

**Masaryk University**  
**Faculty of Economics and Administration**



**Operations Management: seminar work related to Utilization – *application* of the Theory of Constraints (TOC), Critical Chain Project Management (CCPM) as a Project Management Methodology based on TOC principles.**



**MPH\_AOPR**

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## Introduction

This seminar work is based on a real business of a winery, more specifically on their sales process within the Private, Corporate, and Gastro segments, which all require the same approach.

Currently the process is performed entirely by the business owner, there is limited time and it is lost by commuting from place to place, furthermore wine is stored in the owner's private garage, meaning that the sales process is entirely dependent on the owner being in Prague. This complicates things for the new 'marketing employee' because she currently doesn't have an office to be in, and doesn't have access to wine, meaning that she cannot carry out the sales function. The issues will be developed using the appropriate tools. The structure is that of answering the questions presented by the course leader, Ing. Skorkovsky, explaining the theory where necessary.

How would you apply CCPM and TOC tools (e.g. CRT=Current Reality Tree) for the planning of Your dissertation (writing the dissertation is, in fact, a project)? Can you name the main project risks?

### Theory of constraints

Theory of constraints was presented by E. Goldratt in his novel "The Goal". TOC changes the perspective of an organization from the classical accounting cost perspective, towards the throughput perspective, with the main concern being on improving the bottom line and not arbitrary indicators. The necessary trends within TOC are for simultaneous increase in throughput, decrease in inventory, and a decrease in operating expenses, therefore, focusing on a single metric is not addressing the root cause of the issue and is not bringing improvements that are improving the bottom line. The central idea in the theory of constraints is the "bottleneck" which is the factor that is the single most limiting to the throughput of the organization. TOC has a five-step process, which needs to be respected in order to solve bottlenecks and to improve throughput, moving towards the organization's goals.

- Step 0. Identify the Goal of the System/Organization  
Step 0.5 Establish a way to measure progress to Goal
- Step 1. Identify the system's constraint.
- Step 2. Exploit the system's constraint.
- Step 3. Subordinate everything else to the above decision.
- Step 4. Elevate the system's constraint.
- Step 5. If a constraint is broken (that is, relieved or improved), go back to Step 1. But don't allow inertia to become a constraint.

The key questions that are necessary to answer and that lead us through the TOC process are:

- What to change?
- To what to change to?
- How to make the change happen?

These three questions correspond with three TOC thinking tools:

- Current Reality Tree provides the answer to the question of "what to change", providing us with the picture of the current status of undesirable effects and of the end result as well as of the core problem.
- The Evaporating Cloud resolves conflict with multiple solutions of "to what to change", providing us with the final injection (solution) that will be implemented.
- The Future Reality Tree implements the injection and provides us with the visualization of how the desirable effects will affect each other, helping to answer "to what to change".
- The Negative Branch Reservations is the final tool of the second question, allowing us to address objections to the injection.
- The Prerequisite Tree helps us to answer "how to make the change happen?". This becomes the strategic action plan generation, as it identifies obstacles and strategies to overcome those objections as intermediate objectives.

- The Transition Tree provides us with detailed actions that are necessary to be taken in order to fulfill intermediate objectives.<sup>1</sup>

## Critical Chain Project Management

CCPM is an alternative to Critical Path thinking, Critical Chain focuses on the resources available rather than on to the tasks. CCPM takes into consideration a number of phenomena, improving the planning process and speeding up the processes.<sup>2</sup> The main phenomena that it takes into consideration are:

- Student syndrome causes reserve time to be wasted by delaying task to last possible moment.<sup>3</sup>
- Parkinson's law is the effect of an early completed task causing idling until the task is due, instead of saving time.
- Bad multi-tasking causes performance to drop and more time necessary to execute multiple projects.
- Murphy's law: anything that can go wrong, will.

During the planning phase of the project, the phenomena above are taken into consideration in making of the time plan. Individual activity durations are halved and the excess time is added to the buffer, which isn't at the end of each task, but rather at the end of the whole project. During execution, there is strong emphasis on carrying out the task as fast as possible as duration has been cut in half. The measurement of the progress is very straightforward, yet very effective as it uses the penetration relative to completion of project to create a "buffer consumption graph".<sup>4</sup>

I would apply TOC to the project of gaining more customers in Prague simply by following the thinking tools, which guide us through the entire process of identifying a constraint and eliminating it. In this case the sales process is very limited and there clearly more than one constraint, however, for the purpose of this work, the main focus will be on the constraint of commuting to potential customers. The main focus will be on the thinking tools used to answer the three key questions.

Applying the CCPM onto this project is tricky as currently all the operations are in a critical chain, as they are performed by one resource, the main focus at this given point in time is to reduce the time of certain activities within the CC, to allow for more cycles to be carried out. However, if we ignore the scope of this project and look into the future, then the CCPM will be used to create resource buffers. This will be expanded in answering question 3.

To begin the process of TOC the goals of the company must be presented, showing what specific improvements to aim for and the direction to take. This will be done by presenting the Balanced Scorecard. Furthermore, the current situation must be presented first, identifying the current

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<sup>1</sup> Skorkovsky, Jaromir. "MPH\_AOPR - Introduction to the Theory of Constraints." MPH\_AOPR - Introduction to the Theory of Constraints. Brno.

<sup>2</sup> Stepanov, Andrew. "Critical Chain Project Management." Gantt Chart GanttPRO Blog, 1 Sept. 2017, <https://blog.ganttpro.com/en/critical-chain-project-management-ccpm/>.

