Masaryk University
Faculty of Economics and Administration

Operations Management: seminar work

Utilization (application) of the Theory of Constraints (TOC), Critical Chain Project Management (CCPM) as a Project Management Methodology based on TOC principles.

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Contents

1.) How would you apply CCPM and TOC tools for the planing of your own thesis? Can you name the main project risks? Do you know how to diminish these risk factors?

In order to be able to apply the terms of TOC and CCPM, I have to be able to fully understand them. So I will start this paper by providing some theory background about the key terms.

Theory of Constraints

History:
- Founder : Dr. Eliyahu M. Goldratt
- Introduced in the 1984 book titled "The Goal"

What is it?
- A management philosophy/theory that if applied will help organizations to achieve their goal.

Main idea:
- Every system must have at least one constraint that is limiting it from achieving its goal and only by removing the constraint the results will improve.
- A constraint is anything that prevents the system from achieving a higher performance.

Three key questions:
- What to change?
- What to change to?
- How to cause the change?

Five Focusing Steps:
- Identify the system constraint
- Exploit the constraint
- Subordinate everything to the above decision
- Elevate the constraint
- Repeat for the new constraint

Critical Chain Project Management (CCPM):

What is it?
- The longest chain of tasks that takes into consideration not only the task dependencies but also resource dependencies

Based on:
- Resource constraints
- Optimum use of buffers

Important:
- The difference between the Critical Path and CCPM is Critical Chain recognizes that a delay in resource availability can delay a schedule just as easy as a delay in dependent tasks

CCPM overcomes problems such as:
- Bad multitasking : by reducing it
- Student's Syndrome : by not postponing the start until the delay is near
- Parkinson's Law: by not allowing the project to use the safe time

Now that I briefly explained the theory, let's clearly establish what the project is and what needs to be done in order to succeed.

What is a thesis?

"Thesis:
- *a proposition stated or put forward for consideration, especially one to be discussed and proved or to be maintained against objections*
- *a subject for a composition or essay*
- *a dissertation on a particular subject in which one has done original research, as one presented by a candidate for a diploma or degree."*

(Source: http://dictionary.reference.com/browse/thesis)

So the goal of the project is to submit a qualitative written thesis within the deadline.

In the *Table 1* is presented the structure of the thesis, the questions that need to have an answer and some key points to take care of.

Table 1: Thesis Structure

Main Sections	Sub Sections	Question to answer	Key Points
Introduction	Thesis statement	Why do it?	Written last because it is a general idea about what the whole thesis
	Objective of study		
	Definition of terms		
Review of related literature			Present the major idea
Methodology	Research design	What needs to be done?	More chapters Show that the questions were answered Show relevance of work to solution
	Sources of data		
	Data gathering		
	Data analysis		
	Statistical treatment		
	Research instruments		
Results & discussions	Data presentation	What are the findings?	For each paragraph - a sentence
	Interpretation		
	Discussion		
Summary, Conclusion, Recommendation	Suggestions	What does it mean?	Short and concise statement

Having a clear structure of the thesis allows me to split the project time as follows:
- Introduction – 5%
- Review of literature – 30%
- Research methodology – 10%
- Data collection – 20%
- Analysis – 20%
- Conclusions – 10%
- Bibliography – 5%

Total length of the project will be 80 days with at least 4hours of work/ day, in best cases will be 6hours/day. The calculations are the following. The project will be started in January, because as I mentioned I am not good at multitasking and because of winter holidays. The project must be submitted in IS on 15th of May. So the project duration will be around 4 months, but because of the project buffer 50% will represent the buffer and the difference will be the length.(The concept of project buffer will be explained later in the paper.)

In order to have a qualitative thesis the main accent will be on the content, meaning the message of the paper. The ways the message will be presented and formatted are also important but not as much as the content.

Finally TOC can be applied to the project. Because according to the theory the system can have only one constraint at a time, I consider that the first constraint will be gathering data for the theoretical and practical part. The second constraint will be the writing process, especially because content is so important for delivering a qualitative thesis. The third constraint will be time, because unfortunately there is a dead line according to the Faculty Academic Calendar for 2015-2016. On the 15th of May the thesis must be uploaded into the IS. In order to exploit and subordinate everything to the constraints I should not exceed the time for each step. Last but not least the constraints can be elevated by working hard avoiding wasting time on unimportant activities and staying focused on the main goal- submitting a qualitative thesis in time.

