TAMPERE UNIVERSITY OF TECHNOLOGY

TTA-71016 Project Management
2nd Assignment Group 17

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Task 1: Earned-value calculation

1.1

Week	1	2	3	4	5	6	7
System planning	1920	6144	9600	15360	15360	15360	15360
Cooperation with stakeholders	1370	4110	4110	4795	8220	11645	13700
control system	0	0	0	1555	3887.5	6997.5	11663
Production lines	0	0	0	0	753	1882.5	3765
installation	0	0	0	0	525	1575	3150
training, documentation and implementation	0	0	0	0	0	0	0
Project management	750	1500	2250	3000	3750	4500	5250
Administration	3800	7600	11400	15200	19000	22800	26600
Components	0	0	0	0	0	0	0
Rents	0	0	0	0	0	0	0
Other costs	556.96	1113.9	1670.9	2227.8	2784.8	3341.8	3898.7
TOTAL:	8397	20468	29031	42138	54280	68102	83386

Figure 1: Budget Cost

According to the table 1-budget costs, we could get the total budget for each task. Then in terms of level of completeness, we could get the values which is shown in the table 2.

Weeks	Budgeted costs	Cumulative BCWS	Actual costs	Cumulative ACWP	Cumulative BCWP
0	0	0	0	0	0
1	9340	9340	8380	8380	8397
2	9740	19080	14770	23150	20468
3	10740	29820	12050	35200	29031
4	8500	38320	14600	49800	42138
5	11230	49550	12600	62400	54280
6	12720	62270	20750	83150	68102
7	11290	73560	17100	100250	83386
8	9690	83250			
9	35980	119230			
10	14410	133640			
11	12840	146480			
12	17320	163800			
13	8730	172530			
14	9830	182360			
15	10390	192750			
16	6190	198940			

Figure 2: cumulative statistics

From the data calculated from the tables provided, we could make the table as shown above, which contains the data for cumulative BCWS, ACWP, BCWP. Then the cumulative diagrams could be drawn easily (figure 1) shown below.

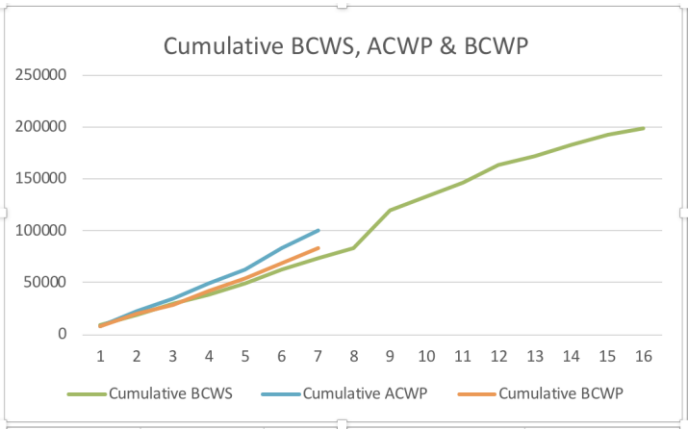

Figure 3: Cumulative figure

1.2

At the stage of week 7 in project, the cumulative BCWS is 73560 Euros, the cumulative ACWP is 100250 Euros

and the cumulative BCWP is 83386 Euros.

Summary of indexes in earned value calculations

Index	Formula	Calculation
CV=cost variance	CV=BCWP-ACWP	83386-100250=-16864
CVI=cost variance index	CVI=100%*CV/BCWP	100%*(-16864)/83386=-20.22%
CPI=cost performance index	CPI=BCWP/ACWP	83386/100250=83.2%
SV=schedule variance	SV=BCWP-BCWS	83396-73560=9826
SVI=schedule variance index	SVI=100%*SV/BCWP	9826/8386*100%=11.8%
SPI=schedule performance index	SPI=BCWP/BCWS	83386/73560=1.13

Table 1

The CV is less than zero, it means the performed work has cost more than planned. The CPI is less than 1, cost performance is lower than planned. The SV is great than 0 which means that the performed work is advanced than the planned schedule. And the SPI is also great than 1, it means that, schedule performance is higher than planned. Therefore, in this project we are ahead of the schedule and over-budgeted.