<sup>3</sup> Usmani, Fahad. "Critical Chain Method (CCM) in Project Management." PM Study Circle, 18 Feb. 2019, <https://pmstudycircle.com/2014/02/critical-chain-method-ccm-in-project-management/>.

<sup>4</sup> "QAPI - How to Use the Fishbone Tool for Root Cause Analysis." Centers for Medicare & Medicaid Services, <https://www.cms.gov/medicare/provider-enrollment-and-certification/qapi/downloads/fishbonerevised.pdf>.

processes and showing what the as is scenario is. This will be done by presenting the Business process models.

## Balanced Scorecard

A Balanced Scorecard—often abbreviated as “BSC”— is a strategy management framework that includes four perspectives of your strategy: Financial, Customer, Internal Process, and Learning and Growth.<sup>5</sup>

The vision for the company is to provide high quality wine to different types of customers, to be available to all segments of the market, to distribute through all channels and in short to be where there is wine. Segments with high growth potential are the Gastro, Corporate, and Individual, and especially in the geographic location of the Capital city of Prague. Here we aim to see more than half of our growth in sales coming from, therefore the strategic objective is to improve the sales process and gain more customers in the Gastro, Private, and Corporate segments, especially in Prague.

The financial objectives are what allows the company to secure the long-term and short-term continuation of its existence. They are in a way the ultimate goal; however, they are implicit to other activities and are not self-sustaining goals. The main financial goals are:

- To increase market share in the Gastro, Private, and Corporate segments in Prague.
- To secure more high-margin contracts and sales and to secure more long-term contracts.
- To increase revenues and profitability.

All of these financial objectives provide us with a different perspective on the same task, however allowing us to avoid the pitfalls of blind metric, we need more sales and more profits.

The customer-oriented objectives allow us to measure how the company’s most crucial stakeholders are being affected by our strategy, how they respond to our business and what is necessary to do in order to bring them fully on board and engage with them in successful business. The customer-oriented goals are:

- To increase customer service by providing convenience in our wine presentation.
- To create a more physical association to increase perception of trustworthiness and to improve brand image and brand recognition.
- To increase random spontaneous encounters with potential customers.
- To spend more one-on-one time with key customers.

These customer objectives allow the company to improve the brand perception and to increase engagement with new and current customers.

The process objectives provide us with a focus on the internal processes of the organization, the way that things are done and the necessary changes to carry out in order to fulfill the vision and the strategic objective of gaining new customers in Prague:

- To Increase the time available to conduct sales-related activities.

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<sup>5</sup> Lucco, Joseph. “A Full Balanced Scorecard Example (Including 6 Templates).” ClearPoint Strategy, 20 Sept. 2019, <https://www.clearpointstrategy.com/full-exhaustive-balanced-scorecard-example/>.

- To make the sales process independent of the Owner.
- To have wine storage in Prague accessible without the owner present.
- To gain office space necessary to hire more people for the sales process.

Learning and growth provides the long-term developmental objectives that will help the company to improve the efforts and take the company forward. There are a number of objectives in this perspective:

- To gain “marketing employee” for full time and to develop them into a marketing/sales person.
- To hire more people in Prague to be able to develop future marketing and sales activities in this key geographic location.
- To gain more time for the owner to be able to focus on key customers and partners.
- To invest in direct distribution channels.
- To have all the tools necessary for a successful sales process.

### Current process of acquiring new customers in the Private, Gastro, and Corporate segments

Currently, the entire sales process in the Gastro, Private and Corporate segments is performed by the owner. The process begins with lead generation, where the owner, creates a list of potential customers, judging their viability based on personal judgement, they call the contact and inquire the interest in wine. If there is lack of interest, the database is updated and the contact is dropped for a period of time. If, however, there is interest in wine, the necessary details are communicated over the phone, e-mail offers are sent and meetings are set-up, preparing for the next steps of the sales process, which are holding the meeting and closing the deal.

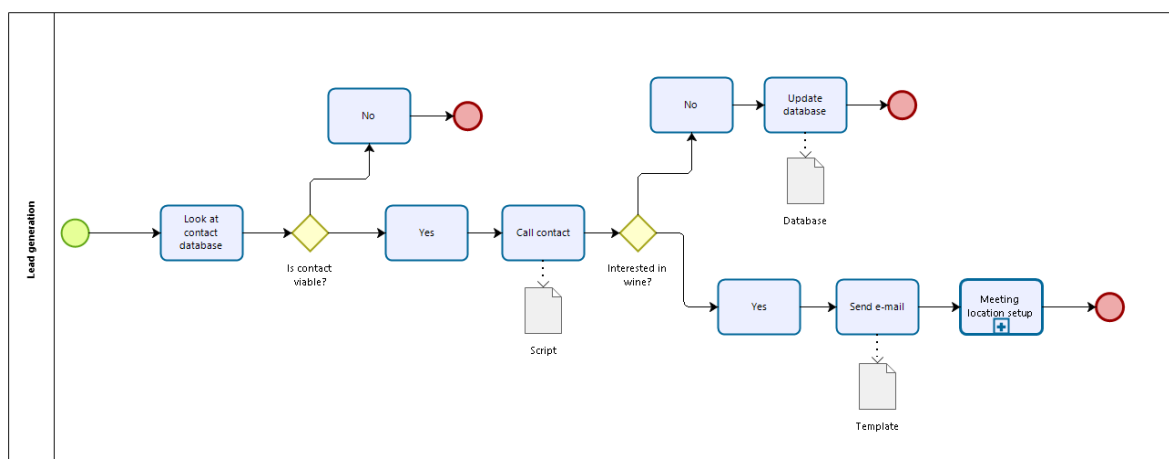


Figure 1: Lead Generation, Jan Cibulka

In the meeting location setup, we can see that the entire process goes through an additional logic loop and task of finding a suitable third party place to hold the meeting, not only is the search for a suitable location time consuming in itself, it is creates an opportunity for the potential customer to have second thoughts at the necessity for multiple coordination phone calls to negotiate the location.