"Project risk is an uncertain event or condition that, if it occurs, has a positive or a negative effect on at least one project objective, such as time, cost, scope or quality."
(Source: A Guide to the Project Management Body of Knowledge 3rd Edition, Project Management Institute Inc., © 2004)

So in the process of writing my thesis I think I will encounter all kinds of risks, which can be classified into three main categories:

Risks that I am aware of:
- Timeline (Gantt chart) setting and following for the work related to the thesis
- Relevant literature
- Supervisor challenge (miscommunication, unavailable, perfect)
- Multitasking (being up to date with current studies, start preparing for the state exam and writing my thesis)
- Fear and panic
- Procrastination

Risks that I can predict:
- Find a job
- Computer errors or failures
- Holliday and vacation spent with family and friends

Unpredictable risks:
- Illness of any kind
- Family or personal problems

"*Risk Management: The process involved with identifying, analyzing, and responding to risk. It includes maximizing the results of positive risks and minimizing the consequences of negative events.*"
(Source: <u>A Guide to the Project Management Body of Knowledge</u> 3rd Edition, Project Management Institute Inc., © 2004)

The benefits of managing risks in project management are huge. Dealing with uncertain projects in a proactive manner is mandatory because it increases the probability of deliver a qualitative project in time. According to some statistics project problems can be reduce by up to 90% by using risk analysis.

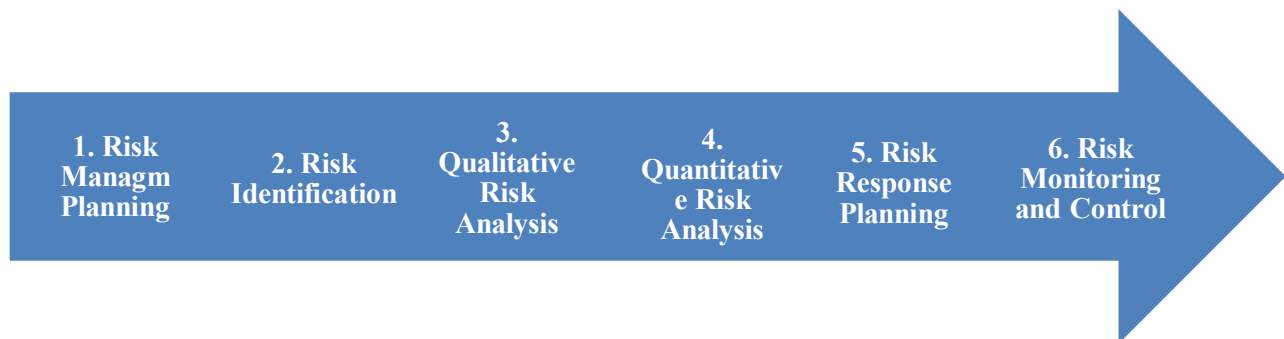The project risk management includes the following steps:

| 1. Risk Managm Planning | 2. Risk Identification | 3. Qualitative Risk Analysis | 4. Quantitative Risk Analysis | 5. Risk Response Planning | 6. Risk Monitoring and Control |

Figure 1: Risk management process
(Source: <u>A Guide to the Project Management Body of Knowledge</u> 3rd Edition, Project Management Institute Inc., © 2004)

1. Risk Management Planing – during this step the management has to decide how to treat, to plan and to execute the risk management activities related to the project.

2. Risk Identification – characterized by identifying which risks might have an impact on the project by gathering information and analyze the data.

3. Qualitative Risk Analysis – risks are divided into categories and assigned probabilities of happening.

4. Quantitative Risk Analysis – analyze numerically the effect and the consequences of the identified risks on the project.

5. Risk Response Planning – developing strategies for increasing the positive effects of opportunities and reduce the negative effects from threats.

6. Risk Monitoring and Control – track the identified risks and evaluate their effectiveness during the project.

By following these steps I can increase the probability of exploiting the opportunities and diminishing the threats effect on my project of writing the thesis. Further a more detailed analysis of risk is provided.

Relevant Literature – the risk can have both positive and negative effect. There is the possibility for me not to find everything that I need, but at the same time there is a possibility for me to find exactly what I need.