Task 2: Forecasting the project's completion

2.1

Budget at completion (Total budget) (BAC)	198940
Budgeted cost of Work Scheduled (BCWS)	73560
Actual Cost of Work Performed (ACWP)	100250
Difference (BCWS - ACWP)	-26690

Table 2

According to the formula in the slide: Forecasted budget at completion = ACWP + (BAC-BCWP) €, we could get that the actual costs 100,250 Euros. Because the rest of the project will be as planned, so the budget won't change and plus the software test fee, the total money is that 100,250 +(198940-83386) +4,000=219804 Euros.
Total time: 7/1.13+9=15.19. The first 7 weeks we are ahead of the plan, but the rest of the project progresses with same pace.

2.2

The profit margin is 14%, therefore the price should be 219804/ (1-0.14) =255,586 Euros.
The profitability of 250,000 is 12.1%. therefore, the profit margin is less if we don't raise up the price to 255,586 Euros.

Task 3: Effect of a change

An extra work of setting an automation system is added with the scheduled project so the extra cost calculation is given below:

Cost of Extra week after week 9	
Administrative costs	3800
Project manager's salary	500*5*0.3=750
employee's salary*	340*4=1360 1360*5=6800(1 week)
Trainee's salary	0
Consultation costs	800*5=4000
Other not-specified costs	590
Total	15940

Table 3

- * 2 Mechanical Engineers, 1 Quality Manager and 1 Product Manager

New Budge Cost including the extra cost:

Old Cumulative Budget Cost = 219804 Euros
Increase in cost due to extra work =15940 Euros
New Cumulative Budget Cost = (219804+15940) =235,744 Euros.

In order to make 14% profit margin the cost the project must be sold is **235,744/ (1-0.14) =274,121 Euros**.

The price charged by the company for extra work is **(274121-255,586) =18,535 Euros.**
If during the work any mishap happens like employee's get injured the customer, extra hours of work must be taken into consideration as extra expenses so the company may charge 20,000 Euros from the customer (20000-18535=1465 Euros) as extra unaccounted expenses.

Task 4: Risks related to the change

4.1 Magnitude of total risk

	Effect on the project's profit (EUR)				
Risk	Min	Most likely	Max	Mean	Deviation
Utilizing the new know-how in other projects	0	10000	17000	9500	2833,333
Integrating the change into the original project	-28000	0	5000	-3833,33	-3833,33
The lack of technical know-how related to the change	-19000	-8000	0	-8500	-3166,67
Possibilities for new after-sales services	0	10000	40000	13333,33	6666,667
Uncertainty related to customer requirements	-25000	-4000	0	-6833,33	-4166,67
Sum	-72000	8000	62000	3666,667	9723,968

Table 5

The mean value of the risk is 3666,67 EUR and the standard deviation is 9723,97 EUR. As the mean value is positive the changes are most likely positive for the project. The mean magnitude of risk was calculated by the sum of means from each part and the deviation magnitude was calculated by:

$$S = \sqrt{\sum_{1}^{5} S_i^2}$$

as instructed in the lecture slides.

4.2 Significance of risk.

The significance of the risk is quite small when comparing to the original project value (250000 EUR). The expected mean value is 1,47% over the original, bringing more profit than the original project. When taking the standard deviation into account the effect of the changes is between -2,42% and +5,36% of the original project value. This means that the negative risk is quite small, and the positive risk is larger, but not huge.

	Mean	Negative	Positive
Risk	3666,66667	-6057,3	13390,63
Significance (%)	1,46666667	-2,42292	5,356254

Table 6

4.3 Risk management

The risks can be managed by analyzing each of them carefully and then acting according to the analysis. In case of utilizing the new know-how in other projects, the better the documentation of the new parts are, the better they can be used in other projects and the knowledge can be used to update the procedure lists that already exist (check and question lists). Integrating the change should be monitored carefully so that the changes don't affect the original plans too much, for example that the use of personnel and other resources don't overlap with other parts of the project and cause other problems. The lack of technical know-how related to the change could be managed by first mapping the available know-how within the company and how more of it could be obtained and what would it require. This should be then compared to the required know-how and acted accordingly. The know-how could be thought or bought from an outside source depending on the price and possible future uses. Possibilities for new after-sales services should be mapped thoroughly and pitched to the client to see which would be profitable to us and which the client would want.

Uncertainty related to customer requirements should be handled through discussion with the client and making sure the requirements are well documented, so the scope stays within limits and if there are problems in the future, it can be shown that the decided requirements were met.

