

PROJECT MANAGEMENT FOR SUCCESS IN RESEARCH



THE PM-CUBE:
A GUIDE FOR PROFESSORS,
POSTDOCS, PHD CANDIDATES,
MASTER STUDENTS

CARINE GALLI MARXER

Book sections presented in this extract:

Cover 1

Copyright 4

Table of contents 5-7

Preface 8-11

Introduction (only some pages) 12-22

Methods of the cube (only some pages) 23-32

Conclusion 33-34

Index 35-41

Back cover 42

**A GUIDE FOR PROFESSORS,
POSTDOCS, PHD CANDIDATES,
MASTER STUDENTS**

**CARINE GALLI MARXER
CUBISMA LTD.**

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<u>PREFACE</u>	11
<u>INTRODUCTION</u>	15
Is this book for you?	15
Do you face similar difficulties?	16
How to use this book	18
<u>THE PROJECT MANAGEMENT – CUBE</u>	19
<u>BASICS OF PROJECT MANAGEMENT</u>	23
Well-managed projects create winning teams	23
What is a project?	24
What does it mean to manage a project?	26
Agile planning: the key to success	29
<u>DEVELOPMENT OF YOUR PM SKILLS</u>	33
What happened in your past projects?	33
<u>METHODS OF THE PM-CUBE</u>	37
<u>A WHY - INVESTIGATE THE CONTEXT</u>	37
1. Benefits of your project	38
2. System analysis and the CREATES © method	41
I. The determining factors in the CREATES fields	42
II. The direct influences	47
III. My autonomy	48
IV. My project boundary	50

3. Stakeholder analysis	53
I. The stakeholders, their interest, their power and their attitude	55
II. The stakeholder map	59
III. Measures to take	61

B WHAT - DEFINE YOUR TARGETS **65**

1. Project objectives and the Project-Cone ©	66
I. An objective is not a solution!	66
II. The Project-Cone©	68
III. The list of objectives	71
2. Deliverables	75

C HOW - PLAN YOUR PROJECT **79**

1. Structuring your project: the Work Breakdown Structure (WBS)	80
I. Sub-projects	81
II. Work packages (WP)	84
III. First Gantt chart	86
2. Milestones	91
3. Resource plan	96
4. Risks	104
5. Budget	113
6. Precise scheduling during the course of the project	116
I. Tasks	117
II. Effort	117

D WHO – PEOPLE **125**

1. Project organisation / Team	126
I. A cogwheel system	126
II. Make sure you get your personnel!	129
III. Parallel worlds	130
2. Roles	132
I. Duties and responsibilities	132
II. How to clarify roles	137
3. Communication plan	142
4. Project handbook	148

<u>E ACT – PERFORM AND ACHIEVE WHAT YOU PROMISED</u>	<u>151</u>
1. Project contract / charter	152
2. Kick-off meetings	156
I. First kick-off meeting	159
II. Second kick-off meeting	160
III. Third kick-off meeting	162
3. Basic people skills	164
I. Group dynamics	165
II. Active listening and using feedback	167
4. Closure meeting	170
<u>F OK? – CHECK THE PROJECT’S STATUS</u>	<u>175</u>
1. Project controlling	176
2. Solving project management challenges	179
<u>CONCLUSION</u>	<u>183</u>
<u>THANK YOU!</u>	<u>185</u>
<u>BIBLIOGRAPHY</u>	<u>187</u>
<u>INDEX</u>	<u>189</u>
<u>ABOUT THE AUTHOR</u>	<u>197</u>

The story of the heroine Olivia is entirely fictional and was created by the author for training purposes. Any resemblance to actual individuals or events is purely coincidental.



PREFACE

Almost everyone is faced with managing a project at some time in their lives. Relocating, planning a trip or organising a large event like a wedding are some examples of private projects. You also manage projects in the professional world e.g., when starting a research project, developing an innovative product, building new infrastructure, trying to find solutions to specific problems or organising a conference.

Because projects are unique, you are like an explorer having to deal with the uncertainty of predictability. In research, for example, you don't know what technical challenges you will have to face, nor who might cause trouble. However, you can prepare yourself!

Imagine being a sailor who plans to cross the Pacific Ocean. You will only succeed if your boat is adapted to handle the expected weather conditions, if it has the appropriate instruments to receive weather forecasts, if enough provisions have been loaded and if your team is experienced, motivated and united. Therefore, sailors need to roughly define their route and prepare themselves accordingly before departing. At sea, the crew have to constantly follow the vagaries of weather and adapt their route in order to be able to moor up in their designated harbour.

Take a look around you and I am sure you will agree: researchers who think about additional aspects alongside their research content are often the most successful ones. These people, for example, evaluate potential risks and try to mitigate them. They can identify their stakeholders and manage them carefully. In addition, they take

time to structure and plan their work.

Project management (PM) is a quite new discipline whose importance is increasing in our competitive world. However, even if such fundamental skills enable researchers to improve their performances, PM is still rarely taught. This explains why I started to write this book – I wanted to disseminate this knowledge to a larger audience.

But additional reasons gave me the energy to finish it. As a working mother with young children, I found myself struggling to find the right balance between having an interesting job, spending enough time with my family and still enjoying some free time. Then I discovered that I could increase my quality of life by adequately managing my professional and private projects.

The first benefit concerned my stress-level. By knowing that I was doing the right thing at the right moment, I could relax. Thereby, I became more aware of my actions, and at the end of the day, I still had some energy for additional ones.

Moreover, I was able to better cope with unpleasant situations. By considering my life as a project, I was able to put some distance between the issue at hand and myself. This enabled me to take appropriate decisions and to find the energy and the motivation to implement them.

Managing projects is challenging because unfavourable events can happen regularly. However, the reward of reaching an objective is great. First, it enables you to erase any negative feelings associated with bad experiences, and secondly, mastering difficult situations gives you the opportunity to acquire new skills.

Therefore, I strongly encourage you to continue your explorations and hope this book will inspire you and enable you to celebrate many successes.