Supervisor challenge – can also have a positive and a negative effect on the project. If the supervisor is continuously busy, writing an email in advance and schedule an appointment to a convenient time is the solution. Miscommunication of any kind can be also avoided by clearly stating what needs to be done. At the same time the relation with the supervisor can be very productive and fruitful.

Multitasking – I am one of those persons that are not very good at multitasking. So trying to be up to date with current studies, start preparing for the state exam and writing my thesis will be the recipe for disaster in my case. The solution will be to take each activity at a time and to not mix them.

Finding a job - I consider it a predictable risk because I can analyze the status of my writing and realize if there is time to be spared to apply for a job or should this activity be postponed until after a successful graduation. In case of meeting the deadlines- some work experience in European Union can always be an advantage.

Computer failure - this risk has only a negative effect on my project. The probability of this risk to occur is very low, because I recently bought a new laptop. Still in case this risk will happen the consequences will be devastating, because I will have to start from the beginning. So in order to diminish the effects of this risk I could and I should save my work not only on my computer but also in google drive for example or upload it in Dropbox after any changes made.

Procrastination during holidays – of course holidays are the time of the year that everybody expects and cherishes, but I should not forget that writing my thesis and submitting it in time is a prerequisite for obtaining the degree for which I studied for the last two years. So in order for me to enjoy future holidays, I am sure that I can invest an hour a day to write or gather information and data for the project during these holidays.

Unpredictable risks - I consider that the only solution would be to introduce time buffers in the project in order to avoid any delay. A more accurate explanation about time buffers will be provided further in the paper.

Table 2: Summarized risk analysis

Risk		Effect		Solution	
Type	**Detailed**	**Positive**	**Negative**	**Exploit**	**Avoid**
Aware of	Gantt chart following	Yes	Yes	improve the quality	checking each step
	Relevant literature	Yes	Yes	focus on the most important	reading too much
	Supervisor challenge	Yes	Yes	ask for advice and guidance	email
	Multitasking		Yes		one task at a time
	Fear and panic		Yes		ignore and focus on the project
	Procrastination		Yes		focused on goal
Predictable	Find a job	Yes	Yes	gain work experience	do not apply
	Computer errors		Yes		copies on google drive
	Holidays		Yes		an hour a day for thesis
Unpredictable	Illness		Yes		time buffer
	Family/personal problems		Yes		time buffer

2.) What kind of effects do you expect by possible using buffers (time buffers) during the working out of your thesis? Can you explain what a time buffer is? How you can measure a reached result.

There are three types of buffers used in project management in order to ensure a successful delivery of the project:

Project Buffer – it is the buffer for the whole project, inserted at the end, between the last task and the date of submitting/finishing the project. The main idea of this type of buffer is to absorb any delays that may occur during the realization phase of the project leaving the finishing date unchanged.

Feeding Buffers – are the buffers created for each task that feeds into the critical chain. Delays in the critical chain can impact the starting of a subsequent task and in this way to postpone the whole project.

Resource Buffers – are buffers assigned in the critical chain to ensure that the necessary resources and people will be available when needed.

Time buffers can be defined as the amount of additional time added during planning at the end of the project or after some critical points in order avoid not delivering in time or to compensate for uncertainty.

Every person when asked about the amount of time needed for completing a certain task will include a safety period. There are very few those who will say the actual period of time needed. Most human beings include a safety net for "just in case" situations, because being late is a state of mind that we all got used to it.

The reality of life is that uncertainty exists so in order to protect from it we include additional time. Adding a small amount of safety time it is not unreasonable and it is actually advisable. But of course one should not abuse the concept. Using to many buffers may indicate the fact that the planning of the project was done poorly. Too large or too many buffers can also have a negative effect by increasing the duration of the project, because the humans are built the way that if they know that there is some additional time they will use it and might even register delays in delivering the project in time! According to Parkinson's Law there are many of those who will *"expand the work to fill the available time."*

So buffers can also be perceived as a way to waste time and to prolong the project duration because although having buffers may allow the project to run smoothly they do not add any value. The student should bear in mind that the use of buffers must be carefully done and not use buffers just for the sake of using them. Additional safety will only extend the project duration and will not protect it from uncertainty. Inflating the time is not the solution.

