



**XIOS HOGESCHOOL LIMBURG
DEPARTEMENT TOEGEPASTE INGENIEURSWETENSCHAPPEN**

THE ORGANIZATION OF A COURSE ON DRY ETCHING

Eddy KUNNEN

Afstudeerwerk ingediend tot het behalen van het diploma van
master in het PROJECTMANAGEMENT

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Thanks to my wife Sandra, my kids Stef and Eva and Rene my father in law for their love and understanding, taking care of things when I was studying... .

Also thanks to my promoters Sandip Halder and Jos Schepers for the ideas that enriched this thesis. Hans Lebon for his support. Special thanks to Annemie Maes from the imec academy, she dug up the data for the program and for the quality assessment. I also want to thank the teachers of the course, for the time and effort they spend to educating project managers, getting the best out of people. Especially I want to thank Chris Kindermans, why I cannot explain, you have to meet him.

"Would you tell me, please, which way I ought to go from here?"
 "That depends a good deal on where you want to get to," said the Cat.
 "I don't much care where--" said Alice.
 "Then it doesn't matter which way you go," said the Cat.
 "--so long as I get SOMEWHERE," Alice added as an explanation.
 "Oh, you're sure to do that," said the Cat, "if you only walk long enough."
 (Alice's Adventures in Wonderland, Chapter 6)

Finally after taking this course I realize that actually everything is already known for years. It is just a matter of doing it. Time to catch up and to learn from each other. Humor is important in my life and therefore I included Dilbert for some guidance and smoothening for possible unforeseen change issues.



Abstract

The organization of a course on dry etching

Master thesis submitted by Eddy Kunnen to achieve the degree master in project management.

Promoters : Jos Schepers and Sandip Halder.

The organization of a course on dry etching is chosen as a topic to write this thesis for achieving a master on project management. The project has been executed earlier without any knowledge on project management. First, it is described how the project was carried out using a list of key events. Second, the different aspects of the PMBOK methodology are reworked in an elaborated fashion compared to the project size. Starting with defining the roles of the project manager and sponsor a charter is created. Stakeholders are interviewed and requirements are documented leading to a scope statement . A procedure for change control is set up. The project management plan is expanded with the work break down structure by using MS Project. The latter is used as well for project tracking, performance and forecasting. Next to scope and scheduling, the cost are estimated and a baseline is created. A quality plan is setup and by means of control and feedback the quality is assured based on the real measurements. The required profiles are defined as well as when these profiles are needed and the associated costs revealing a human resource plan. Time for teambuilding, evaluation and adjourning is foreseen in different meetings. Finally a risk assessment is made with mitigation and contingency plans followed by the conclusions.

Abstract

Het organiseren van een cursus droogetsen

Proef schrift ingediend door Eddy Kunnen voor het behalen van de graad master in project management.

Promotoren : Jos Schepers and Sandip Halder.

Als topic voor het schrijven van een thesis is gekozen voor het organiseren van een cursus over droogetsen. De cursus is destijds gegeven zonder voorkennis over project management. Vooreerst wordt beschreven aan de hand van een aantal sleutelmomenten hoe de organisatie van de cursus verliep. In tweede instantie zijn de verschillende aspecten van de PMBOK uitgewerkt rond dit thema. Ten eerste zijn de rollen van de projectmanager en de sponsor gedefinieerd en is er een charter opgesteld. De belanghebbenden zijn geïnterviewed en de vereisten zijn gedocumenteerd hetgeen leidt tot een scope statement. De procedure voor veranderingen is opgesteld. Het project management plan is uitgebreid met de work break down structure gebruikmakende van MS project. Dit programma is gebruikt voor het opvolgen van het project, het meten van de performantie en voorspellingen te doen. Naast de scope en het schema zijn de kosten geschat en is er een kostenplan gemaakt. Kwaliteit is ingepland en door middel van metingen en terugkoppeling is de kwaliteit verzekerd. De nodige profielen en geassocieerde kosten zijn opgesteld hetgeen geleid heeft tot een personeelsplan. Tijd voor team building, evaluatie en afsluiting is voorzien specifieke vergadermomenten. Ten slotte zijn de risico's ingeschat met bijbehorende voorzorgen en plan indien het risico zich voordoet. De thesis eindigt met de conclusies en punten die voor verbetering vatbaar zijn.

List of abbreviations

AC	Actual Cost of work completed
BAC	Budgeted cost at completion
CPI	Cost performance index
CV	Cost Variance
EV	Earned Value
EAC	Estimated cost at completion
PMBOK	Project Management Body of Knowledge
PV	Planned Value
SPI	Schedule performance index
SPI(t)	Earned schedule performance index
SV	Schedule Variance
SV(t)	Earned schedule variance
VAC	Cost Variance at completion
WBS	work break down structure

The organization of a series lectures on dry etching

Introduction

As topic for this master thesis the organization of a set of lectures on plasma etching is chosen. This project is carried out at imec. Imec (founded 1984 by Baron Professor Roger Van Overstraeten) is officially an "Instituut van openbaar nut" with an international character having branches for research and development in the Netherlands, China, Taiwan and India. Imec Belgium is a non-profit organization representing more than 60 nationalities and 2000 employees. The main product is knowledge on nano technology, aiming to improve life in a sustainable society. More information on our mission, vision and company profile can be found on http://www2.imec.be/be_en/home.html.

In order to make nano technology, materials need to be deposited and patterned on a nanoscale. Plasmas are used for etching these small features and hence is one of the key techniques, expertise's needed. This expertise is settled together in a group called the dry etch group that is part of the patterning department. Regularly new people join and other leave the group creating a need for continues education. It is in this context that I took initiative to generate a series of lectures in order to teach the new people the basics of plasma etching.

These lessons were given during the second half of 2010, well before the start of the course on project management. I have chosen this topic for writing a master thesis for several reasons i.e. as it is preferred by the school to take a topic that is already finished. Somebody asked me to write a book on this course, however I'm not sure if he expected a master thesis on management instead of an educational book on the topic itself.

Strategically I want to stress with this thesis the importance of learning, sharing knowledge with each other. Our Flemish society is based upon learning as well learning is one of the foundations of imec, it is a core value. The choice of the English language is simple because it is the language I speak with my promoter. It is the daily language on our job. Having the thesis written in English enables also other people to profit from some learning on project management. The purpose is to learn about project management and the organization of a set of lectures can be regarded as a small project. Therefore I'm going to apply what I have learned on this event to show that I master several aspects of the PMBOK [PM08a]. The result may look like an overkill of project management methodology for such a small project. For a moment bear in mind that we live on the 'planet' project somewhere in space. The thesis is build in similar why as the PMBOK i.e. discussing the several knowledge areas.

At the end I will conclude with the real points that the project would have benefitted from.

Facts&comments on the project as it was executed.

Firstly the project needs to be described. Therefore a list of key events and other evidence is listed in this chapter.

The project started with an idea to organize training for the new employees so that they have a good starting basic knowledge on plasma etching. From this moment on several events took place and an overview of the most important events can be found back in table 1. This table is constructed from the email communication at that time. The overview of all the lectures can be found back in figure 1.

Log of Key Events	Based upon stored email communication (received/not sent).
Pre	It has been decided to do an training for the new etch people.
28/06/2010	Announcement by email by group leader in etch group / people start to inscribe by email / talking. I will organize the training and Dries will help giving lectures.
28/06-04/08	Based upon the inscriptions a program is established.
04/08/2010	Announcement of the program by email and first list of attendees (10). Results in new wave of inscriptions (20).
10/08/2010	Involvement from imec academy : registration, evaluation, announcement in imec newsflash, coffee, rooms.
14/09/2010	More inscriptions than place. Shift to other dates for larger room.
16/09/2010	Communication of new schedule to participants
16/09/2010	Newsflash within imec
17/09/2010	First request for video streaming of course./ Negative wrong room infrastructure.
20/09/2010	Extra inscription – make extra handouts support from secretary
20/09/2010	Problem : request for a soft pdf version of the lectures. Choose not to give.
11/10/2010	Received of two homework's (BT and Laurent)
12/10/2010	Changes two extra lectures bad communication / problems with Dries.
	Before each lecture the attendees are reminded of their inscription
15/10/2010	Receive third home work (Peter Verheyen)
25/10/2010	Extra lesson on gasses beyond the etch tool – update and communication of scheme through the secretary of the imec academy.
26/10/2010	Feedback / Evaluation of first four lectures to teachers on 17/9, 8,13,15 October
28/10/2010	Received of Alexey's contribution. The shown data is approved by the Alexey's customer
29/10/2010	Received of the extra lesson on gasses beyond the etch tool by Jan Coenen.
29/10/2010	New request to tape the lecture of Jan Coenen (Wang Wei-E). Try to adapt scheme for him.
09/11/2010	Feedback / Evaluation of second 4 lectures.
10/11/2010	Switch to auditorium for recording of the remaining lessons/live streaming
10/11/2010	Swap of two lectures.
24/11/2010	Receive of examination questions from Denis/Alexey
25/11/2010	Communication of Schedule for homework lecture
25/11/2010	Received of evaluation feedback of last three lectures on 15&19&22 November

30/11/2010	Received of several homework's
8/12/2010	Received of feedback of last two lectures on 29/11 and 3/12
Jan 2011	Closure Lunch in Via Via with teachers and drinks paid by organizer.

Table 1 : List of key events

As can be deduced from this log it started with the need for education. After the announcement of the group leader people start to inscribe and one gets an idea of the participants / stakeholders. It became clear that not only new people but also more experienced people, some management and people from the neighboring support group were interested to follow the training. Based on these stakeholders a program has been setup. Two additional trainers were appointed by the group leader to support the lectures. The announcement of the program (Appendix A, p.37) resulted in a second wave of inscriptions. Contacting the imec academy resulting in support for publicity, logistics for registration, drinks, arrangement of rooms and evaluation of the lectures. New rooms have been scheduled because the amounts of inscriptions (20). One of the first issues I encountered here was the situation of the trainers. Preparing lectures and giving training on top of the their situation was not that welcome and it took some time settlement to divide the workload. Some opportunities like people from the etch group with a certain expertise have been added to share their knowledge and the program has been extended and communicated as in Appendix B, p.39. Additionally, the program had been announced on the intranet just before the first lecture. It is a point that can be seen as a start of the project. During the lectures it has been decided, to give some small homework tasks to increase the involvement of the attendees. The imec newflash had drawn attention to people beyond the patterning department. This resulted in an extra lecture on "Gasses Beyond the etch tool". I also decided to organize for the volunteers a final examination. These changes were badly communicated to the other trainers and led to some emotions when the schedule needed to be adapted. The final scheme is shown in figure 1 . After a second request to record the lectures on video, lecture 13 and 14 were taped in the auditorium. Simultaneously, the imec academy collected, analyzed and summarized feedback from the attendees to the trainers. At the end of the course the attendees presented their homework in a separate lecture and finally to possibility for a test has been done in the last lecture. The examinations had been corrected and discussed face to face. After the closure of the course, the trainers went out together for a lunch and drink in the Via Via. With the help of the imec academy the number of attendees are found back, see table 2.

There are always more inscriptions than people that actually attend at the end. A lot is based on the good will of the people. Especially, the time they want to make free for organizing and attending the courses on top of the regular work. This is always in addition to the regular workload. The organizer and trainers do not have any operational authority over the attendees. The education is offered free.

DRY ETCH TRAINING (ST-260)

Contents

Title: Dry etch training

Lecturer: Eddy Kunnen, Dries Dictus, Denis Shamiryay, Vladimir Samara, Alexey Milenin, Kaidong Xu

Abstract

Lecture 1: Plasma's in our daily live - Eddy Kunnen - 17/09/2010 - 16h-17h30

This part will deal with the history of plasma's and a walk through all the plasma's that surround us. The lecture is taken from Christophe Valee, University Joseph Fourier Grenoble.

Lecture 2: Basic Dry etch Package - Special support edition - Eddy Kunnen - 13/10/2010 - 8h30-13h

This is the introduction to dry etching where the very basics (why a plasma is used for etching, selectivity, anisotropy, tools, etc) are explained targeting starters in the etch group and the support people.

Lecture 3&4: Fundamentals 1&2 (taken from Coburn's lectures) - Denis Shamiryay - 24/09/2010 and 27/09/2010 - 16h-17h30

Definitions, Vacuum aspects, Pattern transfer, what is plasma, electron energy distribution & crosssections, species, anisotropy, relative concentrations, Mobility, Potentials, capacitive coupling, inductive coupling, frequency dependency, reactor geometries.

Lecture 5&6: The physics of RF discharges 1&2 (taken from Coburn's lectures) - Denis Shamiryay - 01/10/2010 - 16h-17h30

Time variation of potentials, symmetric- asymmetric systems, sheaths, ion distribution, frequency effects, Plasma potential, high density plasma's, ICP, ECR, MERIE, helicon.

Lecture 7: Anisotropy mechanisms (taken from Coburn's lectures) - Dries Dictus - 04/10/2010 16h-17h30

Reactive Ion Etching, neutralization flux, halogen size effect, sidewall passivation.

Lecture 8&9: The etching of silicon and its compounds and Assisted Phenomena 1&2 (taken from Coburn's lectures) - Eddy Kunnen - 08/10/2010 and 15/10/2010 - 16h-17h30

Silicon, SiliconDioxide, SiliconNitride, Carbon blocking, Loading, Silicon (steep) trench etching.

Lecture 10: The etching of Other materials (taken from Coburn's lectures) - Dries Dictus - 05/11/2010 - 16h-17h30

Aluminum, Organics, Ti, W, Silicide, Si-V compounds, GaN, InGaAs, Cu, ...

Lecture 11: Gases beyond the etch tool - Jan Coenen - 15/11/2010 - 16h-17h30

In this interesting seminar gases will be treated before they enter the etch tool and what happens with them when they have left the etch tool i.e. gas distribution, statement, safety, GWP, ...

Lecture 12: Equipment related topics (taken from Coburn's lectures) - Dries Dictus - 19/11/2010 - 16h-17h30

Non-uniformity, wall interactions, contamination, chemically assisted ion beam etching.

Lecture 13: Wet strip - Kaidong Xu - 22/11/2010 - 16h-17h30

Lecture 14: Plasma diagnostics (taken from Coburn's lectures) - Dries Dictus/Alexey Milenin/Vladimir Samara - 26/11/2010 - 16h-17h30

Optical emission, actinometry, Massspectroscopy and the probes within the dry etch group.

Lecture 15: Home work presentations - 29/11/2010 - 16h-17h30

During the course exercises have been given to the attendees that leads to an overview of the current etch tools at imec and their properties, SPC testing and practical phenomena. In this session the individual attendees will present their findings.