I wish you good luck for all your (research) projects!

Dr. Carine Galli Marxer
Switzerland, 2019

INTRODUCTION

Is this book for you?

Yes, if you are a researcher performing or supervising research project(s), or anyone writing a research proposal or grant. This book is written for professors, senior scientists, postdocs, PhD candidates or master students from any academic field and whose aim is to ensure the success of their projects.

Olivia, the heroine of this book, is a motivated and smart PhD candidate who is facing challenges during her thesis. Her story will allow you to discover the Project Management-cube © (*PM-Cube*), a powerful tool empowering you to not only successfully complete your projects, but also to find a path to follow in the face of adversity. This has been confirmed by many voices from researchers who have applied the *PM-Cube*.

According to a European survey, senior researchers regretted not having received training in project management (PM) early in their career [1]. Studies in the private sector support the fact that such expertise is crucial for successful organisations [2,3]. Therefore, the acquisition of project management skills will be useful throughout your career.

You may wonder when is the best moment to read this book. The answer is “right now!” in order to improve the success of your current projects and to start new ones under the best conditions. As you will learn from Olivia’s story, the activities undertaken at the beginning of a project pave the way for its successful completion.

Do you face similar difficulties?

Two years ago, Olivia was delighted to start her PhD project within the renowned group of Prof. Anna since it gave her the opportunity to combine her two passions of IT and medicine. The aim of her thesis, described in the proposal that Prof. Anna wrote, was to improve the treatment of people with diabetes (who need daily injections of insulin) by studying the role of physical activities on their glycaemia level.

During her first year, the young researcher settled into her new environment and felt very confident under the supervision of Luis, a senior postdoc. Her work progressed rapidly since she was able to develop a powerful App for diabetic patients that would enable her to gather the necessary data for her thesis.

The collaboration with the physician Prof. David, an expert working with diabetic children, was excellent. Olivia could feel a mutual trust and enthusiasm for her project. She was now ready and motivated for the next step of her research, which required recruiting enough patients for her cohort study.

Unfortunately, her second PhD year started differently. First Luis left the group and was not replaced, leaving Olivia with almost no supervision since Prof. Anna was very busy. Next, she started to be overwhelmed by all the activities she was responsible for: she had to teach medical students once per week and for the past two months she had also been supervising a new master student. Finally, Olivia was experiencing critical communication difficulties with the medical staff of Prof. David's office. She feared important delays in her research because they were supposed to recruit all the patients she needed for the cohort study. And as if this was not enough, the private company co-funding her PhD work announced a reduction in its financial participation last week due to unforeseen changes in the market.



“Teaching, supervision,
research, conflicts with
staff, reduction in budget
...”

The young researcher starts to doubt whether she will be able to achieve all the objectives mentioned in the research proposal, because after the completion of the cohort study and the analysis of the data she was supposed to modify her initial App for future commercialization. It was foreseen that a start-up would be created and that the new App would even be improved further to allow direct transmission of the insulin dose information to insulin pumps.

Olivia decides to take a break and to reflect on her situation. She realises that she has lost the clear vision she previously had for her thesis, causing her a lot of stress and decreasing her excitement about the project. Looking for the sources of the problems, Olivia concludes that her lack of attention to additional aspects of her research may be an explanation. But she is unable to define them. Therefore, Olivia decides to have a serious discussion with Prof. Anna.

The meeting turns out to be beneficial for both parties. It gives them the opportunity to review the project situation and to clarify their mutual expectations. Above all, they decide to improve the project management skills of all group members. Olivia gets the mandate to follow the dedicated PM course offered by the university and to later train the other researchers in the group.

How to use this book

This book describes Olivia's training. She will encounter all the methods included in the Project Management-cube that enable her (and you!) to successfully complete projects. For the sake of understanding, scientific details have been deliberately omitted and only the relevant theory is presented.

Because each method delivers useful information for subsequent steps, it is important to respect the order in which they appear. I strongly advise you to directly apply each method to a project you are currently managing in order to fully understand the subtleties of the various methods as well as to observe their positive effects.

You may feel challenged the first time you apply these methods. Please don't worry! With time, it will get easier and you will become more confident. As a motivation, I can reveal that 95% of the postdocs participating in my workshops reported having applied the *PM-Cube* in the subsequent weeks; the majority of them observed an immediate medium-to-large impact on their projects.

As you will find out later, the *PM-Cube* will accompany you during the entire course of your projects. In order to facilitate your work, each method contains a short summary that will help you to easily remember how to re-apply it.

It is now time to discover the Project Management-cube!

THE PROJECT MANAGEMENT - CUBE

The *Project Management – Cube (PM-Cube)* is a project management tool specifically developed by the author for researchers in academia. Its application will enable you and Olivia to successfully manage your research projects in a very flexible way, irrespective of your field. In the case of unforeseeable events, the *PM-Cube* will empower you to take adequate decisions.

The *PM-Cube* shown in Figure 1 visually represents the different PM methods that have to be considered during a project: from the idea to the development of the concept, to its realisation and finally to its end. The logical positioning of the methods on the different sides of the *PM-Cube* allows you to apply the right method at the right moment.