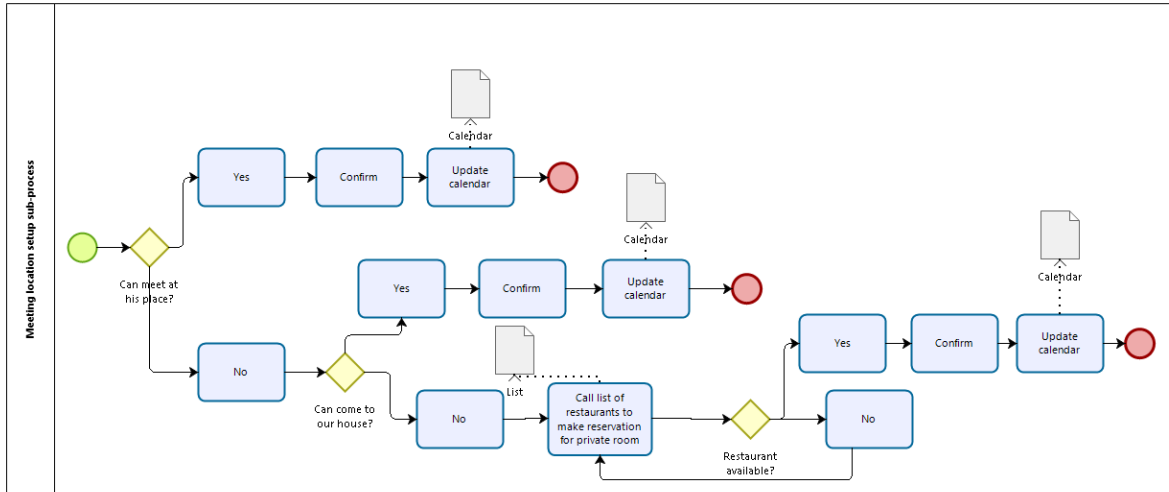


Figure 2: Meeting location Setup, Jan Cibulka

Stemming from the fact that the owner has other things to tend to, they are not present in Prague for the entirety of available time, this makes it even more difficult to negotiate with the possible customer the terms of the meeting.

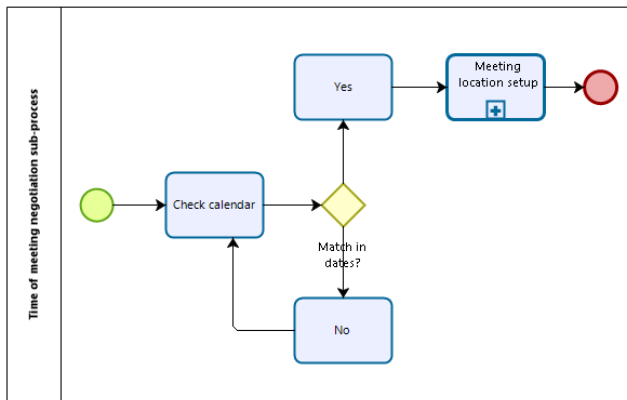


Figure 3: Time of meeting negotiation, Jan Cibulka

During the day of the meeting, the necessity to commute to and from meetings, or the necessity to stay at home means that during an average day, a very limited number of meetings are held, generally no more than two major prospects.