I consider that it is almost impossible to make an accurate estimation of time needed to complete each step/task of the project. One way of avoiding the use of buffers might be to make a thorough analysis of the risks and having a proactive approach towards avoiding them or decreasing their effect on the project. Plus the main goal is to deliver a qualitative project in time, not specific parts of it. That's why I decided to use only the project buffer and to add some time at the end.

Let's not forget that writing the thesis is mostly a creative process with mainly one actor, so 90% of the success of the project depends on the person that is writing it and its ability to stay on track and focus on completing the project. Because there are different students there will be different scenarios: some might get stuck at the writing of the thesis statement and not move from that point, others might write first the chapters and then after having an idea about what the thesis is mostly treating might go back and formulate the thesis statement. So it will depend only on the student to organize its workload.

As a conclusion, I think that the key is to make a feasible and realistic time schedule and no matter what to follow it. And more important than adding buffers after any key activity will be to add buffers only at the end of the project to protect it from any unpredictable risks. I will apply the simplest method proposed by E. M. Goldratt, meaning that I will calculate the buffer by multiplying the length of the project by 50%. The result of using a project time buffer will be that it will protect my project from risks and it will allow me to finish it in time.

Table 3: Gantt chart

Activities	Week 1	2	3	4	5	6	7	8	9	10	11	12
Searching info for theoretical part	█											
Reading and selecting the gathered info		█										
Writing the theoretical part		█	█									
Gather data for practical part				█								
Analyze the data				█	█							
Writing the practical part					█	█						
Conclusion and Introduction							█					
Formatting and revision								█				
Bibliography								█				
Buffer time									█	█	█	█

3.) Can you specify by use of Thinking Process Tools Your personal bottleneck as far as studying processes or writing a work or working on assigned school tasks (by other tutors) is concerned? Create CRT and create a list of Undesirable Effects

Current Reality Tree (CRT) process contains six major steps:
1. Determine the scope –write a qualitative thesis and submit it in the time frame
2. List between 5 and 10 undesirable effects
3. Diagram the cause and effect relationships between the entities
4. Review and revise for clarity and completeness
5. Apply the "so what" test
6. Identify the core causes

My list of Undesirable effects (UDE):