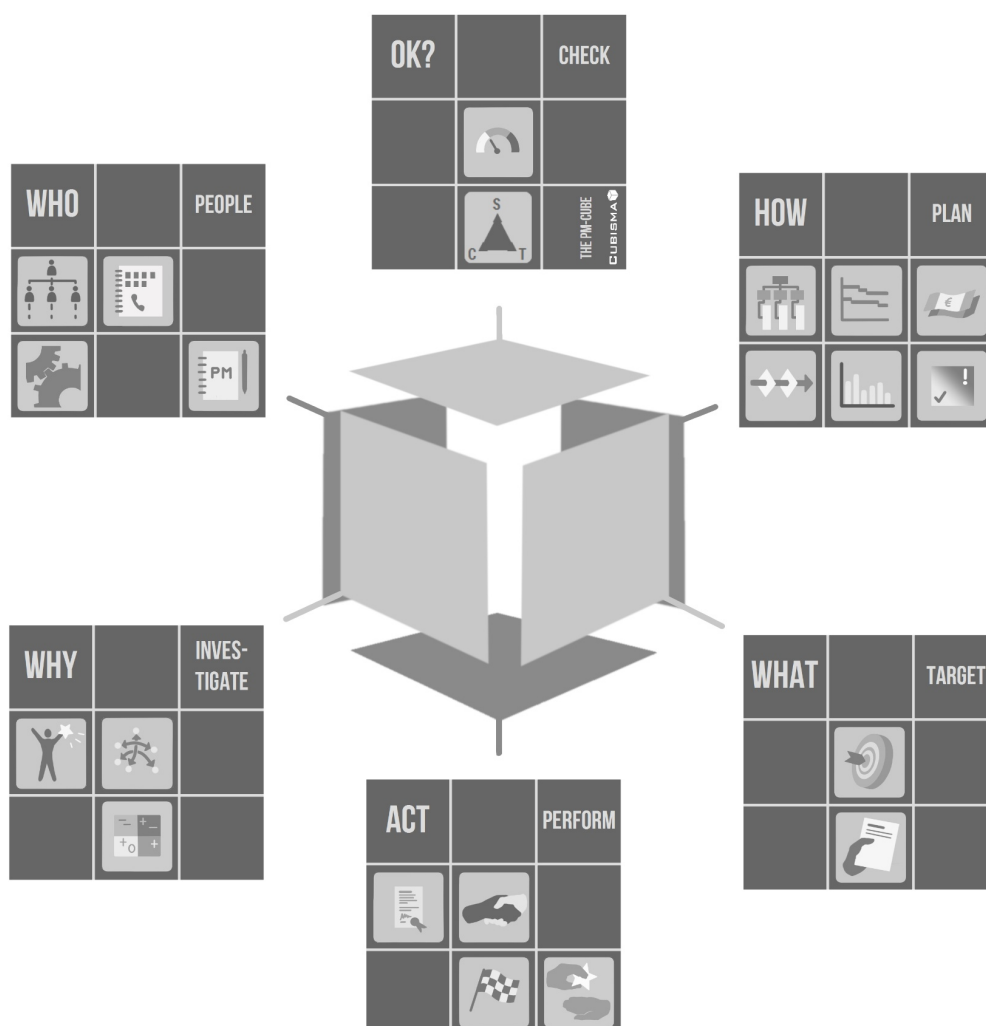


Figure 1: PM-Cube and all its methods.

The young researcher is relieved to hear that an App named The *PM-Cube* has been developed. It will enable her to access this knowledge wherever she is. It contains a short summary of all the presented methods and can be downloaded under <http://www.cubisma.ch/app.php>

During her training Olivia gets the chance to actually build her own cube. It allows her to better comprehend the logic behind the different methods. She realises that it is also a fun tool that will remind her to re-apply the various project management methods throughout her PhD project. She decides to roll it once a week and to re-consider one of the tools appearing on the top. In the future, she may also fill the cube with small rewards (e.g. sweets) to treat herself after having re-applied one of the methods. To train Prof. Anna's group, Olivia will definitively print the *PM-Cube* template on heavy paper and bring scissors and glue. You can build your own cube, accessing it under <http://www.cubisma.ch/PM-Cube.pdf>



BASICS OF PROJECT MANAGEMENT

The description of the basic concepts of project management allows Olivia to build her PM vocabulary and to understand the philosophy of managing research projects. She realises that the PM-Cube will empower her to reach her objectives and she is surprised to discover that plans are meant to be changed!

Well-managed projects create winning teams

Olivia recognizes that all persons participating in her project will benefit from good management and that they can be divided into three groups.

The first group comprises the **sponsors** funding her project. In her case, they are the national funding agency and a private company producing insulin pumps. For them a well-managed project means a higher return on investment since disasters are more likely to be avoided and the performance of the team increased.

Olivia belongs to the second group since she is now the main person managing the project. She is therefore entitled to be called the **project manager**. The application of the PM-Cube will give her the best possible overview of her project, enabling her to “steer” and guide it as desired. She will be able to structure and plan her research work in the most appropriate way, she will be assured that the best decisions for the project are made and that the team stays focused and therefore performs better. This will indirectly allow her to publish interesting results more rapidly. Olivia will also increase her chances to get funding in the future, having demonstrated excellent managerial skills.

The **team members** represent the third group of beneficiaries since they will work in a healthy and motivating environment. Clear communication about their roles and responsibilities will clarify their positions and

Olivia's project, ending at a precise date. Within that time Olivia performs her work and the objectives become reality at the end of the project. Because new questions or challenges often arise in research, the initial objectives described in the proposal may have to be adjusted. For instance, the budget cut in Olivia's project will induce a re-definition of the objectives. Nevertheless, the initial project has to be completed. If new questions arise, new projects tackling them might start at a later date. This is especially important for PhD candidates and postdocs who need to plan their future careers.