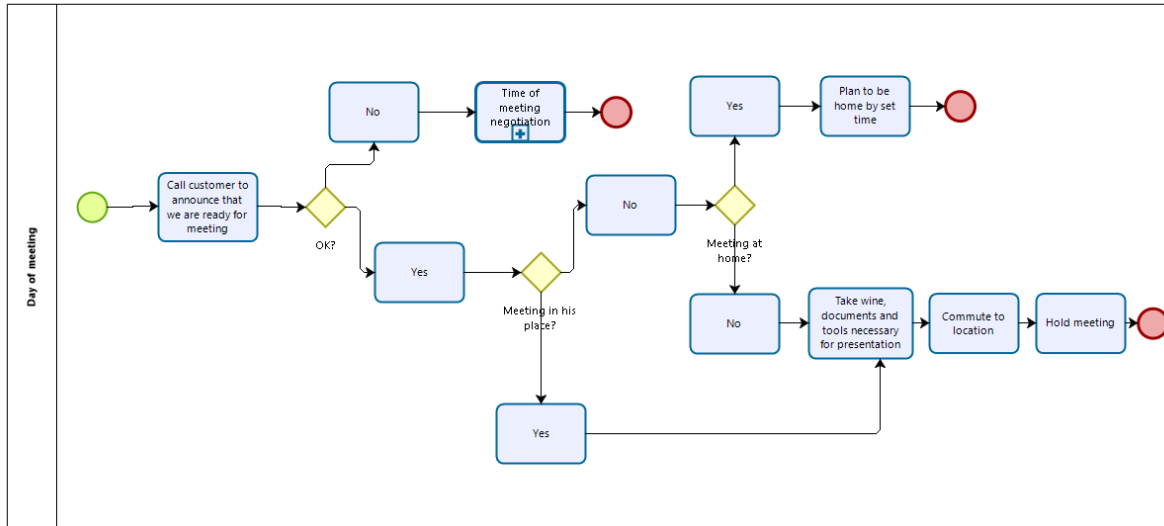


Figure 4: Day of meeting, Jan Cibulka

Currently, the risks that arise from this model are various congestions within the process, every additional decision point, every additional call that is made, and anything that lowers convenience for the potential customer not only presents the company as unprofessional, unreliable and untrustworthy, but it also provides room for second thoughts, prospect deals must be closed as soon as possible and not allowed to be given the opportunity to be lost. Some of the risks are:

1. Having an old database to call from
2. Calling a number that has been called before and forgotten about
3. Misjudging the viability of a contact
4. Forgetting about a meeting
5. Confusing the location of the meeting
6. Not finding a viable location in peak season
7. Being stuck in traffic commuting to prospect
8. Not finding a time that suits the prospect
9. Missing potential customers
10. Taking the wrong wine

Do you know how to diminish (to reduce) these risk factors (to avoid obstacles)? Name at least ten obstacles!

Reducing these risk factors means reducing the uncertainty within the process by reducing the decision points and making the automatic response much simpler. The following suggestions are meant to reduce the risk factors shown above.

1. Have a set period for database rejuvenation
2. Update the customer database religiously, ideally implement a CRM system
3. Having metrics for assessing a contact, eg.: revenue, no. of employees, location, etc.
4. Having multiple alerts in the calendar, ideally linked with a CRM system
5. Calendar alerts should have location integral to them, CRM
6. Have less-than-ideal solutions in the list
7. Taking traffic times into consideration
8. Offering alternative methods, ie.: sending samples by messenger and offer by e-mail
9. Exerting extra effort to expose winery to customers, ie.: fairs, conferences and events
10. Part of calendar/CRM should be what wines need to be taken to customer

What kind of effects do you expect by possible using buffers (time buffers) during the working out of your thesis (dissertation or other chosen project)? Can you explain what the time buffer is? What is project buffers its penetration? How you can measure reached results (used metrics such as time, resource capacity, costs, good-will and so on).

A project buffer is placed between the schedule of the last task in a project and the project completion date. This “safe” duration buffer acts as a contingency for the project activities. Any delay on the critical chain will consume this buffer, but the project completion date will remain unchanged. If any activity in the project is completed early, then the gain would be added to the Project Buffer. The duration of this buffer is usually 50% of the contingency that was removed from each task estimate. This helps to move uncertainty from each task to the project buffer. Once the project moves into execution phase, this buffer size is fixed and cannot be modified.

Any path of activities merging into the critical chain is called a feeding chain. A feeding buffer protects the critical chain against violations in the feeding chain. Basically feeding buffers are added to the non-critical chains so any delay in non-critical chains does not affect the critical chain. Like Project Buffer, feeding buffers are placed between the last activity of a feeding chain (non-critical chain) and the activity on the critical chain which will be added to the project baseline schedule. These feeder buffers are calculated the same way as the project buffers.

A resource Buffer can be a Person or an equipment. Usually resource buffers are kept alongside the critical chain to make sure they are available when they are required. While the Project Buffer and Project Buffer add “Safe” time so the project is completed within the scheduled time, resource buffer makes sure that the critical resources are available to work on the critical chain activities.<sup>6</sup>

There isn't that much potential to improve the process at the current time as there is a single resource handling the entire process. Currently there is a “contact buffer”, which provides the owner with a sufficient amount of contacts that they can reach out to, this is done by eliminating bad multi-tasking and gathering all the contacts in one sitting. Furthermore, the elimination of bad multi-tasking is what has created the necessity to call contacts in one sitting and thus fill in the calendar with meetings, rather than calling before every meeting. Further improvements are possible; however, they would require a larger salesforce, sales and promotional coordinators.<sup>7</sup> In the future this is the plan, however we must proceed one bottleneck at a time.

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<sup>6</sup> Reddy, Sudarsan. “Critical Chain Project Management Methodology and Buffers Explained.” Medium, Medium, 27 Feb. 2019, <https://medium.com/@sudarhtc/critical-chain-project-management-methodology-and-buffers-explained-4caf3f0a2a2e>.

<sup>7</sup> “How to Build a High-Throughput Sales Process.” Sales Process Engineering, 23 Aug. 2012, <https://salesprocessengineering.net/2008/07/18/how-to-build-a-high-throughput-sales-process/>.