There are also other risks that come with the change. The availability of personnel and extra work given to the people can affect the timeline and cost of the project as the personnel might already be assigned to some other projects. Getting the required extra resources from the company (within reasonable time frame). The availability and cost of the suppliers and subcontractors on short notice. How well the communication and information transfer works between the groups, so everyone is aware how the changes affect each part of the project and how

they must adapt into it (timeline changes, workloads etc.). It is important to avoid overlapping and possible time sinks caused by not having everything done when it is supposed to be, or have some parts are left undone as no-one thinks it is their job. Last thing to consider is how any arising new problems will be solved without prior experience.

Task 5: Project learning and post-project evaluation

5.1

In figures (see appendix), we can see that the reports of within our group were quite similar to each other. The main differences in opinions were in communications and how we worked together. This was due to two reasons. First two of the member knew each other and one didn't and the third person who didn't had to work mainly from afar whereas the two were able to work together. This means that the two communicated together more face-to-face but had to communicate with the third mostly through electronic devices. The third person also had a week-long trip which made working together and effective communication even harder. This can also be seen in decision making as the one member who was away had to make many decisions himself, but the others could do it collectively. We all did give advice and feedback to each other but some of us hoped that it could have been done more. Other than the third members trip, exams and other deadlines also affected the schedules and available time negatively, so we couldn't do as much as we hoped.

Overall our group members did their parts in scheduled time and got the work done as promised. The biggest problems rose from the long distance working as we couldn't discuss the problems that arose between each part effectively, which cost us extra work and lost time in the first assignment.

As advice for future groups, you should check the assignments thoroughly before splitting the work as different parts take very different amounts of work. You should also have meeting to discuss the different parts so that there won't be any misunderstandings that might cost you lot of time and work. And as always start the work as soon as possible, so that you have enough time to polish the final report.

5.2 Example of project failure: Denver International Airport Baggage Handling System

The Denver International Airport Baggage Handling System was supposed to be world's largest automated airport baggage handling system, which was supposed to replace the normal manual tug and trolley system and allow aircraft turnaround to happen in 30 min. It was supposed to be a system that covered all 3 concourses at the airport. Instead it ended being a huge failure. It took 16 months over the estimated time to complete costing the city of Denver $1.1M dollars per day. The cost consisted of maintaining the empty airport and the interests of constructions loans. Not only was the project delayed it only covered 1 concourse, used by single airline, instead of all 3 and even it was shut down later as its maintenance cost was higher than the manual tug and trolley system. [1]

The failure was due to several factors. One of the main factors was underestimating the complexity of the system and the required time to implement it. There was already a similar but much smaller and simpler system in use in Munich which had taken 2 years to build. As the Denver system was much larger and more complex, but they still stayed in the same 2-year schedule. As the time was underestimated so was the effort. The system covered all concourses of the airport, so it became the critical pathway which prevented all other functions in the airport. [1]

Originally the automated system was supposed be only for United Airlines. The project management team wanted the integrated system to cover the entire airport and took charge of the project. The change was made too late to considering how much the complexity would increase by adding the additional systems to the whole airport instead of just one concordance and with no extra time to do it. Another problem was the decision to make it into one big integrated system instead of three smaller systems. This increased the complexity even more [1]

Another failure was to not listen feedback and change the project according to it. The project management team

was told several times by several different sources that it couldn't be done in two years (Breier Neidle Patrone Associates, Bids from companies to make the system, experts from Munich airport), but they decided to keep the original timeline. [1]

With the rigid schedule, scope and budget the risk was very high as they had no room for changes. They also excluded their key stakeholders like the other airlines from the discussions on the used system. Later they gave in to the stakeholders demands on changing parts of the system that caused even more troubles in a project that was already in trouble. [1]

There was also lack of reviews during the process. When the Mayor of Denver finally intervened and commissioned a manual trolley system to be built the project was already 6 months behind and the airport had missed 4 opening dates. Through reviews the problems should have been noticed sooner and the changes should have been made much earlier. [1]

Overall many things caused the failure, but it all stem from the failure to recognize the scope of the project and being over ambitious while ignoring the warning of experts and contractors. This was likely because the people making the decisions lacked the required knowledge to understand the complexity and scope of the project and seemed to think that increasing the automation to several places instead of 1 would not increase the workload time and resource requirements significantly. They might have considered that its simply doing the same thing 3 times instead of creating a much more complex system.

Example of successful project: Tampere Tunnel

The Tampere "Rantatunneli" tunnel is a successful project that was finished 6 months ahead of schedule and within budget. It also reached its other goals in quality and work safety. [2]

There were several reasons to the success of this project. First it managed to secure its funding from the city of Tampere (67%) and Liikennevirasto (33%) [2]. Most of the success in the project was attributed to the alliance model in which the project was executed. In alliance model all the choices, risks, gains and failures are shared. [2][3] This gives the advantage that the contractors are interested in the entire project and not just their small part as all members of the alliance benefit from the success of the project.