Lecture 16: Test your knowledge on dry etch - Review time - 03/12/2010 - 16h-17h30

For stimulating learning and improving knowledge transfer the course will end with a moment of individual review/test. A list of questions that represent the key know how is generated by each teacher. During this session each participant will have time to answer them in written way using the course next to them. After reviewing the answers, the lectures will feedback individually to each participant to ensure correct understanding of the matter.

Info

You can always [contact us](#) for more information about prices and bookings.

If no dates are scheduled, you can [send us an e-mail](#) to be registered on the waitinglist.

Duration

24.50 hours

Figure 1 : The lectures as the finally have been given.

Datum	Titel	Deelnemers
17/09/2010	Plasma's in our live - Taken from Lect. of Christophe Valee	16
24/09/2012	Fundamentals 1 - Coburn	17
27/09/2010	Fundamentals 2 - Coburn	16
01/10/2010	The physics of RF discharges 1&2 - Coburn	18
04/10/2010	Anisotropy Mechanisms	14
08/10/2010	The etching of Silicon and it's compounds and Assisted Phenomena A	15
13/10/2010	Basic Dry Etch Package - Special Support Edition	8
15/10/2010	The etching of Silicon and it's compounds and Assisted Phenomena B	13
05/11/2010	The etching of other materials	15
15/11/2010	Plasma Diagnostics	14
19/11/2010	Equipment Related topics	10
22/11/2010	Wet strip	11
26/11/2010	Plasma Diagnostics	33
29/11/2010	Home work presentations	10
03/12/2010	Test your knowledge on dry etch - Review time	4

Table 2 : Overview of the amount of people that attended the different lectures

The planet PMBOK

Let's move now to the parallel galaxy of project management. In between the planets Prince2, Scrum, Extreme, Agile, Flemish sayings, ... we find a planet where everything is carried out according to the wisdom of half a million certified project managers written down in the project management body of knowledge (PMBOK).

Currently, of course in an exaggerated way. Lets carry out this project on that planet and see how things could go.

For this project I have chosen the PMBOK methodology because the scope, time and budget are clear. "I also prefer being able to walk before to run i.e. agile methodology is based upon traditional methodologies, it is more than just being agile".

Important to know is that all the different processes can run in parallel, overlap and are repeated but each time with a clear start and an end. There are several ways of managing a project. The sequence followed in this thesis is arbitrarily chosen. We dive partially into the several knowledge areas of the PMBOK except for the procurement area which would lead us to far.

It all started with an idea/need. This idea needs to be worked out. Is the idea clear ...? Some roles need to be identified.

Building the project management plan

The sponsor and the project manager

First a sponsor needs to be identified. The sponsor (person or group) provides the resources for carrying out the project. He also stands for the benefits the project will bring and promotes it throughout the organization. He is the one that wants' the project to be realized and chooses a project leader.

In this case the group leader is the sponsor since he wants to educate his new employees so they have a good start. His team will benefit from it. He also provides the resources for the project i.e. trainees&trainers and he will be the escalation path for the project manager.

I'm appointed as the project leader and I'm going to be responsible of the success of the project whatever happens. Therefore it first needs to be analyzed what (project charter) needs to be done and who is affected (stakeholder identification). At the end the sponsor signs of the plan i.e. he agrees on the content and pays the bills.

A first check to be made is 'does the company support these initiatives, is it in line with the corporate strategy, does it contribute to realize this strategy'? Imec does have a strategy and one could find that it fits into.



The project charter (what)

Ideally the sponsor puts the project charter together and hands it over to the project manager. Or the charter is assembled in a mutual discussion. On the charter you find the initial requirements that satisfy the stakeholders needs. Having a project charter formally authorizes you to go ahead with support of the sponsor.

At the time of the course there was no formal way of doing projects, support of such initiatives. I took part in developing stage gates and a charter for supporting certain project initiatives is currently in place. Therefore this project charter will be used for the project. The charter can be found back in Appendix C, p.41.

The charter expresses the wish of the sponsor and one can learn that there should be an effort done to educate new people who join the etch group.

With this charter the project manager starts to research a way of achieving the objectives in the most cost effective and timely manner not compromising on quality. The objectives can be achieved in different ways, i.e. we could put the new employees in a box with books and internet courses or outsource it. Evaluating the different ways of how to get these people on to speed it was agreed to organize a course on dry etching.

Finally, more elaborated, as input for preparing a charter you need next to a statement of work, the business case and information on the organization and it's environment. We have an important workshop at the end of October 2010 and therefore no lectures will be planned in the timeframe 16 October – November 5th.

Having this charter you can check who is impacted by the project i.e. building the stakeholder register.

Stakeholder analysis (who)

One of the first activities is the identification of the stakeholders. See appendix D p.42, for the stakeholder register. I included also the team members because they play a vital role in the success of the project. At that moment there wasn't a real kickoff meeting. The task just enrolled in the daily mode. A more formal approach would have helped teaming up. I also mentioned the attendees in the stakeholder analysis. At the end, the training is for them and the success of it depends on their experiences. Finally, the PMBOK tells that for the stakeholder analysis you need as input the project charter, procurement documents, enterprise environmental factors and organizational process assets.

Collecting the requirements

Once the stakeholders are identified, the requirements of each stakeholder had to be collected and documented. Let's assume that all stakeholders had been interviewed, brought together for discussion and as a result having the requirements documented. It has been commonly agreed that for ranking the requirements a MoSCoW matrix is used, see appendix E, p.43.

Define the Scope

Having the project charter (what) and the stakeholder register (who) and all requirements (what) one can start writing down the scope. This occurs through

frequent interaction between the sponsor and the project manager until both are satisfied. All other processes can keep running in parallel.

Project scope statement

Product scope description

The scope of this project is the delivery of 16 training sessions in English on dry etch for 20 possible attendees on each session. Out of the different methods for knowledge transfer the model of a teacher in a room with students is chosen. The sessions are described in figure 1. Handouts for all session will be foreseen for every attendee before the lecture starts. Coffee, water and orange juice is offered and the possibility to fill out an evaluation form. The evaluation forms will be anonymously summarized and returned to the lecturer of that session within a week. Each attendee will get a single homework task during the course that needs to be presented in lecture 15. In lecture 16 the attendees have freely the possibility to test their knowledge by filling out a questionnaire. This examination will be corrected and feedback to the attendee will be given. All these trainings should fulfill the standard imec norm of lecturing. Finally the trainers will go for a lunch in the "Via Via" and the project leader will give a drink.

Product scope acceptance criteria

The project scope statement does not only give a description of what is to be done but it tells you also how to judge if a task/deliverable is achieved or not i.e. the acceptance criteria. This has an important impact on progress monitoring and calculating the earned value. How to evaluate in the initial phase if this project is successful or not and how it progresses, does it stay on track. Three rules, 0/100, 50/50 % complete are used for completing tasks. An example of a deliverable can be a lecture. The success, acceptance criteria for a lecture can be

- Is the lecture given?
- Are the notes distributed?
- Was there coffee, orange juice and water available?
- Have the evaluation forms been distributed and the returned forms collected.
- Is the attendee list distributed and collected?
- Is the knowledge transferred?

I used MS Project to add for each task the acceptance criteria, this can be found back in appendix F p. 44.

Project deliverables

The project has the following deliverables :

D.1	Lecture notes for every attendee.
D.2	At least 150h of training from people from the patterning department should be registered.
D.3	The organization of 15 lectures on dry etching.
D.4	For each lecture an evaluation report meeting the quality standards of imec lecturing.
D.5	Weekly Progress reporting on the project
D.6	A special session on dry etch for the support people
D.7	A homework task and related presentation for each attendee
D.8	The organization of a examination that proves the knowledge transfer

These deliverables are related to certain requirements and tasks from the WBS this relationship can be found back in the requirement traceability matrix, appendix G, p45.

Project exclusions

- 1) The majority of the lecture material already exists i.e. the trainers did not have to make new lecture material.
- 2) Only imec owned lecture material will be made available in soft copy version.

Project constraints

- 1) The training is offered free, i.e. people can inscribe but cannot be formally forced to attend the training. Therefore the amount of attendance will not be known upfront. This is according to the culture of the organization. New people are strongly encouraged to participate.
- 2) All trainings should be finished before January 1st 2011 because of resource limitations.
- 3) Except for the examination session, a lecture will be cancelled when the amount of inscriptions is lower than 5 for that lecture.
- 4) No lectures in the period October 16th till November 4th.

Project assumptions

- 1) There are enough meeting rooms available in which the trainings can be held.
- 2) The company and the business remain rather stable such that people find room for attending the training.
- 3) The people that inscribe have sufficient background to understand the courses.



Finally, this project has an effect on the amount of training hours. Currently, the amount of training that an employee attends yearly is a key performance indicator (KPI) of imec (the project serves the strategy). Therefore such project could be part of a larger program/portfolio setup to achieve this KPI. The task/project is to offer a series of lectures in order to increase the amount of training. In total 150 hours of training have to be followed.

It is also from this point of view that I will plan the earned value. Some creativity is needed to demonstrate the ability to use earned value. In the beginning 20 people inscribed. The plan had been setup to give all the trainings to 20 people. This is the

planned cost/baseline of the project : the organization was willing to spend this effort. However, it is a cost that the project manager cannot control since the education is offered free and not everybody shows up, as can be found back in table 2. Nevertheless, it gives the possibility to demonstrate the use of earned value from cost point of view. The amount of people that actually attended the training represent the actual cost. The difference between the planned cost and the actual represent the people that did not showed up. If people do not show up, then the objective of giving a lecture is still achieved, but at a lower cost. The impact on the KPI will also be lower.

Integrated change control

The scope is now clearly written down. However when starting the project inevitable changes with respect to the plan will happen. How to deal with these changes has to be agreed upon upfront. Therefore if a change is requested following process needs to be followed.

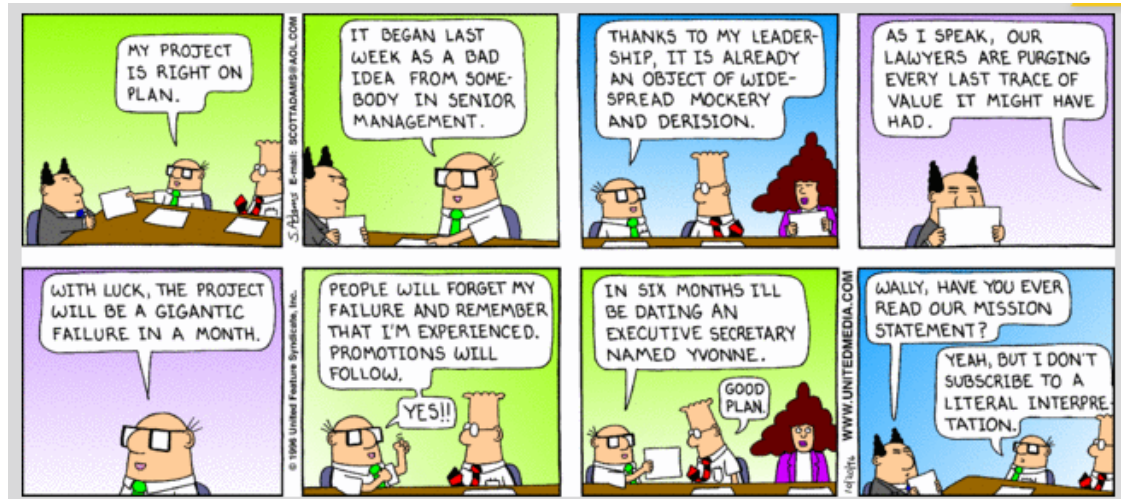
- 1) The change needs to be documented (what, who, date) and forwarded to the project manager. The project manager keeps a list of the changes in an excel sheet.
- 2) The project manager calls the team together to discuss the change. They study the impact of the change on the project. The findings are documented.
- 3) Changes that have no impact on the budget nor deliverables can be approved and implemented by the project manager and the team itself.
- 4) Changes that impact the budget, deliverables one way or another need to get approval from the sponsor.
- 5) After approval the MS Project file is updated.

Work break down structure

The Work Break Down Structure (WBS) is a list of all the tasks. Using Microsoft Project a list of all the tasks can be found back in appendix H, p.46. The complete individual description of each task can be found back in the work break down dictionary. The work break down dictionary is not taken up in this because it would lead us too far since the tasks are trivial.

This list of tasks is the backbone of the project. All following activities, risk, resource estimation, communication, ... are related to a specific task.

Project time management

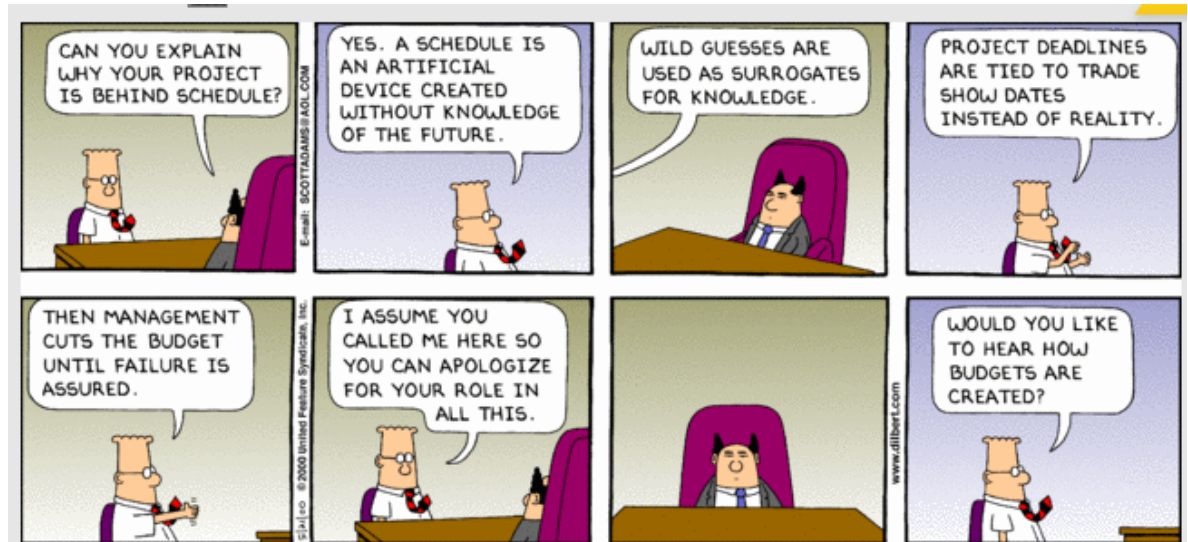


All our activities are defined in the WBS. The activities need to be sequenced and estimations of duration and workload need to be made. Again the PMBOK provides the processes for achieving this : define activities, sequence activities, estimate activity resources, estimate activity duration, develop the schedule and finally control the schedule. I carried it out in MSproject and the schedule can be found back in appendix H, p. 43. The lectures need to be given at a certain moment , that's why they have a fixed constraint on time. Typically the schedule is impacted by the workload of the people and leveling needs to occur. In this particular case no resources are really overbooked. MS project will indicate the need for leveling certain people but if this is analyzed in detail it comes down to two overlapping tasks for one person. There is never more than 8 hours of work/day for a person. It's expected that people can manage at that moment two tasks in parallel. The schedule took into account the October 16th till November 5th period where hardly resources are going to be available because of internal imec activities.