UDE 1: difficulties in starting the process
UDE 2: lack of time (due to procrastination or any other "more important" activities)
UDE 3: problems staying focused on the thesis preparation (reading and writing)
UDE 4: reading too much and postponing starting the writing process (one cannot read all the information related to the subject)
UDE 5: cannot find the necessary literature and data for the writing the thesis and for analyzing the practical part
UDE 6: supervisor is too busy or there will be miscommunication
UDE 7: student syndrome meaning that I will postpone starting working on the thesis until the last moment
UDE 8: perfectionism syndrome meaning that I finished a chapter and instead of starting the next one I am wasting time for formatting and reediting the existing one (there is a specific time and activity at the end of the project, no need to do it in the middle of project)
UDE 9: ignore the Gantt chart with the timetable and rely on buffers (Parkinson syndrome)
UDE 10: bad multitasking: trying keep up to date with current project, starting studying for final exam and writing the thesis
UDE 11: setting bad or confusing priorities: going to the gym and skip writing
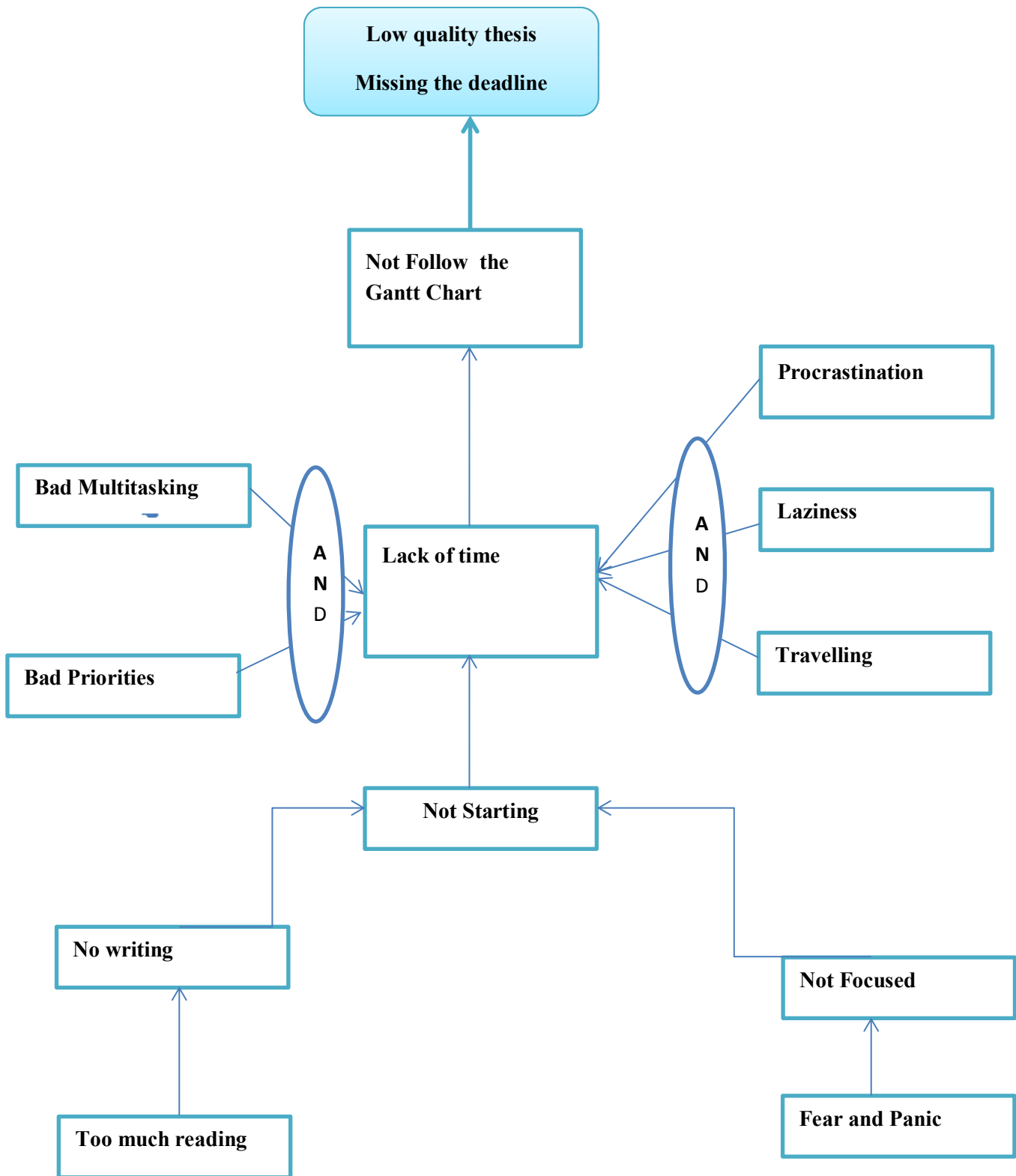UDE 12: being lazy and not in the mood of writhing
UDE 13: deciding to go travelling for a few weeks and stop any activity on my thesis
UDE 14: fear and panic make me being worried and block me from doing anything so I will do nothing
UDE 15: computer failure

After analyzing I consider that the core problem will be time management.

Low quality thesis

Missing the deadline

Not Follow the Gantt Chart

Procrastination

Bad Multitasking

Laziness

A N D

Lack of time

A N D

Bad Priorities

Travelling

Not Starting

No writing

Not Focused

Too much reading

Fear and Panic

4.) Create with use of already existing set of UDE´s Ishikawa fishbone diagram and put some weights meaning numbers specifying an importance of assign reasons. Based on the set of assigned score create Pareto Lorenz curve. Specify most important reasons. Compare with root problem found by use of Current Reality tree.