What gives alliance model an advantage compared to other models in multi contractor projects is that all the participants are involved in the process from the beginning, this includes the client. All the participants have their say already in the development phase. The project team includes members from the contractors and the client. They together decide how the project is done and how the risks and benefits are divided and what the cost aim of the project is. The contract is formed between all the members not between the client and each individual contractor. The parties also form a singular organization that makes all the decisions, so all the partner groups get to affect the decision. The parties also share the risks. [3]

The creation of this unified organization brings several advantages to the project. As all parties are involved, it is in the best interest for each group to help the whole project instead of caring only about their This can help to solve problems that might delay the project. Also, the information is shared more efficiently and the requirements and needs of the contractors are easier to fill and scheduling can be made more smoothly when all involved parties work together. For example, in the tunnel there is limited space to use and several contractors might need it for something. In alliance where all parties are making the decisions these can be made easier instead of different parties blocking each other while trying to do their work. Also, if problems arise it is faster to react to them when all parties are involved.

In this project the alliance model seemed to work and bring the required benefits to make the project a success, which can be seen from the result like being chosen the project of the year 2017 [2]. The combined knowledge of each party was able find solutions to problems that normally face building projects. At least in this case having

many different parties in deciding group didn’t cause problems which could have been possible.
own part.

References:

[1] Calleam Consulting (2008), Case Study – Denver International Airport Baggage Handling System – An illustration of ineffectual decision making.
[2] Projektitoiminta lehti 3/2017 [www] available at https://indd.adobe.com/view/f92cb040-66d3-4acf-9a1b-4cc84fe1bb3e (accessed 12.4.2018)
[3] Pertti Lahdenperä (2015) Allianssiurakan arvontuoton mekanismit: Johdon sosiaalinen kognitiivinen kartta (available at) http://urn.fi/URN:ISBN:978-951-38-8389-8 accessed (12.4.2018)

Appendix

	1	2	3	4	5	
Schedules and distribution of work						
1. We scheduled assignment work				2	1	very poorly --> very well
2. How well did you stay in schedule?				3		very poorly --> very well
3. We planned the distribution of work between group members					3	totally agree --> totally disagree
4. How did the distribution of work work?			2	1		very poorly --> very well
5. When solving the assignments, leadership was				2	1	centalized --> distributed
Ways of working						
6. When solving the assignments, decision making was mostly		1	1	1		individual --> collective
7. Our group's ways of working could be described as discussive		1	1	1		totally agree --> totally disagree
8. Our ways of working were functional/effective				3		totally agree --> totally disagree
9. How would you describe the solving of the assignments?			1	1	1	individual --> collective
10. Our group meetings were too long	1	2				totally agree --> totally disagree
Communication						
11. We shared lots of knowledge between the group members		2		1		totally agree --> totally disagree
12. Communication between the group members was smooth and easy			2	1		totally agree --> totally disagree
13. Within the group we communicated mostly	2				1	electronic channels --> face-to-face
Group dynamics						
14. We were able to solve conflict situations well				2	1	totally agree --> totally disagree
15. Our group had an inspiring spirit				3		totally agree --> totally disagree
16. I knew my group members beforehand	1		2			totally agree --> totally disagree
17. Our group was motivated to solve the assignments well				3		totally agree --> totally disagree
18. Our team work improved during the assignments				2	1	totally agree --> totally disagree
19. Team work improved my motivation to work hard				3		totally agree --> totally disagree
Results						
20. Team work in total went well			2	1		totally agree --> totally disagree
21. External factors affected our work in a negative way			1	1	1	totally agree --> totally disagree
22. Our project management knowledge was adequate to solve the assignments			1	2		totally agree --> totally disagree
23. I'm satisfied with our group's achievements			2	1		totally agree --> totally disagree