Important to state here is the upfront difference between the plan and reality. One can make a lean plan and communicate it, let everybody act according to plan. However it is natural that unforeseen events pop up and will cause a delay. Therefore you need to foresee a certain amount of extra time in the risk budget i.e. all work is targeting a date "below" the official project finish date. Here a 10% risk budget is a fair start.

Costs

A project manager has to deal with costs. The PMBOK foresees three main processes : cost estimation, budget determination and cost control. We foresee that all the people participating need, to be paid for their effort. As such you need to plan these expenses and provide money to pay them.



Estimate the costs & determine the budget

The direct costs are straightforward, making the map with the notes, catering, The indirect costs such as electricity, depreciation of the building, ... are included in the cost of a person. We have taken the cost of a person for activities aside the business lines. The cost for such person is divided over the different business lines. These activities are not directly related to a particular business line. Arbitrary we set this cost to 100 euro/hour (Imec has ~ 2000 employees, 200 days of work, turnover ~ 300 million).

With this information a bottom up estimation is carried out for cost control using MSPProject. Each activity has been mapped and for each activity the cost is estimated. The estimation can be found back in appendix I, p. 47. Knowing the risk register requires an additional budget of 320 euro to be foreseen in case of formal complaint. We assume that the projects with a bottom up estimation in the company typically have a +/- 10% performance from the original budget. This extra budget is foreseen for unexpected events that naturally occur. The 320 euro from the risk analysis is embedded in this 10%. Therefore the granted budget is 113606.13 €. The planned budget is 103278,48 €. The planned cost baseline corresponding with the resource usage is shown in figure 2. It directly corresponds with the amount of working hours planned, figure 3.

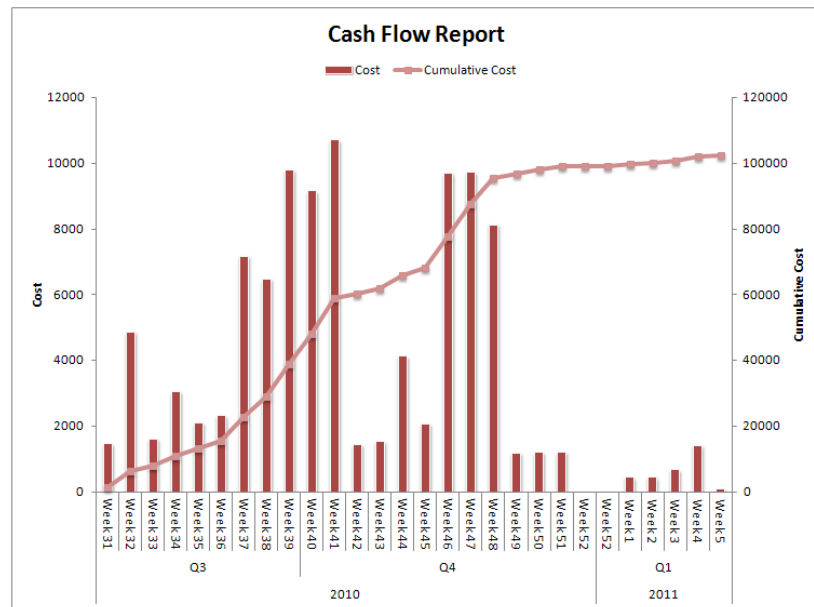


Figure 2 : The costs associated with organizing the training.

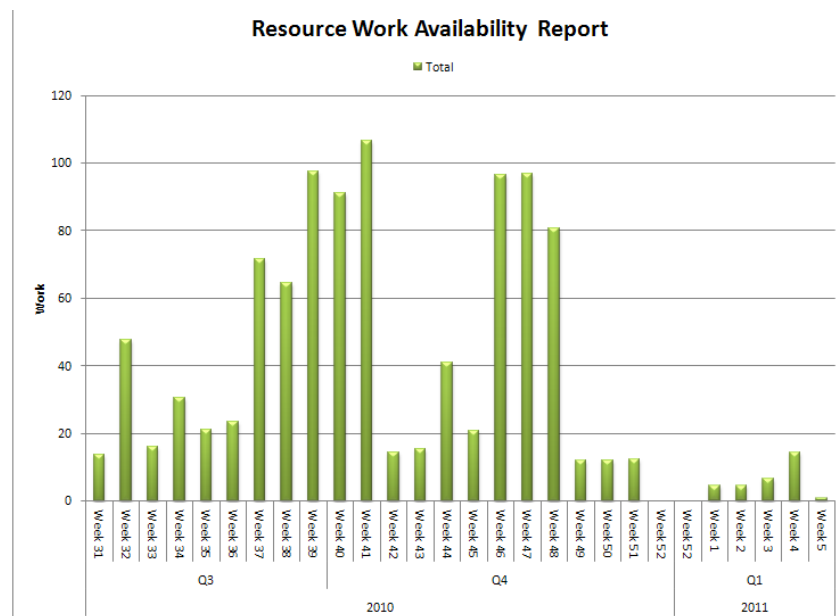


Figure 3 : The amount of work hours planned.

Control the cost

Two KD (kostendrager) are defined :

- KD 00001 : for registration of all the cost related to the organization of the training.
- KD 00002 : for registration of the cost made by attending the courses.

All stakeholders use these KD's for their time registration and expenses made. The financial department provides the project manager each week with a report of the expenses booked into these KD's. The project manager enters this information into the MS project file of the project. (For the moment we use the attendee list for KD 00002).

Quality

According to PMBOK, quality contains three processes : plan quality, perform quality assurance and perform quality control.

Quality plan

The chosen method for knowledge transfer is teacher&students. For a good attendance the lecturing is placed on Monday and Friday late afternoon. The lectures are limited to 1.5 hour and drinks are foreseen. We are going to hire trainers that have the knowledge and are able to teach.

All this we call the planned quality i.e. the way the courses are planned. As metric we are going to use the standard evaluation form see appendix J, p. 48 for measurements of the attendees satisfaction. These forms are distributed in the lecture and gathered by the trainer who hands them over to the project leader. They are send to Annelies who compiles them to one feedback form. The feedback is given to the trainer within one week. All attendee's get the form but are free to return it. All these action can be found back in the WBS as "evaluate lecture".

Next to the evaluation form the total amount of people inscribed is going to be a metric of the success/quality of the course. If it drops below 3 the course is cancelled.

The aim of the course is learning on plasma etching. In order to check if this goal is achieved a the possibility for an examination will be given in open book style. The list of questions can be found back in Appendix K, p. 49. The answers are corrected and discussed face to face with the students. Note that only 4 students joined the session on the examination. It is fun to sit in a training but when it really comes down to learning, some organizational improvements can be made.

Quality assurance

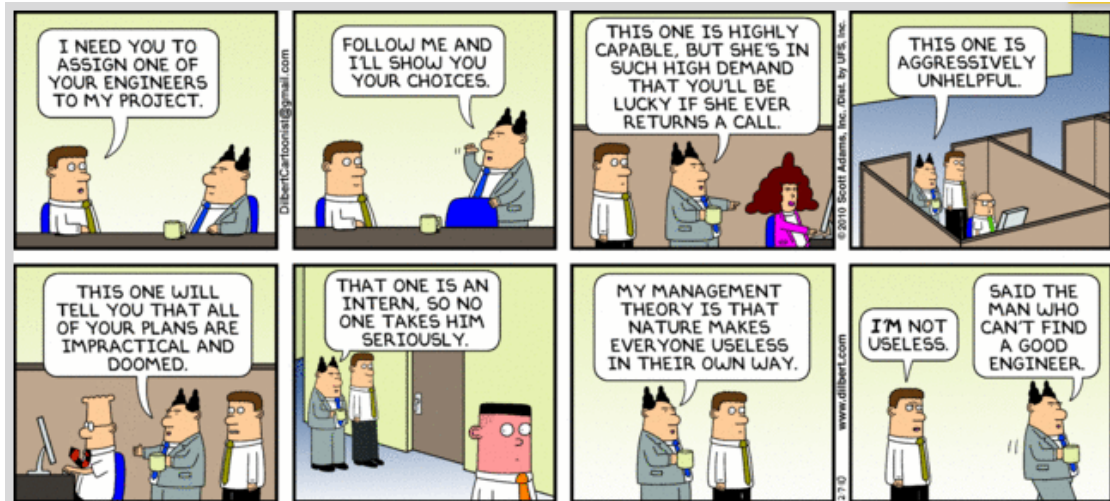
If a certain item scores below 3, the case is investigated by the team and an action plan/change request is evaluated and proposed. In this way continuous improvement is assured.

Quality control

The work performance measurements can be found back in appendix L, p. 52. Only for one training we had a score of 3. The case has been investigated and solved. No change request was needed because it was regarded as an isolated event.

Human resources management

The HR processes consist of developing the human resource plan, make the project team, develop the project team and manage the project team. In reality the development of a human resource plan and acquiring a project team went kind of parallel. In the framework of planet PMBOK it's further worked out here.



Develop the human resource plan.

A lot of activities needs to be done and these require resources. Having the activities listed with a resource estimation in place we find that certain profiles are needed at a certain moment in time.

Roles and responsibilities

Apart from the project manager two additional roles are identified as requirements : trainer and secretary.

Trainer

Role : The trainer is accountable for the lecture he gives.

Skill : He is a recognized senior/expert in the matter that he teaches. He is able to give a lecture such that is it appreciated by the attendees i.e. he is not only an expert but is also able to teach.

Responsibilities : He is responsible for the composition and teaching of a lecture. He distributes and collects the attendee list and evaluation forms (quality metrics).

Authority : He can change the content of his lesson as well as the timing.

Secretary

Role : The secretary fulfills a support function for the lecturing. The secretary is accountable for the announcement, the notes, catering and processing of the attendee list and evaluation forms.

Skill : She is familiar with the imec reservation system, knows how to communicate lecture programs and has an a clear view how to prepare lecture notes for a course in maps. She also knows MS Excel.

Responsibilities : She is responsible for the reservation of the rooms, layout of the lecture notes and ordering of the catering. The evaluation forms are prepared upfront and she processes the filled out form for feedback.

Authority : She has authority to arrange rooms in the imec reservation system and buying office material for making maps. She has the authority to communicate imec wide.

Project organizational chart

The organizational chart at the moment when the project was executed is shown in figure 4 and corresponds to a weak matrix for this project. The staff needs to put a team together and coordinate the project themselves.

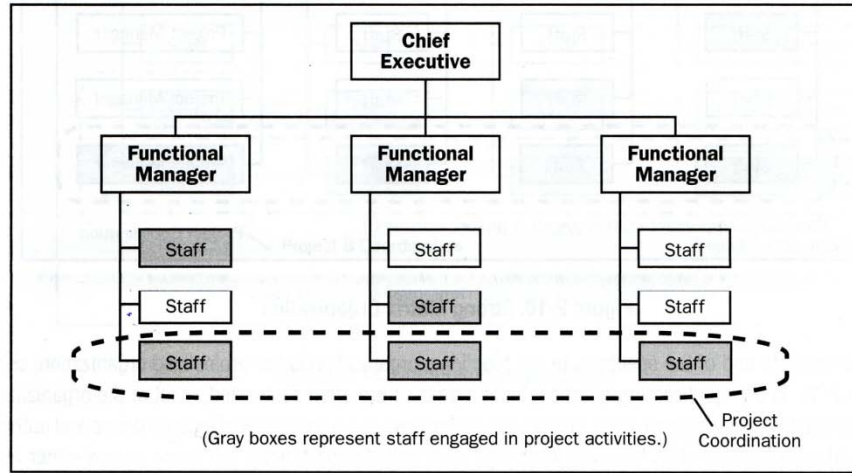


Figure 2-8. Weak Matrix Organization

Figure 4 The weak matrix

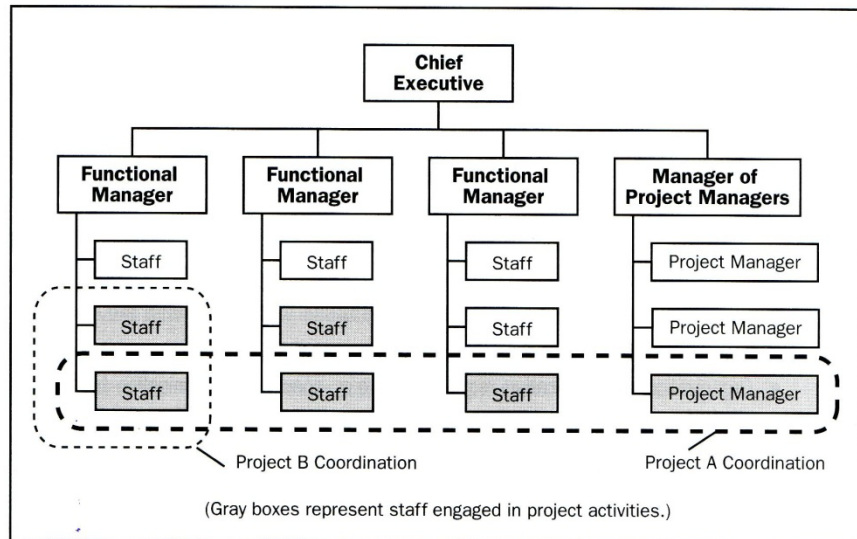


Figure 2-12. Composite Organization

Figure 5 The composite organization.

Such scheme has an influence on how projects are carried out as well as on the success ratio of the projects. A flavor of possible organization forms is shown in figures 5 and 6. Globeli and Larson found a 50% of success ratio in a functional organization to 70%/80% in a strong matrix or projectized organization [gl87].

Table 2-1. Organizational Influences on Projects

Project Characteristics	Organization Structure	Matrix			Projectized
	Functional	Weak Matrix	Balanced Matrix	Strong Matrix	
Project Manager's Authority	Little or None	Limited	Low to Moderate	Moderate to High	High to Almost Total
Resource Availability	Little or None	Limited	Low to Moderate	Moderate to High	High to Almost Total
Who controls the project budget	Functional Manager	Functional Manager	Mixed	Project Manager	Project Manager
Project Manager's Role	Part-time	Part-time	Full-time	Full-time	Full-time
Project Management Administrative Staff	Part-time	Part-time	Part-time	Full-time	Full-time

Figure 6 A flavor of the different organizational structures and how jobs typically are carried out.