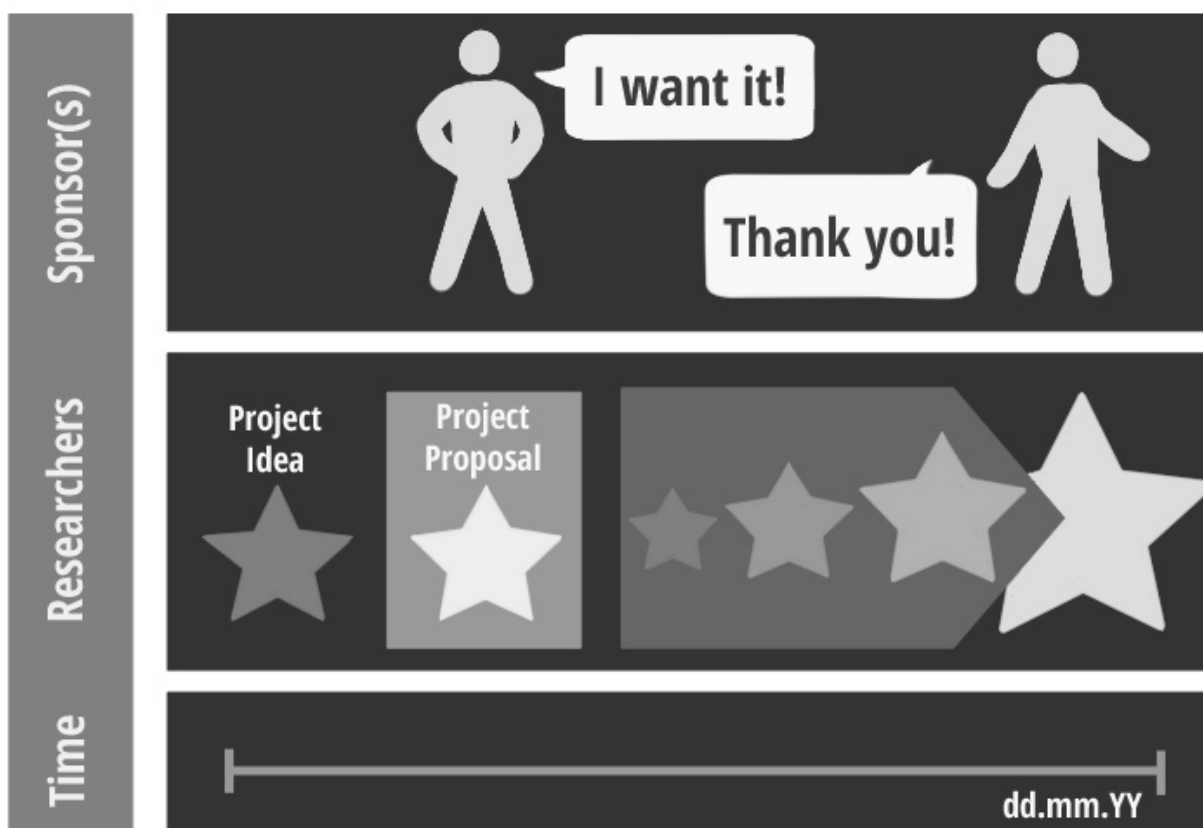


Figure 2: Characteristics of projects: they are unique, time limited and should fulfil the wishes of sponsors.

The uniqueness of projects also implies that specific people like Olivia and Prof. David are needed. Also, appropriate infrastructure (rooms, instruments, etc.) and defined consumables are required for the realisation of any project. Besides her working space, Olivia needs a dedicated IT infrastructure as well as marketing material for her cohort study. These represent the resources required for the successful completion of her

project, and they are always limited in time and quantity. In research, they mostly consist of funding, allowing senior researchers to pay salaries and cover all the additional costs generated by the project. Sometimes infrastructure or additional person-hours are made available to projects.

Finally, each project possesses at least one sponsor, which can be a person, an organisation, a company or a funding agency. Olivia's project is co-funded by two sponsors having different reasons to invest. While the funding agency aims to improve the quality of life of the population, the private company seeks to increase its market position. Therefore, sponsors always benefit from positive outcomes of projects. This is represented in Figure 2 by the happy sponsor on the right receiving the big star (project outcome) at the end of the project.

Olivia is now aware that the uniqueness of projects, with their limited time frame and resources, implies that their realisation is risky. This is the reason why she will greatly increase her chances of success by carefully managing her PhD project!

What does it mean to manage a project?

Research projects are not only complex because their content is complicated, but also because people (including the sponsor) constantly influence their realisation. Olivia has to deal with many unknowns throughout the course of her project. She had to first face technical challenges related to her App, now she needs to solve organisational problems and later she will surely be confronted with data analysis issues. Therefore, the main purpose of managing a project is to reach its objectives in order to satisfy the sponsors.

This requires the smart researcher to reduce the complexity of her project by first considering the entire process. It can be simplified and described by three main stages as shown in Figure 3, each of them containing the corresponding methods of the *PM-Cube*.

Olivia is relieved to find out that she has unconsciously performed some management activities already. But in the future, she will methodically apply the *PM-Cube* to benefit from its outcomes. When training her group, the researcher will emphasize the beauty of managing research projects. She will show them how valuable it is to encompass the science and art of applying appropriate skills and methods; they help to guarantee the best performance of the project team in order to reach the project objectives, and include the important core activity of project planning.

My project has just been funded. I hired a PhD candidate and started the first interactions with our industrial partners. Until now I only focused on the scientific aspects of my first research project as a PI, but now the management part has become overwhelming!

Attending this course was a lifesaver: now I know what to expect, and what techniques to apply in order to manage people, time, and resources. Even the simplest tricks make a huge difference in making the management of my project more professional and effective!

A Senior researcher in electrical engineering

Agile planning: the key to success

Olivia is curious to discover how she will be able to plan her project, taking into account that its realisation cannot be fully predicted. The fact that disasters can be avoided by defining a first research path that will constantly be adjusted and refined during the course of the project intrigues her. It is called “agile”, in contrast to traditional project management where all activities are planned in detail already at the

This iterative process of analysing-adjusting-planning-researching until the completion of the project suits Olivia. Being able to visualize the progress of the project will allow her to both motivate the entire team and to precisely communicate the project status to the sponsors. It is therefore only at the end of the project that the detailed plan (solid line in Figure 4) will be known!

When training her colleagues, Olivia will surely have to answer the question “How much time should be devoted to planning activities alongside performing my research work?”. She is ready to answer that it corresponds to 5% of the project time for research projects in general, i.e. 12 days per year if working full time on the project. This period includes all reflection time that researchers anyway dedicate to planning their daily activities. The junior researcher is aware that this percentage will increase for larger and more complex projects.

Considering that most projects fail due to poor management [2,3], Olivia is ready to invest some time in applying the *PM-Cube* in order to increase her expertise!