Can you specify by use of Thinking Process Tools Your bottleneck as far as studying processes or writing work or working on assigned school tasks (by other tutors) is concerned? Create CRT (see full meaning above) and create a list of Undesirable Effects (named by You as it was mentioned already in clause 1)

### Current Reality Tree

The current reality tree helps us to solve the question of what is a core problem, or what is necessary to change.<sup>8</sup>

The CRT construction process is as follows:

1. Determine the scope of the analysis
2. List between 5 to 10 pertinent entities
3. Diagram the effect-cause-effect relationships that exist among the entities.
4. Review and revise for clarity and completeness
5. Apply the “so what” test.
6. Identify the core cause(s)

### List of undesirable effects

<b>UDE1</b>	No place to meet potential customers in Prague.
<b>UDE2</b>	Lack of time to meet new potential customers.
<b>UDE3</b>	Wine is carried by hand everywhere.
<b>UDE4</b>	Wine is stored in private garage, where owner must be present.
<b>UDE5</b>	Not enough work for marketing employee.
<b>UDE6</b>	Lack of professional image (due to selling door to door).
<b>UDE7</b>	Customers in Prague don't know where to find our products.
<b>UDE8</b>	Business in Prague is limited to time of owner spent in Prague.
<b>UDE9</b>	Lack of Brand awareness.
<b>UDE10</b>	Not enough point of contact with decision makers

<sup>8</sup> Theory of Constraints: Using a Current Reality Tree " Optimal Service Management, <https://optimalservicemanagement.com/blog/theory-of-constraints-using-a-current-reality-tree/>.

<b>UDE11</b>	Not enough Gastro/Private/Corporate clients
<b>UDE12</b>	lack of lead generation

Figure 5: List of undesirable effects, Jan Cibulka

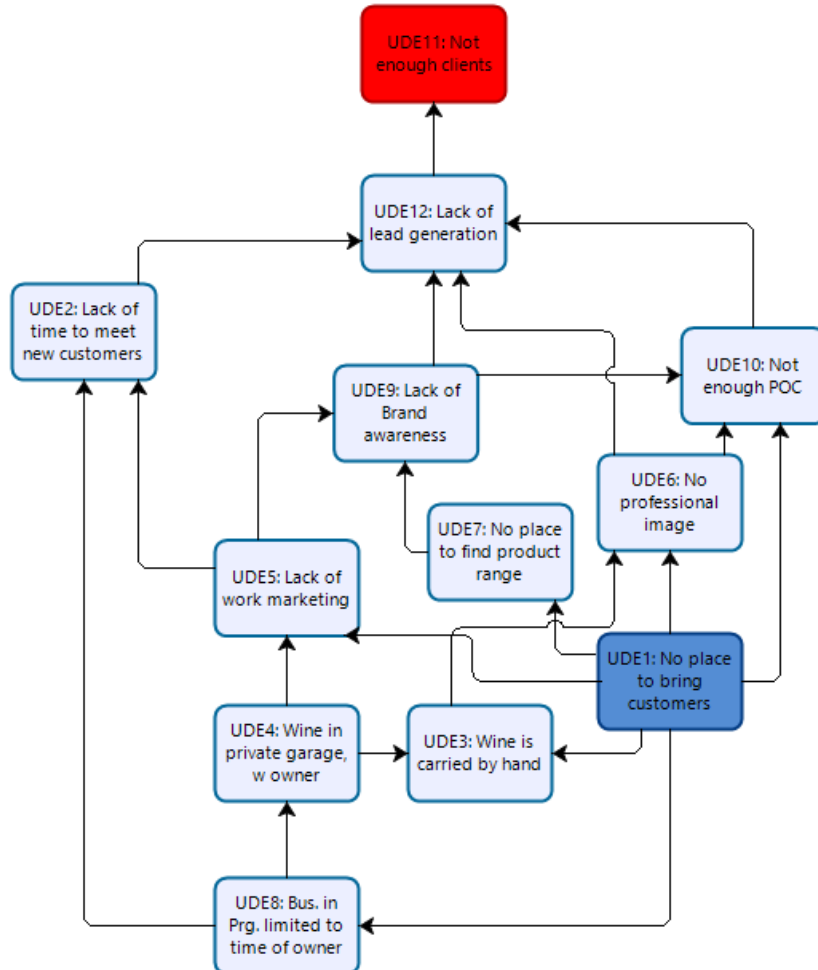


Figure 6: Current Reality Tree, Jan Cibulka

As it is clearly visible from our Current Reality Tree, the Undesirable Effect no. 1 is the core cause, or the Bottle neck of the system, as it affects all the other Undesirable Effects. This will be the main focus for moving forward.

Create with use of already existing set of UDE's Ishikawa fishbone diagram and put some weights meaning numbers specifying the importance of assign reasons. It was clearly shown in Ishikawa FBD power-point presentation. Based on the set of assigned score, create Pareto Lorenz curve (use Excel please). The principle is also shown in just mentioned presentation. Specify most important reasons. Compare with root problem found by use of Current Reality Tree.

### Ishikawa Diagram

The Ishikawa Diagram is another tool to find out the cause and effect of undesirable effects, or known as root cause analysis. The steps necessary to take in order to carry out the Ishikawa analysis are as follows.

- Agree on the problem statement (also referred to as the effect). This is written at the mouth of the "fish." Be as clear and specific as you can about the problem. Beware of defining the problem in terms of a solution (e.g., we need more of something).
- Agree on the major categories of causes of the problem (written as branches from the main arrow). Major categories often include: equipment or supply factors, environmental factors, rules/policy/procedure factors, and people/staff factors.
- Brainstorm all the possible causes of the problem. Ask "Why does this happen?" As each idea is given, the facilitator writes the causal factor as a branch from the appropriate category (places it on the fishbone diagram). Causes can be written in several places if they relate to several categories.
- Again asks "Why does this happen?" about each cause. Write sub-causes branching off the cause branches.
- Continues to ask "Why?" and generate deeper levels of causes and continue organizing them under related causes or categories. This will help you to identify and then address root causes to prevent future problems.<sup>9</sup>

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<sup>9</sup> "QAPI - How to Use the Fishbone Tool for Root Cause Analysis." Centers for Medicare & Medicaid Services, <https://www.cms.gov/medicare/provider-enrollment-and-certification/qapi/downloads/fishbonerevised.pdf>.