Thus, the success of a depends on who is reporting to whom, the organizational chart. Ideally the project manager has full authority and 'hires' the needed people at a certain moment in time for the needed work. All team members report directly to the project manager. The project manager can only take responsibility if he has authority. The natural way is first authority, then being responsible before being held accountable. Thus for increasing the project performance all team members report to the project manager i.e. you put the project manager at a higher level. This of course depends also on the culture in that organization. Some cultures are more sensitive to this than others. It can be kept simple but it is important to make it and to communicate it. If the project manager has full authority it also puts an organization through a change i.e. independent of the function somebody has, he/she has to play a role in a project and reports to the project manager. It can put an organization up-side down.

Staffing management plan

Having the roles and needs identified on the project activity schedule, one can create the needs of certain roles in function of time i.e. the staffing management plan. Figure 7 and 8 show resp. the needs for the secretary and trainer role.

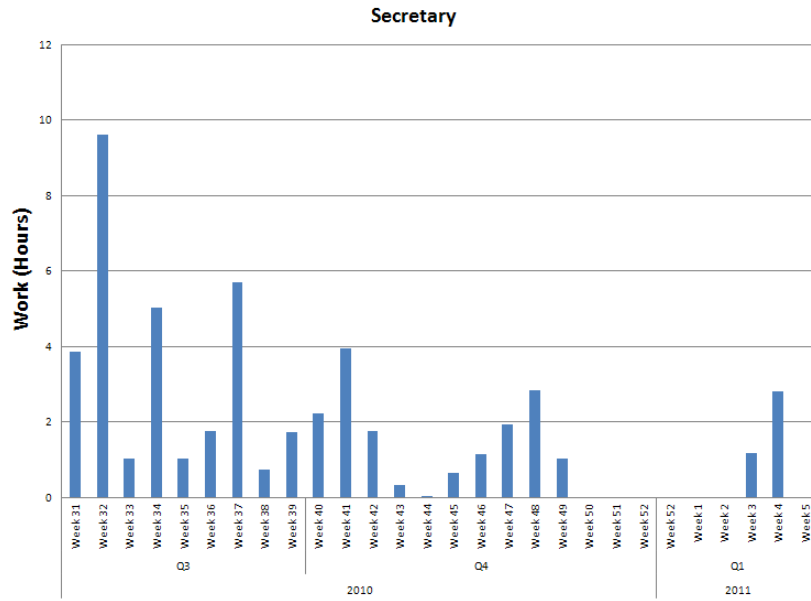


Figure 7 : The amount of secretary work/week as a function of time.

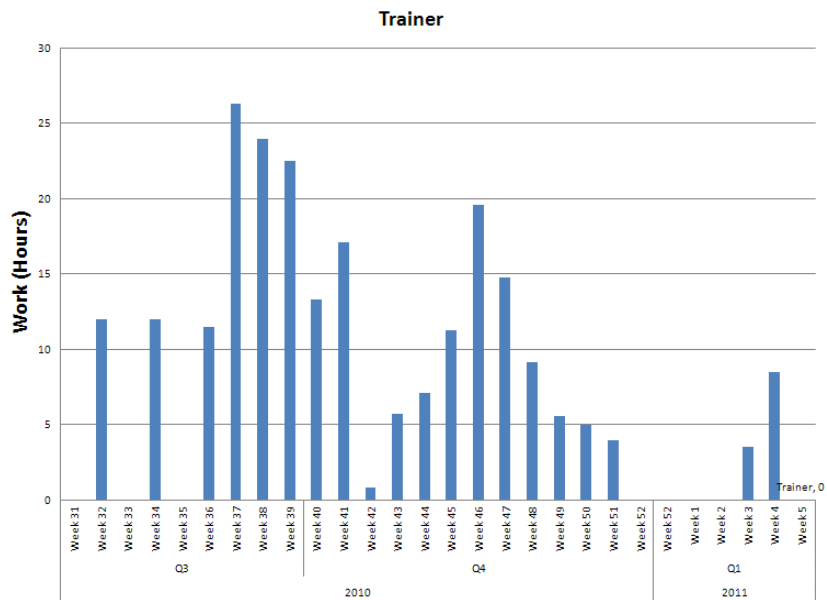
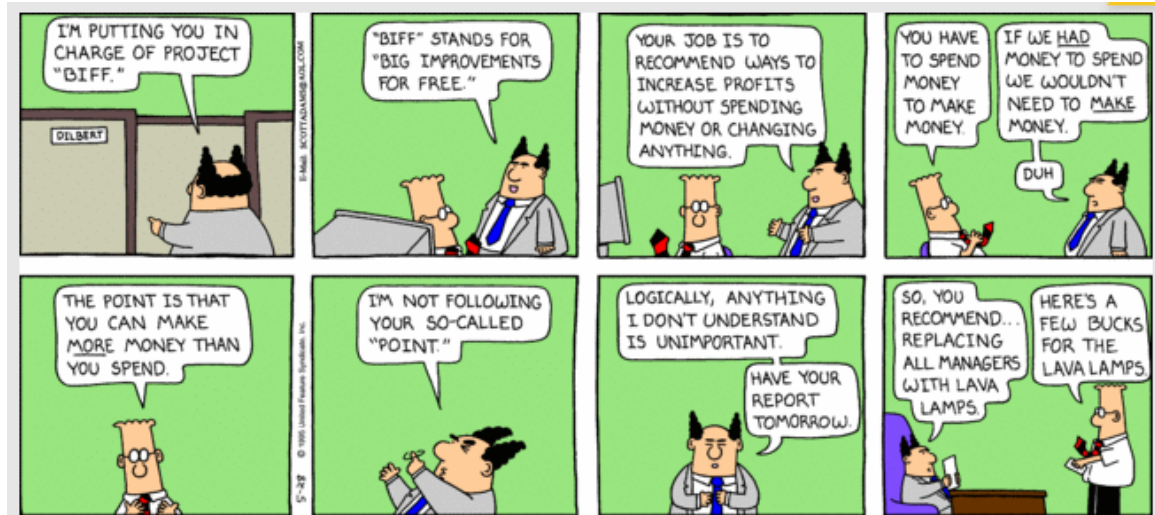


Figure 8 : The amount of trainer work/week as function of time

Acquire project team

If you have a proper plan upfront you can start acquiring the right people. People can be hired or trained There has been discussion on who does what since lowest effort is required for some people. A RACI matrix clears out these uncertainties, see figure 9. A more detailed overview can be pulled from the MS project file.



Activity	Eddy	Dries	Denis	Annelies	Claire	Kaidong	Vladimir	Alexey	Jan	Video team
Announcement	A	I	I	R	I	I	I	I	I	O
Preparation of the lecture material	A	C	C	I	R	C	C	C	C	O
Lecture 1 - plasma's in our daily live	R	I	I	C	O	I	I	I	I	O
Lecture 2 : Basic dry etch package - support edition	R	I	I	C	O	I	I	I	I	O
Lecture 3 : Fundamentals	A	I	R	C	O	I	I	I	I	O
Lecture 4 : Fundamentals	A	I	R	C	O	I	I	I	I	O
Lecture 5&6 : The Physics of RF discharges	A	I	R	C	O	I	I	I	I	O
Lecture 7 : Anisotropy mechanisms	A	R		C	O	I	I	I	I	O
Lecture 8 : The etching of silicon and its compounds and assisted phenomena	R	I	I	C	O	I	I	I	I	O
Lecture 9 : The etching of silicon and its compounds and assisted phenomena	R	I	I	C	O	I	I	I	I	O
Lecture 10 : The etching of other materials	A	R	I	C	O	I	I	I	I	O
Lecture 11 Gases beyond the etch tool	A	I	I	C	O	I	I	I	R	O
Lecture 12 : equipment related topics	A	R	I	C	O	I	I	I	I	R
Lecture 13 : Wet Strip	A	I	I	C	O	R	I	I	I	R
Lecture 14 : Plasma diagnostics	A	C	I	C	O	I	R	R	I	R
Lecture 15 : Home work presentation	R	C	C	C	O	C	C	C	C	O
Session 16 Examinations	R	C	C	C	O	C	C	C	C	O
Closure	R	C	C	C	C	C	C	C	C	C

A=accountable = final responsibility
R= responsible = does the job
C= consult
I= inform
O= out of loop

Figure 9 Defining and communicating roles and responsibilities using a RACI matrix.

In reality I had some issues here. It was clear that I wouldn't manage to teach all the lessons myself. The sponsor appointed a second teacher. However this person was finishing his PhD, couldn't to stay at imec and thus, started to work for another company. What's in it for him for to give this training? Secondly, he knows me as a development oriented person having less focus on research, so there are some sensitive issues as well. I had to ask the group leader to have a chat with him to engage in the training. When I rescheduled lectures and didn't communicate this upfront we had a second conflict. I learned that I should better take care of changes. Two trainers were not enough and a third has been appointed. I looked for additional trainers within the team. At the end we ended up with 7 trainers thereby having a

better spread of the workload. We had an issue with the scarce resources and we couldn't have anymore the full 'buy in' of the right persons resulting in a risk on the quality/performance. The risk had been partially mitigated by finding more trainers for smaller work packages.

Develop project team

The next stage was getting the team going i.e. increase its performance. Key here is to do the job together. Therefore a kickoff, planning, go live party are held as particular co-location team building/ working together events. At the kick off meeting we not only talk on what needs to be done but also the how, we go through the imec values of integrity, passion, connectness and excellence, supporting the implementation of them. The team will go through the forming, storming, norming stage and ideally arrive in a performing stage.

The agreed metric on how the team is performing are the CPI and SPI and quality metrics. One meeting is scheduled half way for feedback and evaluation.

To stimulate engagement a closure meeting in the Via Via with a drink from the project manager is planned and communicated upfront. Adjourning can take place at that meeting.

Manage project team

After each meeting a face to face between the project manager and the trainer is held to evaluate the lecture while walking through the returned evaluation forms. It's also a moment for rewarding and recognizing the effort. The main method used is observation and conversation. An issue log is kept and finally the project manager directly gives input to the project team members evaluation. The latter type of reward is only possible for the people that are in the company.

Project communication management

In the project communication plan one finds all the processes of how and between whom information is exchanged. Basically 5 processes take place : identification of the stakeholders, the planning of the communication, the distribution of information (execution), the management of the stakeholders and reporting of the performance. The identification of the stakeholders and collecting their requirements/needs can be found in appendix D&E. We limit ourselves to the communication plan in which the distribution of information and reporting of performance is captured.



Plan communication

If you have characterized the needs for information from the different stakeholders one can plan the communication. The plan can be found back in appendix M, p.53. The communication is connected to the tasks that have to be carried out.

Briefly, in this communication plan you will find the announcement of activities. The face to face talks for the evaluation of lectures and meeting minutes of several meetings are as well included. The weekly project performance meeting with the sponsor is taken up as the sharing of reports on an accessible project folder.

Risk management

The core of project management is a task. Therefore risks are typically analyzed with respect to a certain task. Risks can have a positive or negative outcome if they occur. Five processes are related to risk management : Plan risk management, identify risks, Perform qualitative risk analysis, perform quantitative risk analysis, plan risk responses and monitor and control risk. In this chapter we identify the risks and perform risk analysis and responses.

Risk identification

- 1) A real trade off that has to be done was about the lecture notes. The main part of the lectures notes are copied from external dry etch courses given by other trainers. Using their material as such could lead copyright issues and harm of reputation. On the other hand some trainers would have been honored if their slides are reused. Risks can be regarded positive and negative.
- 2) Teacher absent. It can always occur that a trainer does not show up. Resulting in a class of people waiting and a depreciation of the lecture.
- 3) Room for the lecture is occupied. Double bookings are rare but do happen. It can result in possible rescheduling of the lecture and depreciation of the course.
- 4) The beamer doesn't work. Although rare, it can happen that a beamer does not work. This can result in a rescheduling and depreciation of the course.
- 5) People inscribe but do not show up. You never know how much people show up. Typically less show up than inscribed. This can result in wasted money used for the catering which is not a good lean attitude.
- 6) Homework tasks – people stay away. Giving homework tasks can have impact on the people attending. On one hand this can be seen as extra work and demotivate the attendees. On the other hand the involvement becomes real and it is a point of discussion. It spices up the course.
- 7) The same reasoning holds for the examination. At this point you ask more from the people than just attending the course. They need to work independently on the course. The advantage is a better knowledge transfer but the disadvantage is a lower attendance.
- 8) Receive of a bad evaluation report because the trainers are not motivated.

Risk analysis

In the risk analysis the risks are prioritized. This can be done by use of a risk matrix.

Following number conventions are made :

Likelihood/Probability 1-5 : 1 less probably / 5 high probably

Impact 1-5 : 1 low impact / 5 high impact on the project/organization

Detection Difficulty 1-5 : 1 easy detectable and 5 difficult to detect.

Risk Event	Likelihood	Impact	Detection	P*I*D	Associated task
------------	------------	--------	-----------	-------	-----------------

			Difficulty		
External complains	1	5	5	10	All project
Teacher absent	2	3	2	12	During lecturing
Room occupied	2	3	3	18	
Beamer doesn't work	2	3	3	18	
Wasted money	5	1	2	10	
People absent	3	3	3	27	
Bad evaluation	3	3	3	27	

Risk response matrix

After categorizing the risks a response need to be planned. This is done by building a response matrix.

Risk	Response	Trigger	Contingency	Responsible
People absent	Check inscriptions	Less than 4 inscriptions	Cancel lecture	Project Leader
Room occupied	Check in booking system the day before	People in the lecturing room.	Check with secretary who really has the booked and find a solution. Have phone numbers ready.	Trainer of that lesson
Beamer doesn't work	Check beamer day before	Beamer problems	Call 1000 and check availability of the portable beamer with secretary	Trainer of that lesson
Teacher ill	Mitigate : Share telephone numbers and prepare backup list	Call from trainer or trainer doesn't show up.	Backup takes over.	Trainer of that lesson
Spilling of money because of too much drinks ordered	Check and order appropriate based upon previous amount of attendees and inscriptions	<75% of inscriptions are present	Thank the people that did show up and tell you will feedback to course organizer	Trainer of that lesson
External complain	Only provide hard copies no soft copies	Formal complaint	Check with legal department how to proceed. Foresee 16 man-hours i.e. 320 euro.	Course organizer
Bad evaluation	More trainers, talk to team.	Evaluation score below 3 on a item	Discuss with trainer how to avoid	Project leader

Project execution

The first thing to be done at execution is to get the official approval for carrying out the project.

Project approval.