I was approaching the middle of my postdoctoral project and was still sticking rigidly to the original plan of the project. Carine said that plans are meant to be changed. Indeed, I realized that some of my original plans were not congruent with the reality of the current state of my project! Changing them increased my creativity and I could better focus on activities that made more sense than just following every single step in my Gantt chart. With this freedom, I realized that I am actually doing more than had been planned in my project proposal.

A Postdoc in neurosciences



METHODS OF THE PM-CUBE



The WHY-side of the PM-Cube represents the point of departure when developing a new project idea or immersing yourself in your running project. The three methods included in this chapter will give you an overview of the context of your project by investigating its benefits, its system as well as its stakeholders.



1. Benefits of your project

Outcome

The analysis of the potential benefits of your project allows you to clearly define or understand its purpose. This will enable you to properly set its objectives.

When

As soon as a project idea has to be developed or you start to work on a project.

How

Brainstorm the direct beneficiaries of your project and define their benefits in the case of successful completion. Try to inform yourself about the challenges they are facing, their potential requirements and wishes towards your project.

A project always starts for a good reason, but funding will only be available when sponsors recognize its benefits and invest in it. Therefore, it is crucial to define the direct potential beneficiaries of your project when you are developing a new idea, or to discover them when taking over a project. Brainstorming sessions with colleagues will allow you to rapidly identify them. The number of beneficiaries will vary for each project and they may represent a single individual or a group of persons.

To define the potential benefits of her project, Olivia draws a table containing three columns, as presented in Table 1. Because the aim of her project is to improve the quality of life of diabetics suffering from Diabetes Mellitus (DM) Type 1, the most common diabetes in young patients (<25 years), she enters these patients as direct beneficiaries in the first column.



Figure 6 : Parameters of Olivia's system.

The young researcher mentions all the parameters she included in her initial App for the *Attribute* field: the glycaemia level of patients, the amount of carbohydrate they eat, their future planned activities, their insulin dose and other personal information. She also adds the OS system for which she developed the initial App, but also additional ones that should run the marketable App.

Olivia considers that she needs many *Tools* to complete her project. In addition to the initial and the marketable Apps, she will need smartphones for the cohort study. She will have to collect the data from the patients, to store it and to analyse it in order to be able to define the influence of physical activities on the insulin dose.

Considering the *Environment* field, the young researcher realises that she never thought about having potential competitors. She will have to research this topic and therefore only writes down “academic competitors



Today

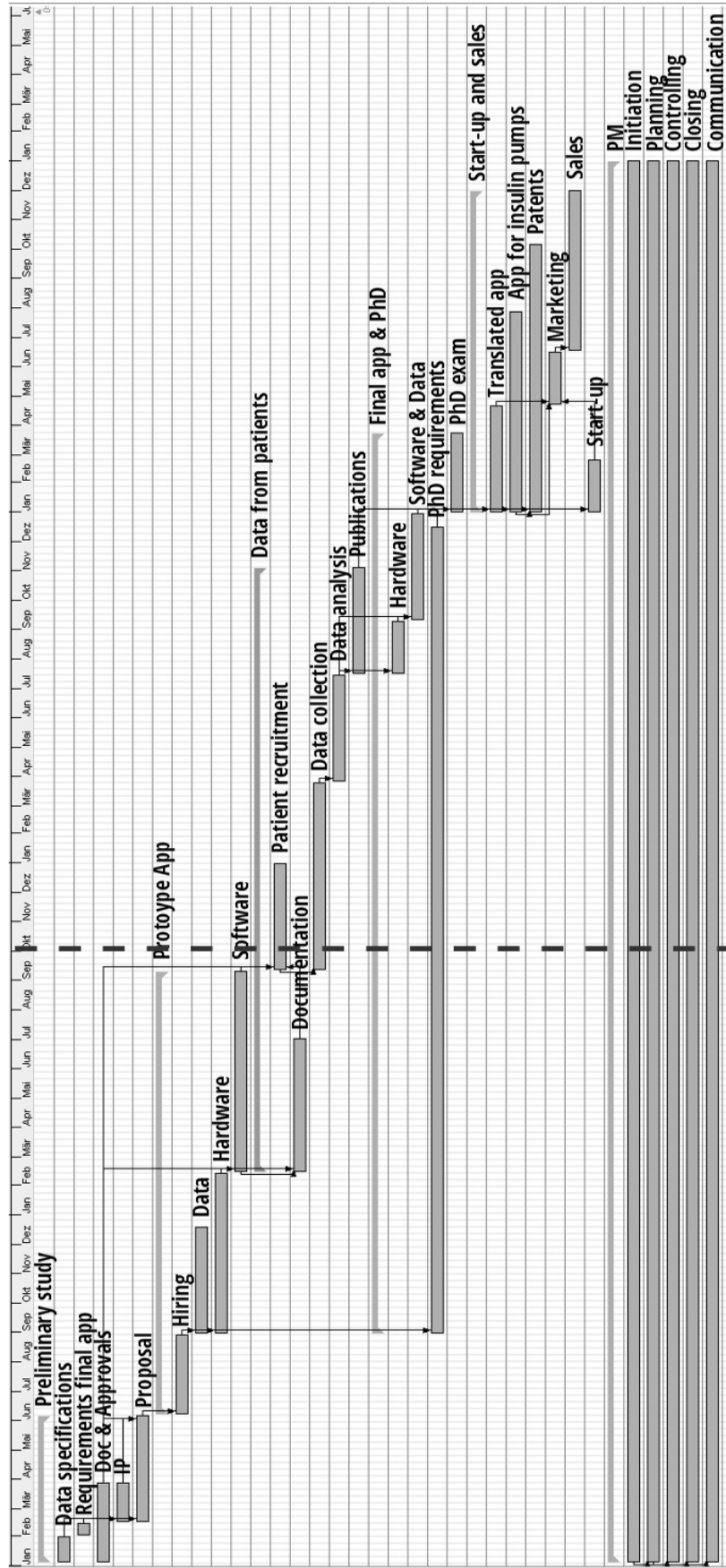


Figure 17: First Gantt chart of Olivia's entire project. The dotted line shows the actual date.