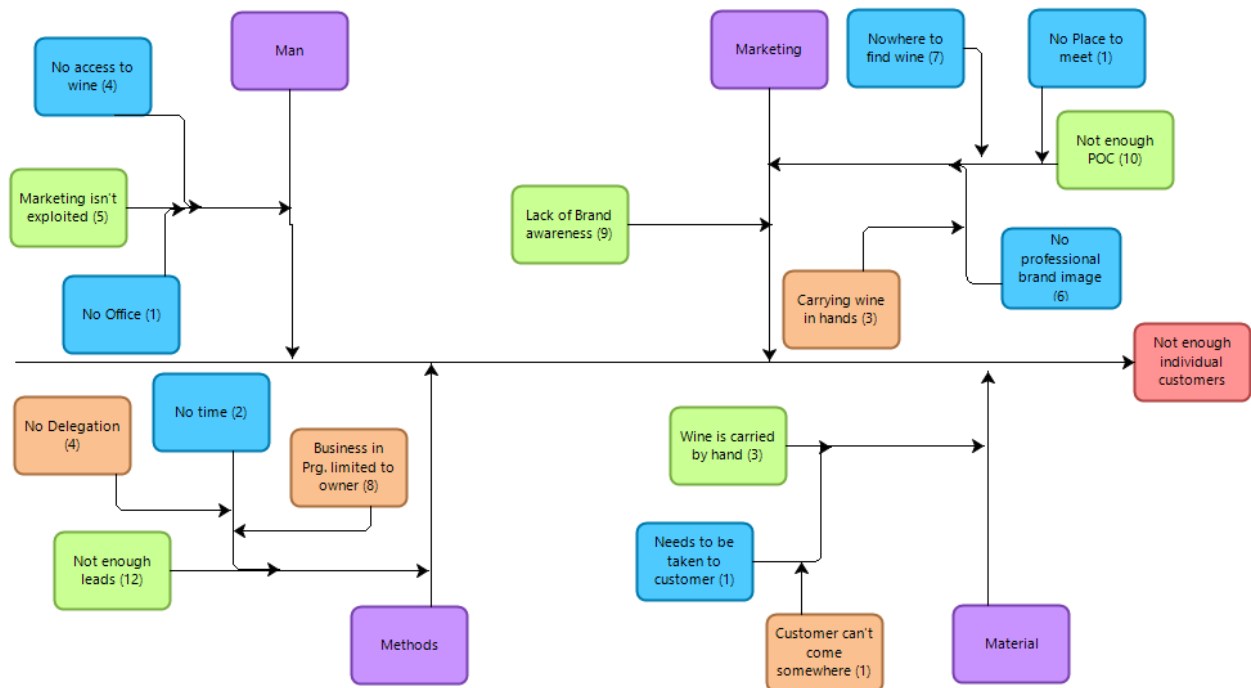


Figure 7: Ishikawa Diagram, Jan Cibulka

Area/Category
Effect
1 <sup>st</sup> level
2 <sup>nd</sup> level
3 <sup>rd</sup> level

Figure 8: Ishikawa Diagram Key, Jan Cibulka

The Ishikawa Diagram offers a different perspective onto the same problem as the Current Reality Tree by following a slightly different logic and graphic visualization, this has allowed for different problems to stand out slightly more than in the Current Reality tree. This doesn't necessarily mean that the bottleneck isn't a bottleneck, however it does show how the other undesirable effects are affecting each other and how they are significant in worsening the current situation.

### Pareto Analysis

Pareto Analysis is a tool for identifying priorities, indicating according to the 80/20 rule which tasks must be done first. There are scores assigned to the undesirable effects depending on their perceived importance and they are graphed against the cumulative percentages of the scores. Where the cumulative curve reaches 80%, up until that point, those are the priorities as solving these will solve 80% of our problems. In our pareto analysis the priorities are:

- Undesirable Effects 11, 12, 8, 1 and 2

Reject type-problem	Score-Weights	Lorenz cumulative curve %
UDE11	20	20%
UDE12	15	35%
UDE8	15	50%
UDE1	15	65%
UDE2	10	75%
UDE6	7	82%
UDE7	7	89%
UDE4	5	94%
UDE5	2	96%
UDE10	2	98%
UDE19	1	99%
UDE3	1	100%