At a certain moment in time the plan is ready. The project manager goes to the sponsor with the Project management plan : Scope, Cost, Planning, HR plan, communication plan etc. He states to the sponsor "that's the answer to your charter". Is it oke, do you pay the bill?

The sponsor agrees with it or rejects it or asks for amendment. But from the moment it is signed, the plan will be carried out as such. The project manager is responsible for successful execution of it but has also full authority over it. Changes can only be allowed using the agreed change control procedure. Even if it is the CEO that wants a change, the project team first studies the impact and the impact is approved before the change is included in the plan.

We use the second chart from the stage gate see, initiate, appendix N, p. 54.

Verify scope

This is the process for formally accepting the completed project deliverables/tasks. Together with the sponsor/customer the deliverables are reviewed and declared accepted when completed satisfactorily. This is part of the sponsor/project manager weekly review meeting. Each week we review the project and accepted tasks/deliverables are taken up into the meeting minutes report.

Project performance

Once the project is started, it needs to be realized i.e. costs are made and value is created. Tasks become done when they meet the acceptance criteria. For the sake of simplicity we update the project as it is planned i.e. task are carried out when planned and in such way included in MS Project.

Project performance can be measured. The project performance is calculated just before the meeting between the project manager and the sponsor. It is weekly available. Table 3 shows the indices. The date is pulled from MS Project 2007. MS project uses

	PV	EV	AC	SV	CV	EAC	BAC	SPI	CPI	VAC
10/08/2010	4,587.32 €	3,053.45 €	3,053.45 €	(1,533.87 €)	0.00 €	103,278.48 €	103,278.48 €	0.67	1.00	0.00 €
17/08/2010	7,233.62 €	3,422.41 €	3,422.41 €	(3,811.21 €)	0.00 €	103,278.48 €	103,278.48 €	0.47	1.00	0.00 €
24/08/2010	8,315.64 €	7,391.38 €	7,391.38 €	(924.26 €)	0.00 €	103,278.48 €	103,278.48 €	0.89	1.00	0.00 €
31/08/2010	11,804.80 €	10,500.00 €	10,500.00 €	(1,304.80 €)	0.00 €	103,278.48 €	103,278.48 €	0.89	1.00	0.00 €
07/09/2010	14,324.32 €	10,800.00 €	10,800.00 €	(3,524.32 €)	0.00 €	103,278.48 €	103,278.48 €	0.75	1.00	0.00 €
14/09/2010	18,192.06 €	13,700.00 €	13,700.00 €	(4,492.06 €)	0.00 €	103,278.48 €	103,278.48 €	0.75	1.00	0.00 €
21/09/2010	23,660.33 €	22,003.19 €	21,363.19 €	(1,657.14 €)	640.00 €	100,274.45 €	103,278.48 €	0.93	1.03	3,004.03 €
28/09/2010	33,559.38 €	32,083.68 €	30,953.59 €	(1,475.70 €)	1,130.09 €	99,640.68 €	103,278.48 €	0.96	1.04	3,637.80 €
05/10/2010	43,001.21 €	41,661.25 €	38,611.25 €	(1,339.97 €)	3,050.00 €	95,717.51 €	103,278.48 €	0.97	1.08	7,560.97 €
12/10/2010	49,792.28 €	48,178.29 €	45,128.29 €	(1,613.99 €)	3,050.00 €	96,740.28 €	103,278.48 €	0.97	1.07	6,538.20 €
19/10/2010	59,147.63 €	53,918.74 €	49,043.73 €	(5,228.89 €)	4,875.01 €	93,940.65 €	103,278.48 €	0.91	1.10	9,337.83 €
26/10/2010	60,614.97 €	60,086.39 €	54,356.40 €	(528.58 €)	5,729.99 €	93,429.58 €	103,278.48 €	0.99	1.11	9,848.90 €
09/11/2010	66,389.83 €	65,418.41 €	58,898.41 €	(971.43 €)	6,520.00 €	92,985.11 €	103,278.48 €	0.99	1.11	10,293.37 €
16/11/2010	71,811.34 €	70,326.93 €	62,766.93 €	(1,484.41 €)	7,560.00 €	92,176.26 €	103,278.48 €	0.98	1.12	11,102.22 €
23/11/2010	81,866.40 €	80,329.42 €	69,839.42 €	(1,536.98 €)	10,490.00 €	89,791.62 €	103,278.48 €	0.98	1.15	13,486.86 €
30/11/2010	90,958.80 €	88,158.95 €	77,495.04 €	(2,799.85 €)	10,663.91 €	90,785.67 €	103,278.48 €	0.97	1.14	12,492.81 €
07/12/2010	95,659.84 €	94,689.20 €	82,129.20 €	(970.64 €)	12,560.00 €	89,579.16 €	103,278.48 €	0.99	1.15	13,699.32 €
14/12/2010	96,577.20 €	96,277.18 €	83,717.20 €	(300.02 €)	12,559.98 €	89,805.14 €	103,278.48 €	1.00	1.15	13,473.34 €
21/12/2010	98,001.20 €	97,701.20 €	85,141.20 €	(300.00 €)	12,560.00 €	90,001.49 €	103,278.48 €	1.00	1.15	13,276.99 €
04/01/2011	98,852.34 €	98,468.48 €	85,908.48 €	(383.86 €)	12,560.00 €	90,104.95 €	103,278.48 €	1.00	1.15	13,173.53 €
11/01/2011	99,295.19 €	98,968.48 €	86,408.48 €	(326.71 €)	12,560.00 €	90,171.50 €	103,278.48 €	1.00	1.15	13,106.98 €
01/02/2011	102,468.48 €	102,468.48 €	89,908.48 €	0.00 €	12,560.00 €	90,619.19 €	103,278.48 €	1.00	1.14	12,659.29 €

Table 3, the project performance indices as obtained from MS project.

The SPI index is below 1. The main reason for this is that the acceptance criteria are not % complete but use the 0/100 rule or the 50/50 rule i.e. a task can only be marked completed when it is fully done. The CPI index starts at one since all cost directly result in earned value. Remind here that the costs for a lecture is related to the amount of people that attend. It is scheduled for 20 people, however typically less people attend resulting in a lecture that is completed at a lower cost. Therefore the CPI index goes above one from the moment lectures are given. Figure 10 shows as a function of time the earned value, planned value and actual cost. The graphs earned value and planned value are on top of each other since MS project uses % rule for the calculation.

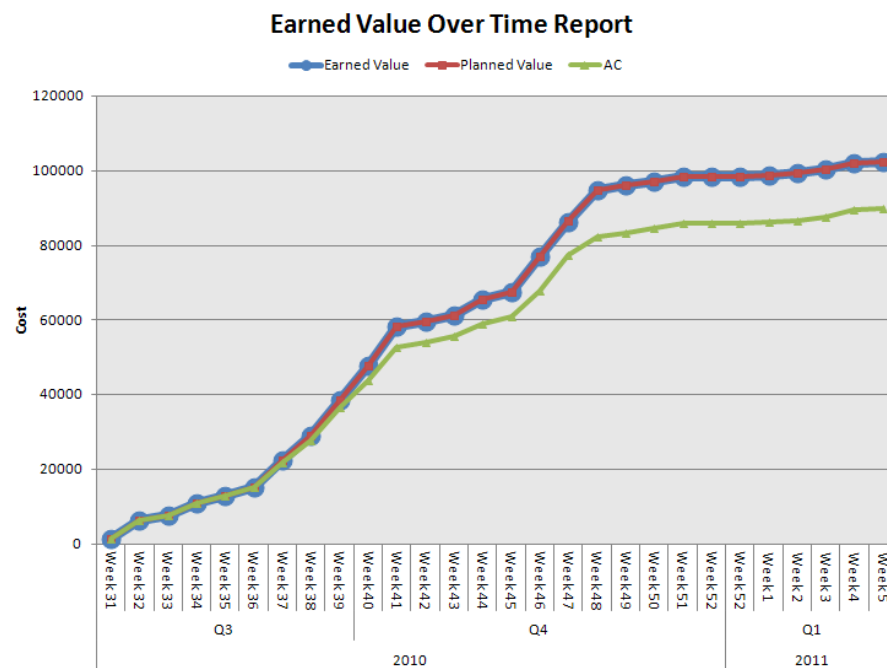


Figure 10 : Earned value, Planned value and actual cost as a function of time

Finally I want to remark here existence and usage today of earned schedule management. Earned schedule management (SV(t) and SPI(t)) outperforms earned value management when it comes down to forecasting the end time of a project. Therefore it is best to use the combination to estimate upfront when a project will be finished and at what budget. Earned schedule management is relatively new and not standard available in MS project 2007, it requires another software tool or some extra programming[VV06].

Quality measurements

All the individual quality measurements after each lecture can be found back in appendix L, p. 52. We summarize the scores in figure 11.

		Typical	Course
Program	Organization of the training	3.93	4.33
	Quality of the content	4.05	4.39
	Relevance to my work	3.63	4.26
	Training adjusted to your needs	3.47	4.27
	Format of the training	3.71	4.30
	Duration of training	3.54	4.21
	Learning material	3.58	4.30
	Syllabus, documentation	3.37	4.25
Trainer	Knowledge of the subject	4.34	4.53
	Theoretical and practical approach	3.84	4.42
	Way of teaching	3.93	4.26
	Interaction with the participants	3.8	4.31
	Answering questions	3.91	4.35
Overall	Overall satisfaction	3.89	4.32
	Location	4.18	4.37
	Catering (drinks, meals)	3.33	4.34

Figure 11 The data that shows that the training meets the imec quality standards.

Issue log and change request

The change request log and issue log can be found in appendix O, p.55. A clear example of scope creep in this project is the external request of an attendee to video tape the lectures in the auditorium. It is a nice idea an added value, but it puts extra work on the team for organizing this. On the other hand this can be a motivator for the trainers. The trade off needs to be made by the team. Thus a way of dealing with this change request, change management procedure should be followed i.e. a brief talk with the affected stakeholders.

Is the target achieved

Up to now all information provided was related to the planning and execution of the project. At the end the question is "are the objectives achieved"? . Lets walk through the meeting reports with the sponsor. These can be found back on the project folder.

D.1	The organization of 15 lectures on dry etching
D.2	Lecture notes for every attendee
D.3	The organization of an examination
D.4	For each lecture an evaluation report meeting the quality standards of imec lecturing
D.5	A weekly report on the project progress and issues
D.6	At least 150h of training from people from the patterning department should be registered.

D.1 Lecture notes for every attendee has been provided

Every attendee got his lecture note, we had to consume a little of the risk budget because on an extra attendee. The formal acceptance of this deliverable can be found back in the meeting minutes with the sponsor.

D.2 At least 150h of training from the people from the patterning department should be registered.

We have 347 hours of registered training achieved. Looking back into the attendee list 304 hours are coming from people from the patterning department. The sponsor acceptance of this deliverable can be found back in the meeting minutes between sponsor/project leader.

D.3 The organization of 15 lectures on dry etching

The 15 sessions on dry etching had been organized. This can be found back in the meeting minutes with the sponsor where this deliverable has been formally accepted.

D.4 For each lecture an evaluation report meeting the quality standards of imec lecturing.

We have this report for most of the sessions except for the one on October 4th. We only scored for one item at one particular session a 3. Nevertheless the sponsor agreed to accept this deliverable as such.

D.5 A weekly report on project progress and issues

This is available on the project folder. The sponsor acceptance of this deliverable can be found back in the meeting minutes between sponsor/project leader

D.6 A special session on dry etch for the support people

Session two is devoted to the support people and has been given. Eight people attended. Therefore this deliverable is accepted by the sponsor.

D.7 A homework task and related presentation for each attendee.

Several homework's have been distributed throughout the course. Not all attendees were present always. A core set of people however presented their homework's in dedicated session. Therefore the sponsor accepted the deliverable as achieved.

D. 8 The organization of an examination that proves the knowledge transfer.

An examination had been organized. However only 4 people attended the examination and passed it. The project could have been more successful if more people would have attended this examination.

It can be concluded that the deliverables are achieved. But did the project stay within budget and timing. The story of the budget can be found back in the project performance indicators. The initial budget foreseen was 113606.13 € (planned and risk budget). At the end 89908.48 € is consumed, thus we stayed well in budget. And finally on timing, all trainings were held before Januari 1st.

Lessons learned&suggestions for improvement

Following recommendations were made by the attendee's. Most recommendations come on the home work and examination task.

- On the examination : to give more exercises that require thinking instead of copying from the course
- On the examination : to do a close book examination
- On the session on home work : make two sessions out of it so more time is available to explain your findings.
- On the 1st lecture : leave out the ugly pictures on skin wounding that are treated by plasma.
- The change of a data a lecture is given is not appreciated.

These findings can be included, be a topic of discussion when the lectures need to be reorganized. It's a way to ensure improvement.

Conclusion

The organization of a course on dry etch had been taken as a project to write this master thesis on Different aspects of the PMBOK have been worked through on this relatively small project.

- Project Scope management: The identification of the different stakeholders and collection of their requirements from the different stakeholders has been used to write down the scope and to create the deliverables. The procedure for change control is defined.
- Project time management: The WBS structure has been setup in MS project taking care of the scheduling and resourcing of each activity.
- Project cost management: By means of the WBS, HR and risk plan the budget baseline is created.
- Project quality management : during the creation of the plan quality is embedded. Quality is assured by means of measuring and feedback. At the end the quality standards are met.
- Project Human resource management : The different profiles have been identified and a baseline was created. Time for team building and management is foreseen in different activities going from kick off to a closure meeting for adjourning.
- Project Risk Management : different risk have been identified and mitigation and contingency plans have been setup. Risk budget is foreseen and incorporated in the plan.

Stepping back from the planet PMBOK to the real live at work, there is still a way to go. It is a change and again it is up to the organization till which extend we foresee to educate people and plan proactively, use knowledge from the past to take care of the future. The project itself would have been improved if proper resource planning would have been applied but this takes a higher level of maturity.

Personal learning's and view on the organization

Following the master in project management and building a thesis on this matter was a journey for me. It opened up my eyes, entering a new interesting world that refreshed my mind with new knowledge. The most important learning point for me is that I should stand up, lead and ask what I really need. I decided to do so. Of course this change has an impact on my environment and it wasn't always easy I'm grateful to the signs of understanding and support offered around me. Let's see what the future brings.

View on the organization

Before diving into project management in the organization I would like to open up the topic i.e. there is more than only project management. An organization has a vision and mission and a strategy. First all employees should understand what the strategy is, which objectives we want to realize together as an organization.