Analysing her result, Olivia understands the source of the unrest she has been feeling recently. Her Gantt chart shows that she is already running behind schedule since she should have already prepared the documentation for the recruitment of patients. The young researcher also realises that although this chart represents the fastest possible execution of the project, it does not take into account the availability of the team members. Therefore, she needs to apply the next two methods (Milestones and Resource Plan) to obtain a realistic schedule for her project. Moreover, Olivia acknowledges that she should somewhat overestimate the duration of her work packages for two reasons: first, she has to bear in mind that unexpected events always occur in research projects, and second, additional time will be necessary for communication.

I attended the project management course just as I started a new project for the last year of my PhD about 'citizen engagement for community scale solar photovoltaic systems'. I was initially overwhelmed about how we were going to complete the project in just one year. However, I became much more confident after learning how to use specific tools to break down the project into more manageable tasks. I also appreciated the new perspective for how to address non-technical problems related to the project. In fact, I still keep the project management cube on my desk at work as a reminder to check on the various facets of the project.

A PhD candidate in architecture



3. Resource plan

Outcome

A resource plan enables you to assign work, to create a realistic project schedule, to define the personnel costs and finally to communicate clearly with your sponsors and team members.

When

As soon as you have created or updated the Gantt chart containing milestones.

How

Define the skills needed from your team members; assign work packages and determine the respective workloads. Check the feasibility of the result; if necessary modify your scheduling to obtain a realistic Gantt chart and resource plan.

The resources of a project include the people, the infrastructure, the equipment, the funding, etc. that are required for its realisation. However, resource plans only focus on individuals; they show the workload of all team members over the entire duration of the project. Therefore, these plans enable researchers to now check the feasibility of their first Gantt chart. They obtain, after modifications, realistic plans and can determine the personnel costs of their project. Finally, resource plans represent powerful communication instruments for project managers.

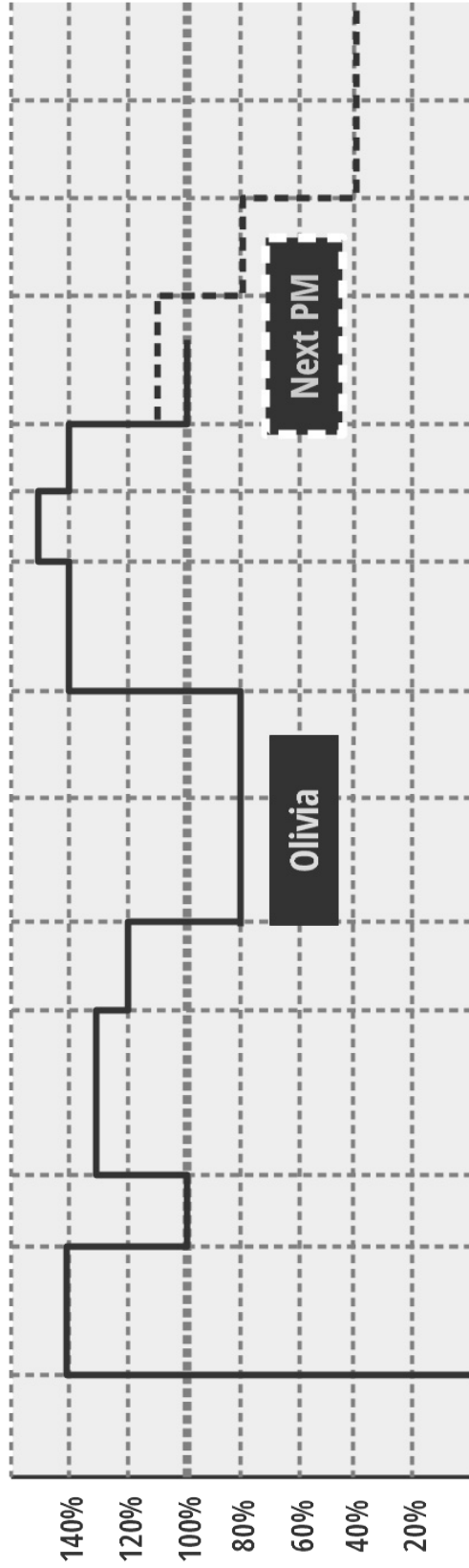
From her first Gantt chart (Figure 19), Olivia has a broad overview of which activities have to be undertaken during her project. Therefore, she is now able to define the skills that her team members should have or acquire in order to successfully complete the project.



“What skills are required from the team members?”

Table 8 presents the result. Olivia first listed all work packages from her phase-oriented WBS and defined the required knowledge or skills for each one. She used her system analysis to thoroughly check the list was complete and – for the sake of visibility – she grouped together all WPs requiring similar skills. In a second step Olivia assigned the work packages to her most competent team members and specific experts within her university. Because she plans to complete her PhD before the end of the entire project, she assigned some work packages to potential future team members (e.g. next Project Manager / “next PM” and “others”).

Nr. of WP	Necessary skills/knowledge	WP assigned to ...
1.2, 1.5, 2.3, 2.4, 3.3, 4.1, 4.2, 5.1, 5.2	App programming, IT	Prof. Anna, Luis, Olivia, next PM
1.1, 1.5, 2.2, 3.1, 3.2, 3.4, 3.5, 5.2, 5.4	Diabetes	Prof. David, Prof. Anna, Olivia, next PM
1.3, 1.5, 3.1, 3.2	Clinical study: legal side (approvals, patient agreements, etc.)	Prof. David, Olivia, university’s legal department?
1.3, 1.5	Proposal writing, collaborations, contracts	Prof. Anna, Prof. David
1.4, 5.3	IP	Technology transfer group of the university, Prof. Anna, Prof. David, others

[illegible]