Total 100

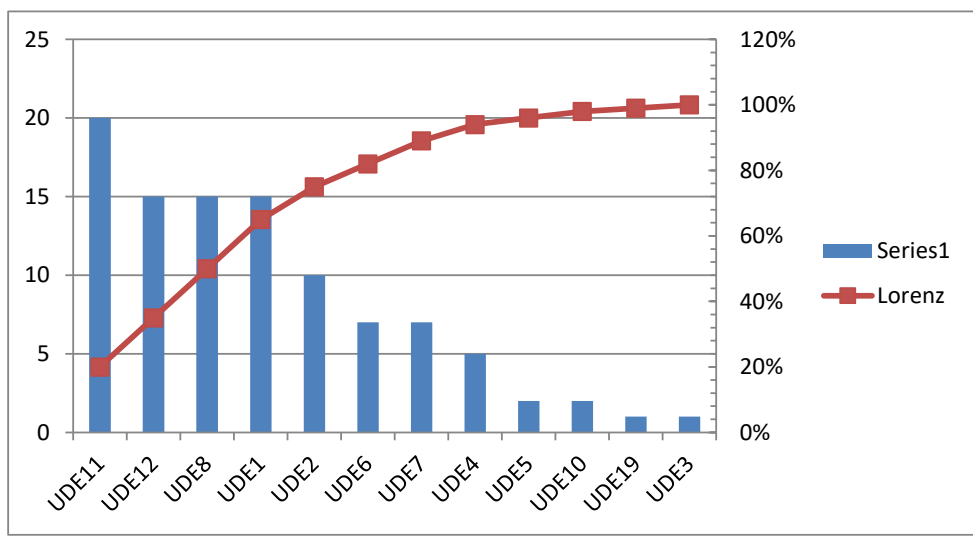


Figure 9: Pareto Analysis, Jan Cibulka



State clearly Your suggestions on how to improve your dissertation writing (or any other chosen project) and related benefits.

### Future Reality Tree

The proposed injection for solving the current situation of having not enough customers in the Gastro, Private and corporate segments, is to open a showroom/company store/office in Prague. The pros that this injection offers are that that it solves all of the undesirable effects, either directly or by collateral effect. The cons of this injection is that it focuses purely on to the current state and does not consider the possibility of re-thinking the entire process altogether, however for the scope of this seminar work it is sufficient.

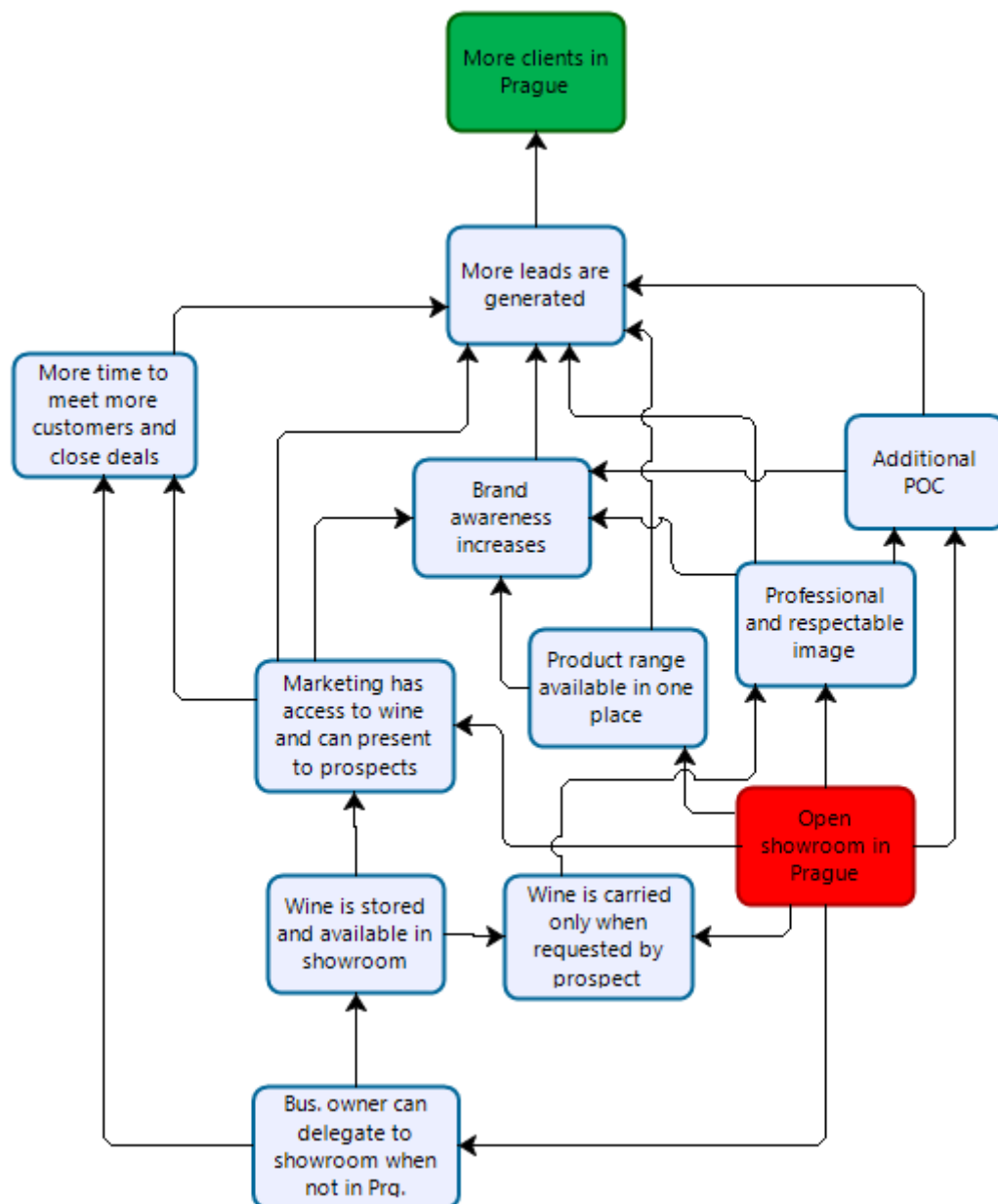


Figure 10: Future Reality Tree, Jan Cibulka

As we can see in the Future Reality Tree, the injection of opening a showroom in Prague will allow us to eliminate all of the undesirable effects that have been identified in the Current Reality Tree. Furthermore, this injection, being so interconnected with all the other undesirable effects, creates a self-reinforcing loop, where the desirable effects reinforce one another.