Table 4: Pareto analysis table

UDE	Importance	Cumulative Count	%	Cumulative %
Time management	60	60	18.18	18.18
Bad multitasking	42	102	12.73	30.91
Follow/Ignore the Gantt chart	40	142	12.12	43.03
Bad priorities	38	180	11.52	54.55
Laziness and procrastination	38	218	11.52	66.06
No writing	36	254	10.91	76.97
Student syndrome	34	288	10.30	87.27
Too much reading	27	315	8.18	95.45
Computer Failure	15	330	4.55	100.00

Figure 3: Pareto Lorenz curve

Fishbone Diagram

Student
- Procrastination
- Student Syndrome
- Delays
- Perfectionism
- Lazyness
- Not Focusing

Supervisor
- Not Interested
- Time consuming
- Too Busy
- Communication Issues

Equipment and Material
- Time saving
- Typing Skills
- Delivery Delay
- Computer Failure
- Delays
- Too much/ Lack of Literature

Planning and Processes
- Delays
- Postponing the Start
- Chaos & Delays
- Chaos & Delays
- Not Following the Chart
- Bad Planning
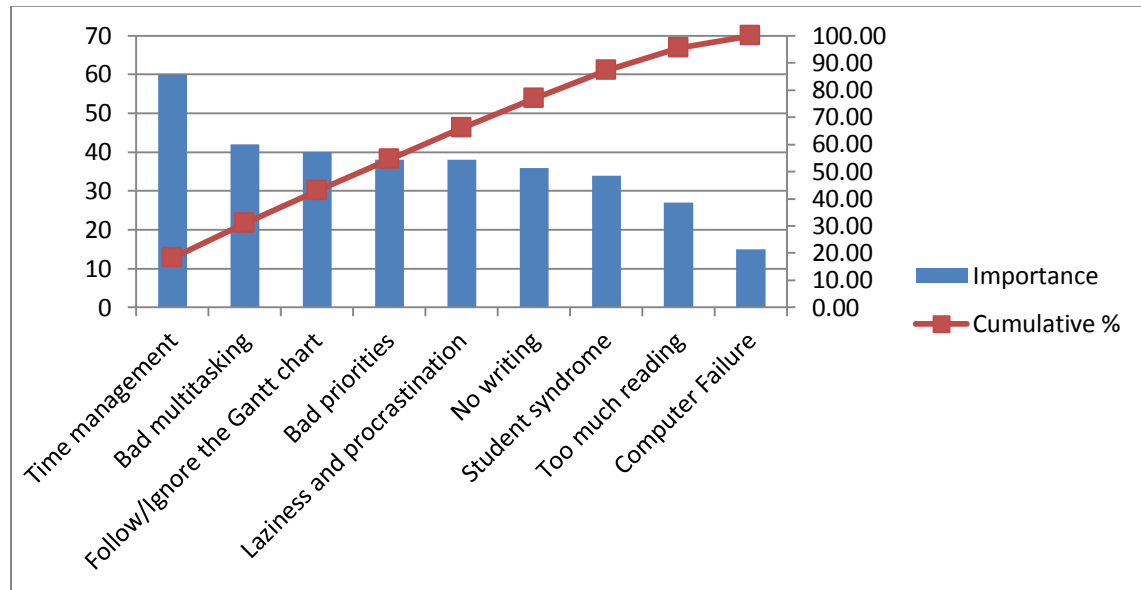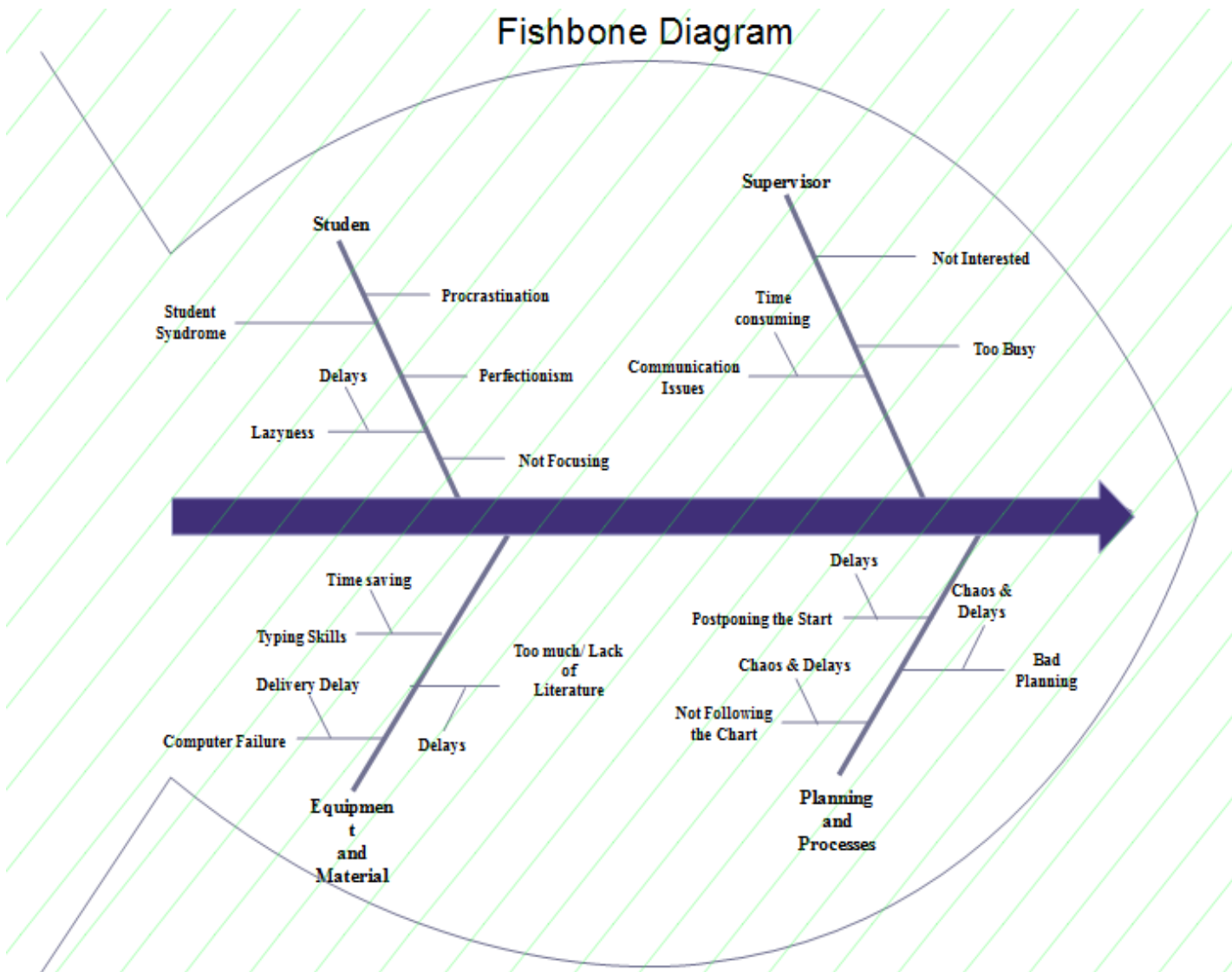
Figure 4: Fishbone Diagram