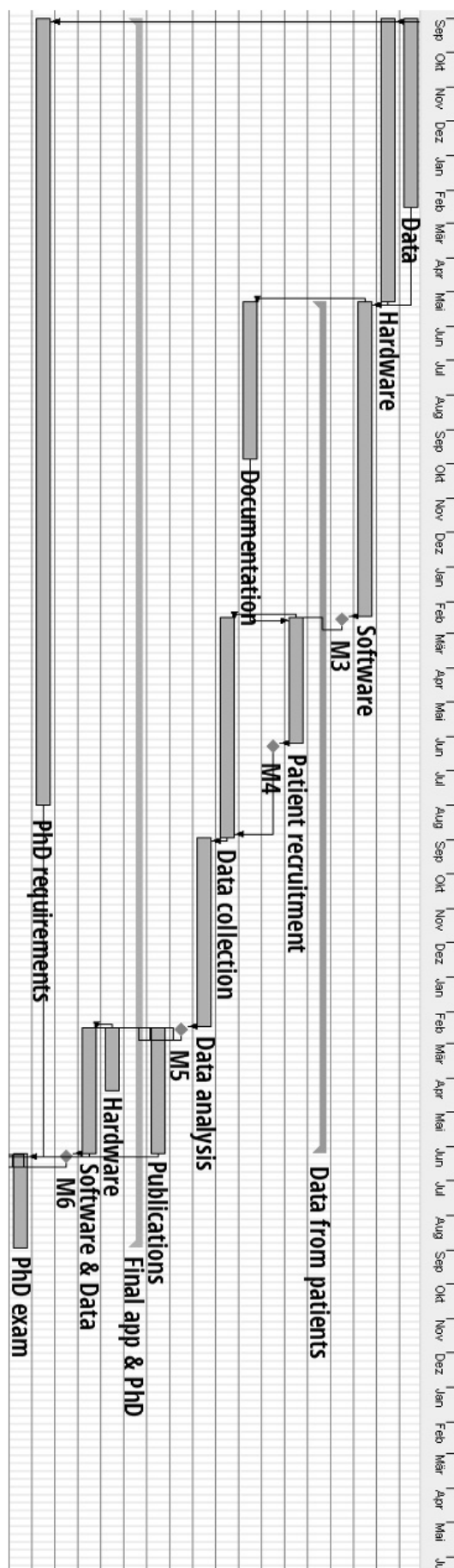


Figure 21: Realistic Gantt chart of Olivia's PhD project.

After several modifications, switching back and forth between her Gantt chart and the resource plan, Olivia obtains her final schedule shown in Figure 21, in which her average workload per week is 90%. She realises that instead of the original 29 months, she will need 37 months to obtain her PhD! Olivia is relieved to see that this duration corresponds to the average time for a PhD in her department. Therefore, it motivates her to continue the work on her thesis, being aware that she still might have to modify her scheduling after analysing the risks. She will also have to discuss this latest schedule with Prof. Anna since her estimates of workload and duration may be unrealistic.

The young researcher is impressed with her results. The Gantt chart and resource plan will enable her to effectively communicate her future plans for progress to the sponsors. It will also help her to motivate the team and coordinate their work by visually emphasising the importance of their contributions to the project. Olivia also understands that the resource plan provides the basis for calculating the personnel costs of her project.



“These plans are powerful for clarifying collaboration and communicating workloads and progress!”

CONCLUSION

Research projects are unique explorations that require specific skills from their project managers. Similar to the preparation of a challenging ocean crossing by boat, research goals have to be developed first in order to define a strategic plan. In a second stage, the project has to be presented to potential sponsors. It is only after successful acquisition of funding that experienced people can be recruited.

The realisation of the project continues with the construction of the appropriate vessel and the training of the sailors. During the ocean crossing, the team will have to face storms and unexpected events before anchoring at their final destination. Therefore, excellent preparation and flexible management of the project are keys to successfully completing research projects.

The PM-Cube enables you to reach your research objectives more effectively by considering your project under complementary perspectives. Its dedicated methods allow you to not only write convincing research proposals, but they also empower you to successfully lead your team and to adjust the course of your project if and when necessary.

The first four faces of the PM-Cube guide the preparation of your project in a step-by-step process. The methods of the WHY-side enable you to first comprehend the context of your project, which subsequently allows you to define your targets with the WHAT-side. At that point, you possess enough information to realistically plan your project, applying the methods of the HOW-side. Finally, the WHO-face focuses on the team members, defining their roles and planning a communication strategy.

Signing the contract marks the official start of your research project. In addition to re-evaluating the first four faces of the PM-Cube, you will consider the ACT-side enabling you to effectively communicate and lead

your team. Finally, the remaining face of the PM-Cube, the OK?-side, will help you to control the course of your project.

Keeping your eyes open will allow you to adjust to the constant evolution of your project's context. Thus, you will be able to recognize interesting opportunities as well as pro-actively detect future challenges.

The beauty in managing projects lies in the fact that you are continually faced with new situations; this is exactly what adventurers and researchers wish for!

I wish you good luck in all your journeys.



INDEX

The methods of the PM-Cube are indicated bold.

A

Academia 19, 20, 24, 33, 54, 55, 128, 132, 135, 136
 Achievable (objective) 71
 Acquisition (funding) 15, 27, 28, 91, 98, 108, 113, 116, 183
 ACT side 20, 151
 Adjourning stage 166, 167
 Agenda (kick-off meetings) 159, 160, 162
 Agile (planning) 29,30
 Alternative 63, 94, 111, 112, 135, 176, 179, 180
 App (of PM-Cube) 21
 Assignment 98, 123
 Attitude (stakeholder) 53, 55, 56, 58, 59, 61, 63, 105, 143
 Attribute 42
 Autonomy 41, 48-50

B

Beneficiaries 23, 38-40
Benefits 38
 Boundary 41, 50, 51, 64, 85
Budget 113

C

Cause (risk) 106-109
 Celebration 172
 Challenges (project) 25, 26, 38, 39, 51, 63, 104, 176, 179
 Channel (communication) 142-146
Charter 152
 Check 20, 30, 175
 Circumstances (external) 67
Closure meeting 170
 Collaboration 126, 128, 129, 130, 136, 156-173
 Commitment 164

