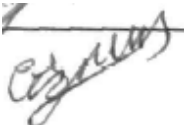

Name	Category	Quality level	Standard rate	Offered rate	Intended assignment for phase 1
Tom Becher	Engineer	Mid-level	\$55	\$67.50	Project management
Kurt Zollinger	Junior Marketing Specialist	High-level	\$59	\$62.50	Market assessment / commercialization
Jane Gavette	Junior Marketing Specialist	Mid-level	\$52	\$60.50	Market assessment / commercialization
Yukio Ashida	Marketing manager	Mid-level	\$91	\$97.50	Market assessment / commercialization
Fulberto Eberstark	Marketing manager	Low-level	\$78	\$91.50	Contingency
Kelly Doe	Project manager	Low-level	\$100	\$100.00	Project management / contingency

5. Next meeting

The next meeting is planned for 12/04/2021 @20h15 on MS Teams, to evaluate whether the first round of bidding was successful or not. If not successful, the meeting will be used to discuss and make bids for round 2.

6. Signatures

A Valkenburg	
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R Lekholoane	
B Kendall	
E Visser	
L Erasmus	
P Kleynhans	

Minutes of the Meeting 2 of Group I-2

Project Management 412

on 12/04/2021 @20h15-20h30 on MS Teams

1. Attendance

- Present: Andre (AV), Bianca (BK), Emile (EV), Leon (LE), Rorisang (RL)
- Apologies: Philip (PK)

2. Minutes of the previous meeting

Refer to Meeting 1 above.

3. Agenda

The following agenda was approved before the meeting:

- Review results of bidding round 1.
- Discuss decisions for bidding round 2.

4. Discussion according to agenda




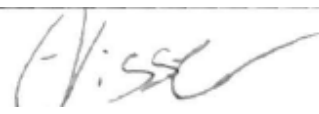
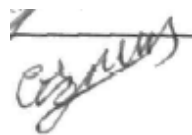
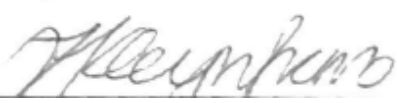
- A. Discussed bidding for a second engineer, to secure for when engineering tasks begin, as we anticipate needing at least two engineers to reduce the workload and time spent.
- B. Discussed whether to bid for another project manager, given that we did not get the previous bid for Kelly Doe (project manager).
- C. Final bidding decisions were made and submitted at the meeting for bid 2 (due 13/04/2021 @ 20h00). Bidding decisions were as follows:

Name	Category	Quality level	Standard rate	Offered rate	Intended assignment for phase 1
Darryl Sandefur	Engineer	Low-level	\$46	\$55.5	
Darryl Mendieta	Project manager	High-level	\$140	\$140	Project management
Shinchi Ishikawa	Project manager	High-level	\$143	\$130	Project management

5. Next meeting

The next meeting is planned for 13/04/2021 @20h15 on MS Teams, to evaluate whether the second round of bidding was successful or not. If not successful, the meeting will be used to discuss and make bids for round 3.

6. Signatures

A Valkenburg	
R Lekholoane	
B Kendall	
E Visser	
L Erasmus	
P Kleynhans	

Minutes of the Meeting 3 of Group I-2

Project Management 412

on 13/04/2021 @20h15-20h30 on MS Teams

1. Attendance

- Present: Andre (AV), Bianca (BK), Emile (EV), Leon (LE), Philip (PK), Rorisang (RL)
- Apologies: N/A

2. Minutes of the previous meeting

Refer to Meeting 2 above.

3. Agenda

The following agenda was approved before the meeting:

- Review results of bidding round 2.
- Discuss decisions for bidding round 3.




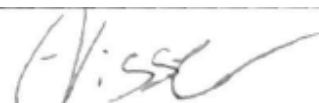
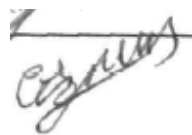
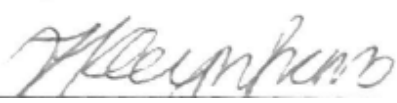
4. Discussion according to agenda

- A. Discussed further actions regarding the project management tasks, given that all bids for a project manager thus far were unsuccessful.
- B. Decided not to bid for another project manager because the only remaining was too high in price per hour.
- C. Decided to fire one Junior Marketing Specialist (Jane Gavette) and one Marketing Manager (Fulberto Eberstark), since they were originally intended as contingencies. These two people were over-bid for, and were thus chosen to be fired.
- D. Final bidding and firing decisions were made and executed at the meeting (due 14/04/2021 @ 20h00).
- E. The fictitious product was discussed and decided upon. To incorporate all engineering disciplines of the group members, the decision was made for the product to be a pressure vessel for industrial processes (with sensors).
- F. The whole team was tasked with contributing to the google doc for assignment 2, over the next few days.