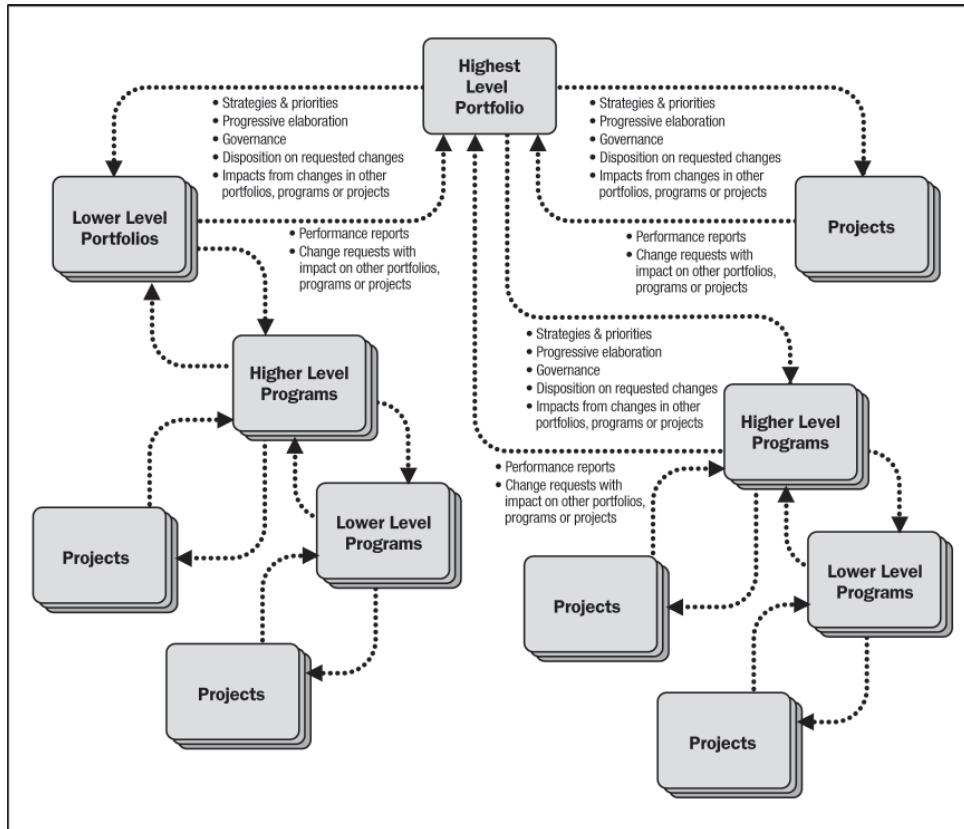


Figure 12 Overview of information streams between portfolios, programs and projects

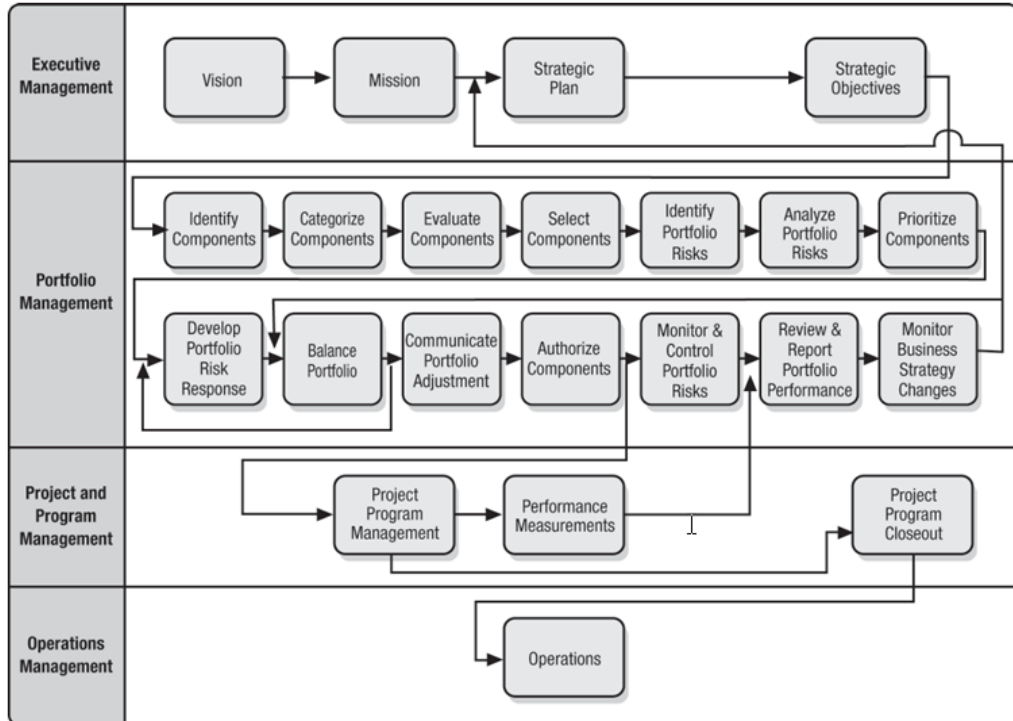


Figure 13 The portfolio management process.

Imec has a strategy i.e. our common goals are available for everybody. Important here is that we quantify the goals so we can measure if we are able to realize the

strategy. It is at this point that project's, programs and portfolio management come into play. Projects point to deliverables while programs and portfolios are more closely linked to business and strategic objectives and the management of multiple components. There are standard's as well available for program and portfolio management [PM08b], [PM08c]. By means of projects, programs and portfolio one schedules the scarce resources for realizing the strategy, see figure 12, 13. It is about selecting and doing the right things. Of course keeping balance with the operational activities that can be part of a larger portfolio, see figure 14.

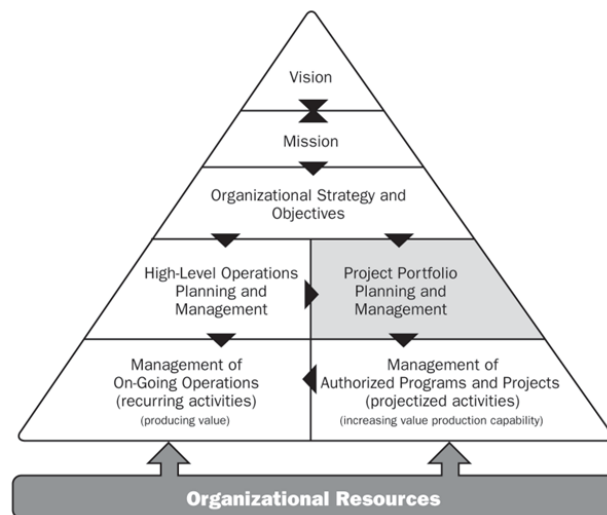


Figure 14: Balance resources between recurring activities (operations) and new activities (projects)

Programs and portfolio's are at the lowest level build out of projects, let's call them the building blocks. It is therefore important to be successful in running projects. The methods and techniques learned in this course can contribute to the success of a project and measuring performance but it takes time to carry them out. Project management should be seen as a tool to achieve certain objectives. A project manager is lead by achieving certain goals in the most cost effective and timely manner. Therefore leadership and education is needed. People that stand or fall with the success of their project and time should be foreseen for doing the job. Looking to the latest Letter from the CEO I can only answer that professional project/program and portfolio management is an answer to the needs of the organization.

Although we are an internationally recognized institute I want to emphasize that there is still a way to go. At the time that the project, described in this thesis was carried, out there was no standardized way of carrying out projects. Ideas popped up and resources were appointed in an ad hoc manner pointing to the lowest maturity models for project management in a organization [MP09]. At today's date the first procedures and evidence of stage gating is present.

Literatuur

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Appendix A Announcement of the program 04/08/2010

Hi,

As announced and internal dry etch training will be organized. Attached you can find the dates/rooms. Notes will be provided for the persons who notify me of their presence on the lectures, before September 7th (I delayed it a little bit). Currently, I have BT Chan (solar), Maarten, Ingrid, Frederic, Peter and Werner and Xu Kaidong from the etch group. The special edition for support will be attended by Jef, Toon and Kristen (new starter). Finally a short summary of the lectures :

Lecture 1 : Plasma's in our daily live

This part will deal with the history of plasma's and a walk through all the plasma's that surround us. The lecture is taken from Christophee Vallee, University Joseph Fourier Grenoble.

Lecture2 : Basic Dry etch Package – Special support edition

This is the introduction to dry etching where the very basics (why a plasma is used for etching, selectivity, anisotropy, tools, etc) are explained targeting starters in the etch group and the support people.

Lecture 3&4 : Fundamentals 1&2 (taken from Coburn's lectures)

Definitions, Vacuum aspects, Pattern transfer, what is plasma, electron energy distribution & crossections, species, anisotropy, relative concentrations, Mobility, Potentials, capacitive coupling, inductive coupling, frequency dependency, reactor geometries

Lecture 5&6 : The physics of RF discharges 1&2 (taken from Coburn's lectures)

Time variation of potentials, symmetric- assymmetric systems, sheaths, ion distribution, frequency effects, Plasma potential, high density plasma's, ICP, ECR, MERIE, helicon.

Lecture 7 : Anisotropy mechanisms (taken from Coburn's lectures)

Reactive Ion Etching, neutral-ion flux, halogen size effect, sidewall passivation,

Lecture 8&9 : The etching of silicon and it's compounds and Assisted Phenomena 1&2 (taken from Coburn's lectures)

Silicon, SiliconOxide, SiliconNitride, Carbon blocking, Loading, Silicon (deep) trench etching

Lecture 10 : The etching of Other materials (taken from Coburn's lectures)

Aluminum, Organics, Ti, W, Silicide, III-V compounds, GaN, II-VI, Cr, Cu, ...

Lecture 11 : Plasma diagnostics (taken from Coburn's lectures)

Optical emission, actinometry, Mass spectroscopy & and the probes within the dry etch group

Lecture 12 : Equipment related topics (taken from Coburn's lectures)

Non-uniformity, wall interactions, contamination, chemically assisted ion beam etching,

Exercise : Our sanity check on our tools by support 30 min contribution from support still to be scheduled.

Regards,

Eddy, Dries, Denis

Appendix B Announcement of the program at 16/09/2012 by imec academy

Dear all,

Hereby I confirm your registration for the Dry etch training for following lectures:

(Some of you may already have received a confirmation before, but dates and rooms changed in the meantime)

- Lecture 1: Plasma's in our daily live - Eddy Kunnen - TOMORROW - 16h-17h30
- imec 4/3B
- Lecture 3&4: Fundamentals 1&2 (taken from Coburn's lectures) - Eddy Kunnen
- 24/09/2010 (CAF -1B) and 27/09/2010 (CAF -1A) - 16h-17h30
- Lecture 5&6: The physics of RF discharges 1&2 (taken from Coburn's lectures)
- Denis Shamiryan - 01/10/2010 (imec 3/1A) and 04/10/2010 (CAF -1B) - 16h-17h30
- Lecture 7: Anisotropy mechanisms (taken from Coburn's lectures) - Dries Dictus - 08/10/2010 - 16h-17h30 – imec 3/1A
- Lecture 8&9: The etching of silicon and it's compounds and Assisted Phenomena 1&2 (taken from Coburn's lectures) - Eddy Kunnen - 15/10/2010 (imec 3/1A) and 05/11/2010 (imec 3/1A) - 16h-17h30
- Lecture 10: The etching of Other materials (taken from Coburn's lectures) - Dries Dictus - 12/11/2010 - 16h-17h30 – imec 3/1A
- Lecture 11: Plasma diagnostics (taken from Coburn's lectures) - Dries Dictus/Denis Shamiryan/Vladimir Samara - 15/11/2010 - 16h-17h30 – imec 4/3B (raadzaal)
- Lecture 12: Equipment related topics (taken from Coburn's lectures) - Dries Dictus - 19/11/2010 - 16h-17h30 – imec 3/1A
- Lecture 13: Wet strip - Kaidong Xu - 22/11/2010 - 16h-17h30 – CAF -1B
- Exercise: TBC (Our sanity check on our tools by support 30 min.)

Kind regards,

Annelies

Appendix C The charter



Problem Description / Business Reason(s)	
<ul style="list-style-type: none"> Improve the knowledge and performance of new dry etch people 	
<p>High Level Objectives</p> <p>Type here – What do we want to achieve?</p> <ol style="list-style-type: none"> Ensure that the knowledge is transferred, gained. Ensure that it was a positive experience for the attendees. Lecture material should remain available for the attendees. 	<p>Customer</p> <p>Type here – Who is the customer for this project?</p> <ol style="list-style-type: none"> New dry etch people Other people can attend.
<p>Project Organization – Estimated Workload</p> <p>Project Manager : <u>7 Mandays</u> Trainers : <u>25 Mandays</u> Secretary : <u>7 Mandays</u> Attendees : <u>60 Mandays</u></p>	<p>Scope</p> <p>Type here – Mark out what's in the scope of the lecture Following the PMBOK, the charter is input for the scope and this is a little early.</p>
	<p>Out Scope</p> <p>Type here – Clearly mention what's not part of this project Constructing of new lecture material. It should be based on existing ones.</p>