5.) State clearly your suggestions how to improve your thesis writing and related benefits

1. Time management is essential for the success of the project

Time management will help me control the time spent on each activity and monitor if I am on track with the planned deadlines. Having a great Gantt chart will not be enough, following it and respect the key points and deadlines will be crucial. The saying goes that:" There is no better time than today to start doing something" like the project in my case, so no postponing, no wasting time on not important things or relying on the project buffer. A smooth and consistent work will be the key for success.

2. Self-improvement

I will be the main actor of this "play", so completing this project depends 90% on me. It will be mandatory for me to be organized, focused, motivated and of course to avoid laziness and procrastination.

3. Implement Reward System

To make this complicated and complex project a little bit more fun I decided to create a Reward System. The purpose of the Reward System is to motivate me enough so I will follow the timetable. The big prize will be a week trip to an exotic destination, but only if I will be satisfied with the quality of the thesis.

Table 5: Reward System approach

Obtained results	Level of satisfaction	Reward
Before the planned date	Satisfied	Week-end gateway trip
Exactly on the date	OK	Evening with friends
After the planned date	Dissatisfied	No chocolate for a week

The benefits of following these three simple steps will be that:

- the process will be more organized and less stressful
- a guaranteed delivery in time of a qualitative written thesis.

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A Guide to the Project Management Body of Knowledge (4th Edition) ANSI/PMI 99-001-2008

Writing a thesis is a unique and complex project. The complexity is a result of all the combinations from time limits, resource finding, paraphrasing, editing, verifying. The number of chapters, the focusing on theory or practice all depend on the view that the student has.
There are the constraints factors like time for example, because according to the faculty schedule the thesis must be uploaded into IS on the 15 may 2016.