5. Next meeting

The next meeting is planned for 16/04/2021 @09h00 on MS Teams, to check on the progress for assignment 2.

6. Signatures

A Valkenburg	
R Lekholoane	
B Kendall	
E Visser	
L Erasmus	
P Kleynhans	

Minutes of the Meeting 4 of Group I-2

Project Management 412

on 16/04/2021 @09h00-09h30 on MS Teams

1. Attendance

- Present: Andre (AV), Bianca (BK), Emile (EV), Leon (LE), Philip (PK), Rorisang (RL)
- Apologies: N/A

2. Minutes of the previous meeting

Refer to Meeting 3 above.

3. Agenda

The following agenda was approved before the meeting:

- Review results of run 1 and the bids made:

Name	Category	Quality level	Standard rate	Offered rate	Intended assignment for phase 1
Kelly Sauseda	Junior Product Designer	Mid-level	\$49	\$55.25	Product design
Raimund Vogel	Junior Product Designer	Low-level	\$42	\$50.25	Contingency
Douglas Rutten	Junior Product Designer	Low-level	\$44	\$52.25	Contingency
Lance Portier	Junior Product Designer	Mid-level	\$53	\$60.25	Product design

- Review progress for assignment 2.
- Plan a date and time for a special risk planning and response meeting.

4. Discussion according to agenda


- A. Decided to fire 2 out of the 4 junior product managers that were successfully hired. The 2 lowest costs were chosen to be fired.
- B. Reviewed the results of phase 1. The team had 100% on cost and time, but 0% on functionality and stakeholders. This was due to the decision to not hire a project manager (to save cost) and instead assign 2 engineers to the project management task for phase 1. The team decided to stick to this decision, with predictions that it will improve later.

- C. Discussed keeping the 2 junior product designers for phase 2 (as their tasks are on the critical path), but spoke about firing one of them before the next phase because there is a lot of slack and so we might not require 2 people on the task.
- D. Walked through the assignment 2 doc together, discussing each section (what still needs to be added, what can be improved) and ensuring each group member was on track with the sections they were charged with doing.
- E. The main task the team is concerned with is the project risk analysis section, and so it was decided that the whole group will work on this.
- F. The team will all read over the content for risk management in preparation for the special risk planning and response meeting.

5. Next meeting

The next meeting is planned for 17/04/2021 @10h00 on MS Teams, to have the special risk planning and response meeting.

6. Signatures

A Valkenburg	
R Lekholoane	
B Kendall	
E Visser	
L Erasmus	
P Kleynhans	

Minutes of the Meeting 5 (Risk Planning and Response meeting) of Group I-2

Project Management 412

on 17/04/2021 @10h00-12h00 on MS Teams

1. Attendance

- Present: Andre (AV), Bianca (BK), Emile (EV), Leon (LE), Philip (PK), Rorisang (RL)
- Apologies: N/A

2. Minutes of the previous meeting

Refer to Meeting 4 above.

3. Agenda

The following agenda was approved before the meeting:

- Develop an appropriate technique to identify risks.
- Collaboratively identify risks. Includes each person identifying risks associated with their discipline of engineering.
- Develop a risk assessment technique (and a level of risk for each identified risk).
- Develop a prioritized risk register including detailed discussion on the priority risks.
- Compile risk management plan.

4. Discussion according to agenda




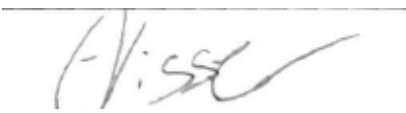
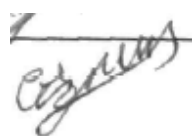
- a. Designed a technique for quantifying risks using a matrix comprising the probability (score out of 5) and impact (score out of 5).
- b. Collaboratively identified risks to the project as a whole (both internal and external) by describing the risk, area impacted, impact score, probability score, consequences, mitigation and response for each.
- c. AV identified the following risks associated with his chemical engineering discipline:
 - i. Flammable substances igniting
 - ii. Substances spilling into the environment
- d. EV identified the following risks associated with his electrical engineering discipline:
 - i. The product's sensors failing
 - ii. Power loss to the product

- e. RL and LE identified the following risks associated with their mechatronic disciplines:
 - i. The pressure limit control system failing
 - ii. Valve control having an error/failing
- f. BK identified the following risk associated with her mechanical engineering discipline:
 - i. Tank deformation or failure
- g. PK identified the following risk associated with his civil engineering discipline:
 - i. Structural failure
 - ii. Tank support structure failing due to fatigue

5. Next meeting

The next meeting is planned for 18/04/2021 @10h00 on MS teams, to review progress.

6. Signatures

A Valkenburg	
R Lekholoane	
B Kendall	
E Visser	
L Erasmus	
P Kleynhans	