Figure.4

Schedules and distribution of work

1. We scheduled assignment work
Very poorly 1 2 3 **4** 5 Very well

2. How well did you stay in schedule?
Very poorly 1 2 3 **4** 5 Very well

3. We planned the distribution of work between group members
Totally disagree 1 2 3 4 **5** Totally agree

4. How did the distribution of work work?
Very poorly 1 2 **3** 4 5 Very well

5. When solving the assignments, leadership was
Centralized 1 2 3 4 **5** Distributed

Ways of working

6. When solving the assignments, decision making was mostly
Individual 1 **2** 3 4 5 Collective

7. Our group's ways of working could be described as discussive
Totally disagree 1 **2** 3 4 5 Totally agree

8. Our ways of working were functional/effective
Totally disagree 1 2 3 **4** 5 Totally agree

9. How would you describe the solving of the assignments?
Individual 1 2 **3** 4 5 Collective

10. Our group meetings were too long
Totally disagree **1** 2 3 4 5 Totally agree

Group dynamics

14. We were able to solve conflict situations well
Totally disagree 1 2 3 **4** 5 Totally agree

15. Our group had an inspiring spirit
Totally disagree 1 2 3 **4** 5 Totally agree

16. I knew my group members beforehand
Totally disagree **1** 2 3 4 5 Totally agree

17. Our group was motivated to solve the assignments well
Totally disagree 1 2 3 **4** 5 Totally agree

18. Our team work improved during the assignments
Totally disagree 1 2 3 **4** 5 Totally agree

19. Team work improved my motivation to work hard
Totally disagree 1 2 3 **4** 5 Totally agree

Results

20. Team work in total went well
Totally disagree 1 2 **3** 4 5 Totally agree

21. External factors affected our work in a negative way
Totally disagree 1 2 3 4 **5** Totally agree

22. Our project management knowledge was adequate to solve the assignments
Totally disagree 1 2 3 **4** 5 Totally agree

23. I'm satisfied with our group's achievements
Totally disagree 1 2 **3** 4 5 Totally agree

Communication

11. We shared lots of knowledge between the group members

Totally disagree 1 **2** 3 4 5 Totally agree

12. Communication between the group members was smooth and easy
Totally disagree 1 2 **3** 4 5 Totally agree

13. Within the group we communicated mostly
Using electronic channels **1** 2 3 4 5 Face-to-face

Other comments about your team work

All of did what we were supposed to, and we could keep the schedule up. Unfortunately, my trip during the first assignment caused some communication and resolving the assignment. Because of this the final version wasn't as good as we knew we could have made it. Otherwise our group work was good.

Figure .5

Schedules and distribution of work

1. We scheduled assignment work

Very poorly 1 2 3 4 5 Very well

2. How well did you stay in schedule?

Very poorly 1 2 3 4 5 Very well

3. We planned the distribution of work between group members

Totally disagree 1 2 3 4 5 Totally agree

4. How did the distribution of work work?

Very poorly 1 2 3 4 5 Very well

5. When solving the assignments, leadership was

Centralized 1 2 3 4 5 Distributed

Ways of working

6. When solving the assignments, decision making was mostly

Individual 1 2 3 4 5 Collective

7. Our group's ways of working could be described as discussive

Totally disagree 1 2 3 4 5 Totally agree

8. Our ways of working were functional/effective

Totally disagree 1 2 3 4 5 Totally agree

9. How would you describe the solving of the assignments?

Individual 1 2 3 4 5 Collective

10. Our group meetings were too long

Totally disagree 1 2 3 4 5 Totally agree

Communication

11. We shared lots of knowledge between the group members

Totally disagree 1 2 3 4 5 Totally agree

12. Communication between the group members was smooth and easy

Totally disagree 1 2 3 4 5 Totally agree

13. Within the group we communicated mostly

Using electronic channels 1 2 3 4 5 Face-to-face

Group dynamics

14. We were able to solve conflict situations well

Totally disagree 1 2 3 4 5 Totally agree

15. Our group had an inspiring spirit

Totally disagree 1 2 3 4 5 Totally agree

16. I knew my group members beforehand

Totally disagree 1 2 3 4 5 Totally agree

17. Our group was motivated to solve the assignments well

Totally disagree 1 2 3 4 5 Totally agree

18. Our team work improved during the assignments

Totally disagree 1 2 3 4 5 Totally agree

19. Team work improved my motivation to work hard

Totally disagree 1 2 3 4 5 Totally agree

Results

20. Team work in total went well

Totally disagree 1 2 3 4 5 Totally agree

21. External factors affected our work in a negative way

Totally disagree 1 2 3 4 5 Totally agree

22. Our project management knowledge was adequate to solve the assignments

Totally disagree 1 2 3 4 5 Totally agree

23. I'm satisfied with our group's achievements

Totally disagree 1 2 3 4 5 Totally agree

Other comments about your team work

The team work was very good, we divided the project fairly and everyone did it well.

Figure.6