### Prerequisite Tree

Within the Prerequisite Tree, the activities that are necessary in order to make the injection happen are discovered by the means of obstacles regarding the injection and then identifying intermediate objectives that are key to solving these obstacles and thus the injection.<sup>10</sup>

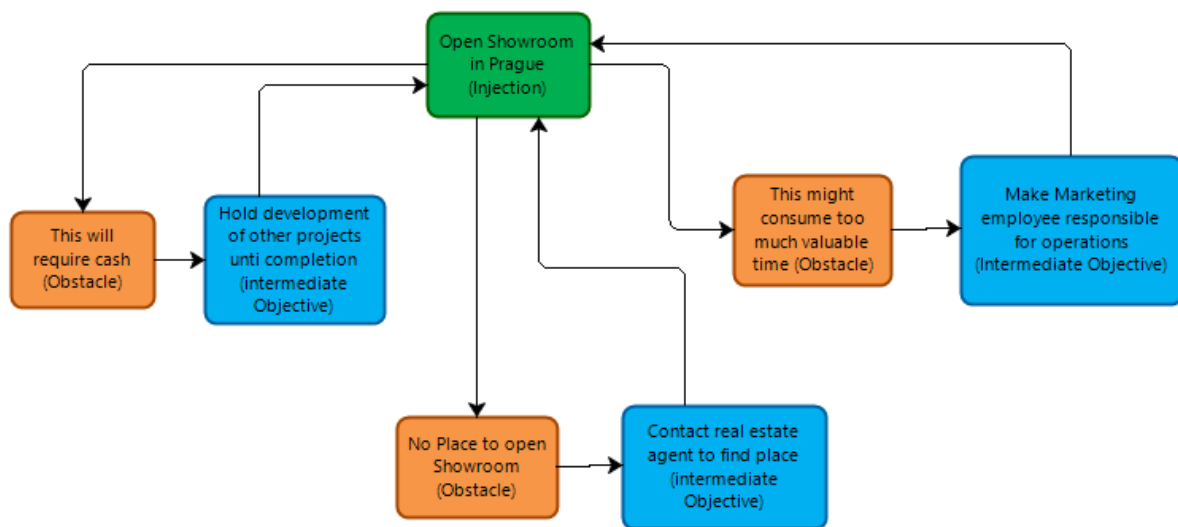


Figure 11: Prerequisite Tree, Jan Cibulka

The Prerequisite Tree regarding the project of increasing the number of customers in Prague allows us to plan for the events that precede the injection, effectively avoiding any blockage towards the implementation of the change and successfully changing the process.

The suggestions that have arose from the analysis are more than clear, to eliminate the bottleneck, by opening a showroom in Prague. The benefits of eliminating the bottlenecks and the related Undesirable Effects have been demonstrated and illustrated throughout this seminar work. Further bottlenecks will arise and those must be addressed using the same methods.

<sup>10</sup> Theory of Constraints Thinking Process Pre-Requisite Tree, <http://www.dbrmfg.co.nz/Thinking Process PrT.htm>.

# Appendix

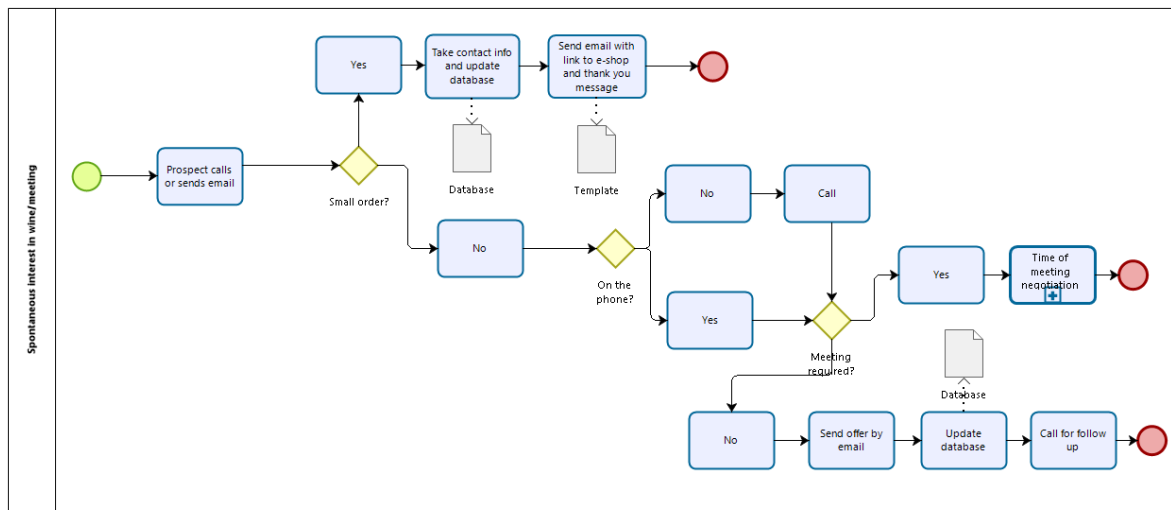


Figure 12: Spontaneous interest, Jan Cibulka

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