Communication plan 142

Company 16, 23, 26, 40, 56, 127, 152, 154

Competitors 42, 45, 53-60, 105

Complexity (project) 26, 41, 66, 80

Conditions 42, 44, 68, 152

Confidentiality 53, 155

Conflicts 24, 28, 41, 48, 116, 130, 132, 142, 153, 164

Consumables 25, 113

Content (project) 26, 41, 80, 104, 152, 160, 162, 172

Context 20, 30, 37, 41, 67, 104, 125, 176, 179

Contract 152

Controlling 176

Costs 113

CREATES 41-43

Cultures 42, 167, 168

D

Days 87, 118

Deadline 70, 72, 75, 159, 178

Decision 19, 23, 41, 91, 104, 133, 176

Deliverable 75

Dependency 47, 66, 80, 104, 116

Deputy 86, 87

Dissolution (team) 28, 170

Documents 42, 43, 75, 84, 135, 148, 152, 172, 177

Duration 80, 116

Duty 50, 94, 132

Dynamic (group) 165

E

Effort 116

End 170

Environment 20, 23, 42, 105, 125, 151, 164

Execution (project) 24, 28, 27, 30

Expectation 17, 63, 104, 138-140

Expertise 42, 96, 104, 126, 134, 152, 159

External condition 68

F

Factors of project 41

Fears (stakeholders) 142

Feasibility 28, 96, 104

Feedback 164

First Gantt chart 80

Forming stage 165-167

Frequency (communication) 142

Funding 23-28, 38, 44, 57, 71, 76, 91, 105, 113, 126, 132, 152

G

Gantt chart 80, 116

Goal 66

Group dynamic 165

H

Handbook 148

Hiring (team) 28, 116, 156

HOW side 20, 79

I

Idea (project) 19, 24, 38, 156

Impact (risk) 104

Indicator 71, 72

Influence of factors 41

Influence of stakeholder 53

Information 142, 148,

Intellectual Property IP 44, 155

Interculturality 105, 167

Interdisciplinarity 104

Interest of stakeholder 53

Intermediate (objective) 66

Investigate (context) 20, 37

Involvement 53, 96, 126

K

Kick-off meeting 156

Knowledge 42, 97, 161

L

Leadership 55, 139
 Legal aspects (contract) 152
 Lessons learned 170
 Listening 167

M

Measurable (objective) 71
 Measure 53, 72, 104, 142
 Meeting 52, 91, 142, 156, 170
 Members (team) 126
 Message 142
 Methods 19, 27, 37
Milestone 91
 Misunderstanding 41, 71, 81, 104, 143, 153, 164
 Mitigation 106

N

Needs (of stakeholders) 142
 Norming stage 166

O

Object-oriented WBS 83
Objective 66
 Occurrence (probability) 104
 OK? Side 20, 175
 Olivia (situation) 16
Organisation 126
 Outcome 24-29, 75
 Overview 20, 23, 37, 41, 70, 86, 99, 178

P

Parties (contract/charter) 152
 People 125
People skills 164
 Perform 151
 Performing stage 166
 Person days 118
 Personnel 54, 96, 113, 126, 154

Phase-oriented WBS 81
 PhD candidate (role) 132
 Place (communication) 142
 Plan 20-30, 79, 93, 116
 PM-Cube 19
 Politics 42, 54, 105
 Postdoc (role) 132
 Power of stakeholder 53
 Precise schedule 116
 Predecessor 87-88
 Preparation (project) 24-28, 159
 Price 114
 Priority 68, 72
 Productivity 142, 168
 Professor (role) 132
 Progress 24, 31, 74, 75, 88, 91, 103, 116, 176
 Project 24
 Project management 23
 Project manager 23, 132
 Project team 126
 Project-Cone 68
 Proposal 20, 24-31, 152, 156, 176
 Purpose 38

R

Realisation (project) 19-31
 Realistic (objective) 71
 Receiver 142
 Relevant (objective) 71
 Requirements 38, 43, 69, 75, 91
 Research 19-31
Resource 96
 Responsibility 50, 133
 Responsible person 132
 Restrictions 67
 Results 23, 75, 105, 142, 152, 170

Review 170

Risk 104

Risk factor 109

Role 132

S

Salary 114, 152

Schedule 116

Scope 105, 153, 179, 180

Sender 142

Sides (of cube) 20

Skills 29, 33, 42, 55, 96, 126, 139, 164

SMART 66

Solution 66, 179

Solving challenges 179

Specific (objective) 71

Sponsor 23-31, 38, 54, 66, 75, 92, 126, 132,
142, 152, 160, 162, 170, 176, 179

Staff (role) 132

Stage (project) 26-30

Stake 56

Stakeholder 53

Stakeholder map 59

Start 20-29, 38, 132, 142, 148, 152, 156

Steering committee 126, 135

Storming stage 166

Strategic decision 91, 127, 134, 176

Structure (see WBS) 80

Sub-project 81

Sub-project manager 127, 136

Success 26-31

System 41

T

Target 20, 65

Task 116

Team 126

Template (of PM-Cube) 21
Time 20-31, 66, 80, 96, 116
Time-bound (objective) 71
Tool 19, 21, 42
Traditional (project management) 29
Triangle (magic) 179

U

Unexpected 20, 41, 176, 179
Uniqueness (project) 24-26

W

WHAT side 20, 65
wishes (stakeholder) 39, 144
WHO side 20, 125
WHY side 20, 37
Winning team 23
Work Breakdown Structure WBS 80
Work package WP 84
Workload 96

Research projects are challenging because of their exploratory character and the special environment in which they are executed.

The PM-Cube is a practical tool that has allowed thousands of researchers, regardless of their field and their position, to successfully manage the complexity of their projects and to deliver high-quality results.

The PM-Cube will allow you to:

- plan your work while maintaining flexibility
- write convincing proposals
- lead performing teams
- communicate effectively
- find innovative solutions
- control projects
- work in a more relaxed manner



All steps of the PM-Cube are embedded in the story of a PhD candidate who not only applies project management methods to her research work but also uses them to tackle the challenges and problems she faces.