Appendix D Stakeholder register

Stakeholders	Role	Information	Stakeholder identification	Impact	Approach strategy	Need information	Communication Plan	When
							from whom	
Eddy	Project Leader/Main Trainer	A little bored by the topic but will do the job. Wants to spice the training with homework and do an examination to ensure knowledge	organization of trainings is with him	Impact	hmm, love peace and understanding, give room works best	All	All	ad hoc and scheduled
Bart Demeij	Manager of training centre	Support of internal trainings is key to him, as well as the collecting of these trainings	Boss of Annelies		Straight talking. Is ok.	Project performance	Annelies	ad hoc
Dries	Main Trainer	Finishing his PhD. Moving to another company because no money to stay at imec. Difficult to get bug in but if a ges: is achieved a good job is done. Preferably the lowest effort	Trainer has a major impact on how the training is perceived by the attendees.		Looking to the information and situation an escalation path is required -> group leader	Project Plan&Changes • Project performance	Eddy	Scheduled face to face
Denis	Main Trainer	Building his house, moving to another company. Will do the job but is not really excited. Is openminded. Needs to learn the sides, preferable lowest effort possible.	Trainer has a major impact on how the training is perceived by the attendees		Straight talking. Is ok.	Project Plan&Changes • Project performance	Eddy	Scheduled face to face
Annelies	Logistics	Verg supportive, professional is located in another building. From imec acadamy, these initiatives are important to them since they	smooth communication, organization		email	Project Plan&Changes • Project performance	Eddy	Scheduled face to face
Claire	Logistics	Verg supportive, professional	Maps with the lecture material		Straight talking. Is ok.	Number of maps	Eddy	scheduled and ad hoc
Anemie	Logistics	Verg supportive, professional	Maps with the lecture material		Straight talking. Is ok.	Number of maps	Eddy	scheduled and ad hoc
Kaidong	Trainer	Fresh new team leader, new to the field but brings in expertise on wet etch. Attendee as well as trainer	Trainer has a major impact on how the training is perceived by the attendees		Straight talking. Is ok.	Project Plan&Changes • Project performance	Eddy	Scheduled face to face
Jan	Trainer	Attendee from beyond the etch area but dealing with the gases and is motivated to give a lecture on this	Trainer has a major impact on how the training is perceived by the attendees		Straight talking. Is ok.	Project Plan&Changes • Project performance	Eddy	Scheduled face to face
Alesey	Trainer	Enthusiastic member of the etch group	Trainer has a major impact on how the training is perceived by the attendees		Straight talking. Is ok.	Project Plan&Changes • Project performance	Eddy	Scheduled face to face
Wladimir	Trainer	New post in the etch group with expertise on plasma probes	Trainer has a major impact on how the training is perceived by the attendees		Straight talking. Is ok.	Project Plan&Changes • Project performance	Eddy	Scheduled face to face
Mireille	Department head/attendee	New departement head, limited knowledge on etching	Showing up at the training can have considerable impact on the attendees		Straight talking. Is ok.	Program content	Eddy	ad hoc
Verner	Group leader/sponsor	Sponsor	Showing up at the training can have considerable impact on the attendees		Straight talking. Is ok.	Project Plan&Changes • Project performance	Eddy	scheduled, weekly
Attendees from the etch group	attendee	all course information is ok	Evaluate the training		Straight talking. Is ok.	Program content and schedule	Annelies	reminder the day before the
Attendees from the support group	attendee	Some course information is to specialized, a special lessons for support people is	Evaluate the training		Straight talking. Is ok.	Program content and schedule	Annelies	reminder the day before the
Attendees beyond the department	attendee		Evaluate the training		Straight talking. Is ok.	Program content and schedule	Annelies	reminder the day before the

Appendix E Stakeholder requirements

Requirements	MosCoW: M=Must Have (4 points), S=Should Have (3points), C=Could Have (2points), W=W'ont have (0 points), NA = not applicable (0 points)													Must	Should	Could	W'ont	NA	Check sum	Total			
	Eddy	Bart D.	Dries	Dennis	Annelles	Claire	Annenie	Kaldong	Jan	Alexey	Vladimir	Mireille	Werner								People from etch group	People from support group	People beyond department
Lecture notes distributed in advance	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	16	0	0	0	0	0	16	64
Lecture in English given	M	M	M	M	NA	NA	NA	NA	NA	M	M	M	M	M	M	12	0	0	1	3	16	48	
Trainings on Friday 16u00-17u30	M	NA	C	C	NA	NA	NA	S	C	S	S	S	C	W	S	1	6	4	1	3	15	30	
Special Session for support	M	S	C	C	NA	NA	NA	C	C	C	C	M	S	M	NA	3	2	7	0	4	16	32	
A homework task for everybody	M	C	C	C	NA	NA	NA	C	C	S	W	W	W	C	W	1	2	6	4	3	16	22	
Evaluation of each training	M	M	C	C	NA	NA	NA	S	S	C	M	S	C	C	C	3	4	6	0	3	16	36	
Attendance list	M	M	C	C	NA	NA	NA	C	C	S	C	M	S	C	C	3	2	8	0	3	16	34	
An examination : test your knowledge	M	S	C	C	NA	NA	NA	W	C	S	W	C	W	W	W	1	3	4	5	3	16	21	
Using existing training material	M	C	M	M	NA	NA	NA	S	M	C	S	M	C	W	W	5	2	5	1	3	16	36	
Coffee on each training	M	M	M	M	NA	NA	NA	S	S	S	S	S	M	S	S	5	8	0	0	3	16	44	
Water on each training	M	M	M	M	NA	NA	NA	S	S	S	S	S	M	S	S	5	8	0	0	3	16	44	
Orange Juice on each training	S	C	S	C	NA	NA	NA	C	S	S	S	S	C	S	C	0	8	5	0	3	16	34	
At least 5 people should attend to get the training KPI of the departement on target this year																							
Progress reporting on the project	M	M	C	C	S	S	S	M	C	S	S	M	S	M	S	5	7	4	0	0	16	49	
	M	M	S	S	S	NA	NA	C	C	C	C	M	W	W	W	3	4	4	3	2	16	32	

Appendix F The acceptance Criteria

Each task has acceptance criteria. I used MS project to define the acceptance criteria for each task. They can be found back in a seperated column and a report is generated to show them.

ID	AcceptCriteria	Task Name	Duration	Work
1		Dry Etch Course ST260	120.34 days	1,021.88 hrs
2		Announcement	32 days	9 hrs
3	0:100 rule ...	Announcement in dry etch group	1 day	1 hr
	Notes			
	0:100 rule			
	1) Presented on dry etch meeting of June 28th			
	2) Announcement by email to all people from patterning department has been sent			
4	0:100 rule ...	Communication of the program in department	1 day	1 hr
	Notes			
	0:100 rule	Program with the dates, rooms and content appears on the intranet portal		
5	5:0:50 rule ...	Collecting the inscriptions	29 days	4 hrs
	Notes			
	5:0:50 rule			
	Start is "first person enrolled"			
	End is complete list of attendees has been sent to project manager			
6	0:100 rule ...	Reservation of the rooms	29 days	2 hrs
	Notes			
	0:100 rule	List of rooms has been communicated to attendees and project manager by email		
7	0:100 rule ...	New trash with in me ec	1 day	1 hr
	Notes			
	0:100 rule	News flash by email has been sent to all imec employees containing the dry etch course		
8		Preparation of the lecture material	7 days	8 hrs
9	0:100 rule ...	Make copies and put into maps	7 days	8 hrs
	Notes			
	0:100 rule	20 maps with lecture notes of lecture 3, 4, 5, 6, 7, 8, 9, 10 and 12 are given to project manager		
10		Lecture 1 - plasma's in our daily live	16.34 days	52.92 hrs
11	0:100 rule ...	Prepare lecture	7 days	17 hrs
	Notes			
	0:100 rule	1) Power point presentation is ready and printed 20 times		
	2) Coffee, water and orange juice for 20 persons is ordered			
12	0:100 rule ...	Distribute lecture	0.5 days	1 hr
	Notes			
	0:100 rule	All attendees received a map with the lecture notes of lecture 1,3,4,5,6,7,8,9,10 and 12		

Appendix G The requirements traceability Matrix

In this matrix you can find how the approved requirements are related to specific tasks in the project.

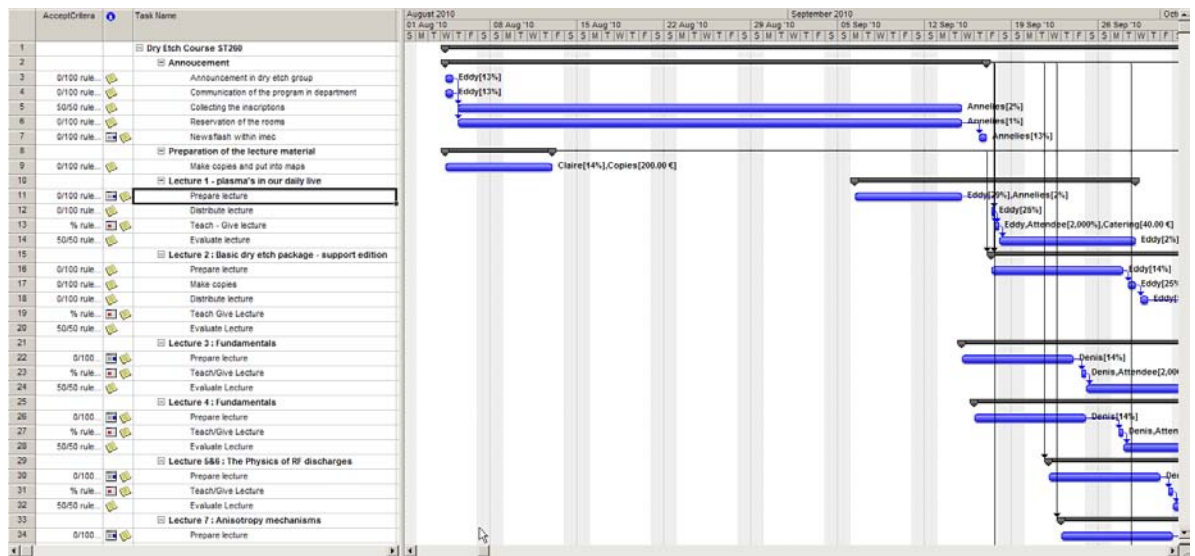
Requirements	Total	Associated Deliverable	Main task ID
Lecture notes distributed in advance	64 D.1	Lecture notes for every attendee	55,58,64
At least 5 people should attend to get the training KPI of the departement on target this year	49 D.2	At least 150h of training from people from the patterning departement should be registered	51,59,65,69,73,77,81,85,89,93,97,101,105,109,113,117
Lecture in English given	48 D.3	The organization of 15 lectures on dry etching	50,53,56,61,67,71,75,79,83,87,91,95,99,103,107,111,115
Water on each training	44 D.4	For each lecture an evaluation report meeting the quality standards of imec lecturing	56,61,67,71,75,79,83,87,91,95,99,103,107,111,115
Coffee on each training	44 D.4	For each lecture an evaluation report meeting the quality standards of imec lecturing	56,61,67,71,75,79,83,87,91,95,99,103,107,111,115
Using existing training material	36 D.1	Lecture notes for every attendee	55,58,64
Evaluation of each training	36 D.4	For each lecture an evaluation report meeting the quality standards of imec lecturing	60,66,70,74,78,82,86,90,94,98,102,106,110,114,
Orange Juice on each training	34 D.4	For each lecture an evaluation report meeting the quality standards of imec lecturing	56,61,67,71,75,79,83,87,91,95,99,103,107,111,115
Attendance list	34 D.4	For each lecture an evaluation report meeting the quality standards of imec lecturing	56,61,67,71,75,79,83,87,91,95,99,103,107,111,115
Progress reporting on the project	32 D.5		15,23-47,
Special Session for support	32 D.6	Not a specific deliverable, it is lecture nr. 2	61
Trainings on Friday 16u00-17u30	30 D.3	The organization of 15 lectures on dry etching	50,53,56,61,67,71,75,79,83,87,91,95,99,103,107,111,115
A homework task for everybody	22 D.7	A homework task and related presentation for each attendee	111
An examination : test your knowledge	21 D.8	The organization of an examination that proves the knowledge transfer is held	115

Appendix H The Work Break Down Structure

Only the high level WBS and a screenshot of a detailed level is given since the detailed simply doesn't fit on a page.

	AcceptCriteria	Task Name	Duration	Work	Cost	Start
1		☐ Dry Etch Course ST260	120.94 days	1,021.68 hrs	102,978.48 €	Wed 04/08/10 9:00 AM
2		☐ Annoucement	32 days	9 hrs	900.00 €	Wed 04/08/10 9:00 AM
8		☐ Preparation of the lecture material	7 days	8 hrs	1,000.00 €	Wed 04/08/10 9:00 AM
10		☐ Lecture 1 - plasma's in our daily live	16.94 days	52.92 hrs	5,332.00 €	Mon 06/09/10 9:00 AM
15		☐ Lecture 2 : Basic dry etch package - support edition	25.5 days	58 hrs	5,850.00 €	Fri 17/09/10 9:00 AM
21		☐ Lecture 3 : Fundamentals	15.07 days	44.4 hrs	4,480.00 €	Tue 14/09/10 5:00 PM
25		☐ Lecture 4 : Fundamentals	15.07 days	44.4 hrs	4,480.00 €	Wed 15/09/10 5:00 PM
29		☐ Lecture 5&6 : The Physics of RF discharges	15.07 days	44.4 hrs	4,480.00 €	Tue 21/09/10 5:00 PM
33		☐ Lecture 7 : Anisotropy mechanisms	15.07 days	44.4 hrs	4,480.00 €	Wed 22/09/10 5:00 PM
37		☐ Lecture 8 : The etching of silicon and its compounds	15.07 days	43.28 hrs	4,368.00 €	Tue 28/09/10 5:00 PM
41		☐ Lecture 9 : The etching of silicon and its compounds	15.07 days	43.28 hrs	4,368.00 €	Tue 05/10/10 5:00 PM
45		☐ Lecture 10 : The etching of other materials	15.07 days	44.4 hrs	4,480.00 €	Fri 22/10/10 5:00 PM
49		☐ Lecture 11 Gases beyond the etch tool	14.94 days	44.4 hrs	4,480.00 €	Wed 03/11/10 9:00 AM
53		☐ Lecture 12 : equipment related topics	15.07 days	48.4 hrs	4,880.00 €	Mon 08/11/10 5:00 PM
57		☐ Lecture 13 : Wet Strip	15.07 days	48.4 hrs	4,880.00 €	Tue 09/11/10 5:00 PM
61		☐ Lecture 14 : Plasma diagnostics	15.07 days	54.62 hrs	5,502.48 €	Tue 16/11/10 5:00 PM
65		☐ Lecture 15 : Home work presentation	55.07 days	87.78 hrs	8,818.00 €	Fri 17/09/10 5:00 PM
69		☐ Session 16 Examinations	22.07 days	62.6 hrs	6,300.00 €	Tue 23/11/10 5:00 PM
74		☐ Closure	7 days	2 hrs	200.00 €	Thu 23/12/10 5:31 PM
76		☐ Meetings	120.94 days	237 hrs	23,700.00 €	Wed 04/08/10 9:00 AM

High Level WBS



Detailed WBS and schedule

Appendix I An example of the cost estimations

ID	Task Name	Duration	Work	Cost	Resource Names
1	Dry Etch Course ST260	120.94 days	1,016.68 hrs	802,378.48 €	
2	Announcement	32 days	9 hrs	900.00 €	
3	Announcement in dry etch group	1 day	1 hr	100.00 €	Eddy(13%)
4	Communication of the program in department	1 day	1 hr	100.00 €	Eddy(13%)
5	Collecting the micrographs	29 days	4 hrs	400.00 €	Anneles(7%)
6	Reservation of the rooms	29 days	2 hrs	200.00 €	Anneles(7%)
7	Newsflash with imec	1 day	1 hr	100.00 €	Anneles(13%)
8	Preparation of the lecture material	7 days	8 hrs	1,000.00 €	Clare(14%),Copies(200.00 €)
9	Make copies and put into maps	7 days	8 hrs	1,000.00 €	Clare(14%),Copies(200.00 €)
10	Lecture 1 - plasmas in our daily live	16.94 days	62.92 hrs	5,332.00 €	
11	Prepare lecture	7 days	17 hrs	1,700.00 €	Eddy(25%),Anneles(2%)
12	Distribute lecture	0.5 days	1 hr	100.00 €	Eddy(25%)
13	Teach - Give lecture	0.19 days	31.92 hrs	3,232.00 €	Eddy,Attendee(2,000€),Catering(40.00 €)
14	Evaluate lecture	7 days	2 hrs	300.00 €	Eddy(2%),Anneles(2%),Attendee(2%)
15	Lecture 2 : Basic dry etch package - support edition	25.5 days	58 hrs	8,659.00 €	
16	Prepare lecture	7 days	8 hrs	800.00 €	Eddy(14%)
17	Make copies	1 day	2 hrs	210.00 €	Eddy(25%),Copies(10.00 €)
18	Distribute lecture	1 day	1 hr	100.00 €	Eddy(13%)
19	Teach Give Lecture	0.5 days	44 hrs	4,440.00 €	Eddy,Attendee(1,000€),Catering(40.00 €)
20	Evaluate Lecture	7 days	2 hrs	300.00 €	Anneles(2%),Eddy(2%),Attendee(2%)
21	Lecture 3 : Fundamentals	15.07 days	44.4 hrs	4,489.00 €	
22	Prepare lecture	7 days	8 hrs	800.00 €	Denia(14%)
23	Teach/Give Lecture	0.19 days	31.92 hrs	3,232.00 €	Denia,Attendee(2,000€),Catering(40.00 €)
24	Evaluate Lecture	7 days	4.40 hrs	440.00 €	Anneles(2%),Eddy(2%),Attendee(2%),Denia(2%)
25	Lecture 4 : Fundamentals	15.07 days	44.4 hrs	4,489.00 €	
26	Prepare lecture	7 days	8 hrs	800.00 €	Denia(14%)
27	Teach/Give Lecture	0.19 days	31.92 hrs	3,232.00 €	Denia,Attendee(2,000€),Catering(40.00 €)
28	Evaluate Lecture	7 days	4.40 hrs	440.00 €	Anneles(2%),Eddy(2%),Attendee(2%),Denia(2%)
29	Lecture 5&6 : The Physics of RF discharges	15.07 days	44.4 hrs	4,489.00 €	
30	Prepare lecture	7 days	8 hrs	800.00 €	Denia(14%)
31	Teach/Give Lecture	0.19 days	31.92 hrs	3,232.00 €	Denia,Attendee(2,000€),Catering(40.00 €)
32	Evaluate Lecture	7 days	4.40 hrs	440.00 €	Anneles(2%),Eddy(2%),Attendee(2%),Denia(2%)
33	Lecture 7 : Anisotropy mechanisms	15.07 days	44.4 hrs	4,489.00 €	
34	Prepare lecture	7 days	8 hrs	800.00 €	Ories(14%)

Appendix J Evaluation form used for a lecture



EVALUATION FORM



TRAINING: Dry etch training: Plasma's in our daily life TRAINER: Eddy Kunnen

RETURNED FORMS: 13 DATE: 17/09/2010

Thank you for your comments and suggestions! This will help us to improve the training program.

		Not satisfied				Very satisfied			
PROGRAM	Organization of the training					3	9	4.75	
	Quality of the content					4	8	4.67	
	Relevance to my work			1	2	3	7	4.23	
	Training adjusted to your needs				2	6	5	4.23	
	Format of the training					5	7	4.58	
	Duration of training				1	4	7	4.50	
	Learning material					4	9	4.69	
	Syllabus, documentation					2	11	4.85	
What did you find interesting?	A lot of examples Historical facts Movies, pictures, relevance with daily life Nice introduction to the plasma in the universe								
What would you leave out?	Same annoying ugly pictures								
Additional remarks to the program									
TRAINER	Knowledge of the subject					6	7	4.54	
	Theoretical and practical approach					5	8	4.62	
	Way of teaching					3	9	4.75	
	Interaction with the participants				1	3	9	4.62	
	Answering questions					4	7	4.64	
	Additional remarks								
OVERALL	Overall satisfaction					5	7	4.58	
	Location					3	10	4.77	
	Catering (drinks, meals)				1	3	8	4.58	
	I would recommend this training	YES	11	NO					
	What did you particularly appreciate?	A very good introduction							
	In contrast, what would you have liked?								
	Other remarks, suggestions	Nice appetizer: looking out for next time							

Please return this form to Annelies Maas-Kathleen Vanderheyden INVOMECH - MTC - 12/1.10

Appendix K Examination questions

1. Which electron impact reactions are possible in plasma?
2. What are ions, radicals, molecules?
3. Which species can emit light?
4. What is sheath?
5. What happens if you put an isolated object into plasma?
6. What is floating potential?
7. What is plasma potential?
8. What is the difference between CCP and ICP source?
9. Why several frequencies are used in CCP reactors?
10. Give 10 different applications/examples of a plasma that are not related to semiconductor/silicon processing.
11. Draw a tube that is used by Faraday and other scientists to study a plasma.
 - a. Indicate on this tube the Anode, Cathode (which is positive, which negative)
 - b. Sheath
 - c. Dark space
 - d. Luminescent area
 - e. Which species cause the plasma to ignite? How were these species called initially? Who discovered the mechanism of plasma ignition?
 - f. What is the name of this tube ?
12. Dry etching is related to phase transition from a solid material to a
13. Explain ion – assisted etching and how it is related to anisotropic etching
14. Next to the ion- assisted etching a second phenoma is important for control profile control. Which phenoma is this and explain how it is related profile control/anisotropic etching.
15. Give the atom-atom bond energy for
 - a. Si, SiO, SiN, SiC, Si-F, Si-Cl, Si-Br, Si-I, C-O
16. Which chemistry is typically used for etching silicon selective to SiO
17. Who was Heinecke
18. Explain how you can etch oxide selective to silicon
19. Provide a chemistrie that can etch SiC and explain why.
20. Can you provide a chemistrie that has potential to etch SiC selective to oxide and why you think this chemistrie has potential.
21. What is scalloping and to which etch process is it related.

22. What are the main differences between the distribution of manifold gasses and bunker gasses ?
23. What are the functions of a droppoint ?
24. A researcher experiments with SiCl_4 and tests a higher gasflow as what was mentioned in the Proces Defenition Sheet. After 30 seconds the gasflow stops. What could be the cause and why
25. Which sensor wafer is capable providing spatial information on electrical characteristics of plasma?
 - a. PlasmaTemp.
 - b. PlasmaVolt
26. A decrease of He backside pressure will lead to
 - a. an increase of wafer surface temperature.
 - b. an improved heat dissipation through ESC.
27. The higher Bias in the recipe means
 - a. more energetic ions, so that the wafer temperature should drop.
 - b. less energetic ions but no any wafer temperature change.
 - c. more energetic ions, so that the wafer temperature will rise.
28. Why does spatially resolved in situ characterization provide the real value in process development?
29. What are main plasma properties and they typical values (order of magnitude)?
30. What are main plasma diagnostics techniques and they relative advantages/disadvantages
31. Is Langmuir probe commonly used in commercial etching chambers and if not, why?
32. Which parameters impact the desorption process during plasma etch.
33. Which methods kan you apply to influence across wafer uniformity
34. Explain that a plasma emits light.
35. Please explain in words what mixtures are the following short forms: SPM, SOM, APM, SC1, SC2. Please list 1 application for each mixture.
36. Is the following statement true or false? – FEOL cleans typically involve more than 1 chemistry steps in a process while BEOL cleans tend to have a single chemistry step, excluding rinse and drying steps.
37. If you reach this question I would like you to fill out the evaluation form and feedback what you think of this exercise.

Appendix L The Quality results

Les	1	2	3	4	5	6	7	8
Date	17-Sep-10	24-Sep-10	27-Sep-10	1-Oct-10	4-Oct-10	8-Oct-10	13-Oct-10	15-Oct-10
Trainer	Eddy	Denis	Denis	Denis	Dries	Eddy	Eddy	Eddy
Inscriptions		24	24	25	25	25	8	24
Attendees	16	17	16	18	14	15	8	13
Forms returned	13	10	14	13		7	7	12
Organization of the training	4.75	4.5	4.29	4.31		4.43	4	3.92
Quality of the content	4.67	4.4	4.14	4.46		4.43	4.57	4.33
Relevance to my work	4.23	4.7	4.21	4.23		4.29	4.43	3.92
Training adjusted to your needs	4.23	4.4	4.21	4.23		4.43	4.29	4.33
Format of the training	4.58	4.3	3.93	4.23		4.29	4.43	4.33
Duration of the training	4.5	4.5	4.29	4.23		4.29	3.86	4.42
Learning Material	4.69	4.4	4.14	4.31		4	4.29	4.25
Syllabus, documentation	4.85	4.2	4.07	4.25		4	4.57	4.17
Knowledge on the subject	4.54	4.6	4.57	4.46		4.43	5	4.67
Theoretical land practical approach	5.62	4.2	4.36	4.23		4.43	4.43	4.5
Way of teaching	4.75	4.2	3.86	4.23		4.71	4.71	4.5
Interaction with the participants	4.62	4	3.64	4.23		4.71	4.86	4.42
Answering questions	4.64	4.4	3.79	4.25		4.57	4.71	4.08
Overall satisfaction	4.58	4.5	3.92	4.38		4.43	4.43	4.36
Location	4.77	4.4	4.38	4.38		4.43	4.14	4.36
Catering (drinks, meals)	4.58	4.2	4.33	4.46		4.43	4.14	4.4
I would recommend this training	11	9	13	13		7	7	11
I would not recommend this training	0	0	0	0		0	0	0

Les	8	9	10	11	12	13	14	15
Date	15-Oct-10	5-Nov-10	15-Nov-10	19-Nov-10	22-Nov-10	26-Nov-10	29-Nov-10	3-Dec-10
Trainer	Eddy	Dries	Jan	Dries	Kaidong	V&A	All	Eddy
Inscriptions	24	25	24	24	23			
Attendees	13	15	14	10	11	33	10	4
Forms returned	12	9	7	5	8	7	7	
Organization of the training	3.92	4.11	4.29	4.6	4.25	4.43	4.43	
Quality of the content	4.33	4	4.14	4.4	4.38	4.57	4.57	
Relevance to my work	3.92	3.89	3.86	4.2	4.25	4.57	4.57	
Training adjusted to your needs	4.33	4	4	4.4	4.13	4.43	4.43	
Format of the training	4.33	4.22	4.14	4.4	4.25	4.43	4.43	
Duration of the training	4.42	4.33	3.86	4.4	4	4	4	
Learning Material	4.25	4.33	4.43	4.4	4.38	4.14	4.14	
Syllabus, documentation	4.17	4.33	4.14	4.4	4.25	4	4	
Knowledge on the subject	4.67	4.44	4	4.6	4.5			
Theoretical land practical approach	4.5	4.33	4	4.4	4.13			
Way of teaching	4.5	4.33	3	4.4	4.13			
Interaction with the participants	4.42	4.44	3.86	4.4	4.25			
Answering questions	4.08	4.44	4.29	4.4	4.25			
Overall satisfaction	4.36	4.14	4.14	4.4	4.25	4.29	4.29	
Location	4.36	4.14	4.33	4.4	4.25	4.43	4.43	
Catering (drinks, meals)	4.4	4.14	NA	4.4	4.14	4.43	4.43	
I would recommend this training	11	9	7	5	8			
I would not recommend this training	0	0	0	0	0			

Appendix N Project initiation and approval.

Project Organization		
Name	Dep./Group	Role
Eddy Kunnen		Project leader/Trainer
Sponsor		Werner Boullart
Dries Dictus		Trainer
Denis Shamiryan	Etch	Trainer
Annelies Maes	Imec Academy	Secretary
All others see project plan	See project management plan	
Estimated Workload		
Who	Effort (MD)	
Project leader	19 MD	
Sponsor	4 MD	
Secretary	7 MD	
Trainers	30 MD	
Attendees	69 MD	

Metric	
# attendees, since 20 inscribes we expect 20. # Performance measured using the evaluation forms # Students that pass examination	
Milestones / Plan	
Date	Description
15-09-2010	Program is fixed and communicated
15-12-2010	Lectures and examination is finished, student received feedback
31-01-2010	Closure with trainers in Via Via

ST-260

Initiation

Appendix O The issue log and change request log.

Issue	Status	Date	Description	Impact	Action	Result
1	Solved	14/09/2010	The person from the newsflash is ill	If the newsflash is not communicated people will not know the room, bad start, failure of first lessons	Annelies takes action we send a mail only to the attendees of the first lessons. Newsflash will be postponed.	
2	Solved	15/09/2010	24 people inscribed while only room for 20 is available	People cannot sit, bad perception of the first lessons	Risk is taken to go on, mostly not all people show up. Bigger rooms for next events are booked and communicated	only 16 people showed up for the first lesson.
3	Solved	20/09/2010	Only 20 maps with notes are foreseen, need an extra since more than 20 people are inscribed	Maps are minor cost	Claire prepares an extra map	Extra map with cost on risk budget
4	Solved	12/10/2012	Conflict with one of the trainers because a change as not been communicated upfront to him	Trainer in bad mood	Talk and let go, decision remains	Cooled down
5	Solved	19/11/2010	Quality issue, score 3	No further impact	Short meeting for feedback and how to improve	ok

The issue log

number	date	Requester	Description	Feedback from Team/impact on project deliverables	Sponsor	Result
1	17/09/2010	external attendee	Request to video tape the lesson	Project manager decides not to do, to much effort for one request		
2	20/09/2010	Bart Demey	To provide a soft version of the lecture notes	Project manager discusses with legal on this issue. It is preferred not to have soft copies circulating.		The issue has been added to the risk register and a contingency plan is in place
3	10/10/2010	Project Leader	Idea is to give to each attendee a homework task and to organize an additional lesson on all these homeworks. Additionally a final extra lesson that is kind of	Team agrees, we make sure that there is no impact on the other lessons. These two extra lessons require the budget to be increased by 3087.60 euro	Sponsor approves the budget	Plan and documents are updated, two extra sessions are communicated.
4	25/10/2010	external attendee	Proposal to give an extra session on "Gases beyond the etch tool"	Team evaluates the proposal, agrees and prepares a plan, this costs 905.6 euro	Sponsor approves the budget	Plan and documents are updated, the extra session is communicated
5	29/10/2010	external attendee	Request to video tape the lessons	Team evaluates the proposal, agrees, prepares a plan, videotaping will be foreseen for lessons 12, 13, 14. Cost is carried Bart Demey and is estimated at 240 euro	Sponsor approves the change	Plan and documents are updated, changes are communicated to the attendees
6	10/11/2012	trainer	Swap lessons on 26/11 with the one of 15/11	Ok, project manager approves the change		Plan and documents are updated, changes are communicated to the attendees

The change request log

