

TPK5100 – PROJECT MANAGEMENT

Made by Group 25

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Introduction

Project and purpose

In this project-based assignment we chose a Product-Based project. We created a fictional case and a fictional company named "Nordic Lambo" which we based our project on. Our project is a prototyping project with the purpose of taking a product idea (shot dispenser) and making it into a functional prototype, ready for further development in the company. The project aimed at creating value for the end-user by contributing to a new and interesting product becoming available on the market. Given that the project was a prototyping project, considerable value was also created for the company.

Case

In order to increase the learning outcomes for the group members, the project was put in the context of a fictional case with a fictional company named "Nordic Lambo". The reasoning behind this decision was that learning outcomes would become easier to transfer over to a professional setting in real life. The fictional case and company are described in the pre-report.

Product

As described in the case in pre-report, the prototyping project was started based on a loosely defined product idea, being the concept of a shot dispenser designed to distribute one pour of liquid into six shot-glasses. The product prototype in the case was selected because it provided a fun and educational project, where the members could make use of existing experience and focus more on the project- side. The expected benefits of using our product would be that you could pour multiple shots at the same time, and the larger opening of the dispenser would aid the aim of the user, reducing potential waste of time and valuable liquid.

Design and production

First pair of prototypes

With the designs ready, two versions of the shot dispenser were produced to test which design was best optimized for its purpose. Due to the possibility of saving production time, it was decided to design a "standard foot". The foot would be a universal design for all the future dispenser models. This saved a lot of production time because we could now focus only on the dispensing part of the product, which was the critical design feature. The two prototypes were tested by the group to see which design had the best potential for further improvement, and it was decided to go for prototype B. The decision was boiled down to which prototype had the best ability to evenly fill the 6 glasses. The test set a pointer for what needed to be improved in the design. The two main problems were to evenly distribute liquid and to avoid spilling the liquid.



Figure 1: Prototype A



Figure 2: Prototype B

Second prototype



Figure 3: 2nd revision of prototype B, with and without the funnel

With the result from the first prototypes, it was decided to move along with design B. To further improve the design, a third part was added to the design with a funnel to lead the liquid into the dispenser. This part was difficult to make a prototype of, since it required a lot of material support during the 3D printing. Material support is extra printed materials to secure the overhang of the design. After the printing, there was a lot of extra work to remove the supports and polish the surface. For future production, we could have tried to print the funnel with the pouring side up and have supporting features on the underside, it could have had a smoother surface finish with this setup. The dispenser cup was easier to print due to the simple geometry.

The foot was reused to save production time. Fortunately, all the prints were finished on the first try, which was one of the biggest hurdles to overcome if the 3D-print failed. Starting the printing process over again would have increased the duration of the project since each failed print would cost one extra day.

Market Research

In order to investigate the market and to gain feedback from end-users, the group conducted a survey where the participants were presented with the product prototype and answered some questions about it. They were also given the opportunity to make suggestions for the improvement of the product. This gave us useful information about the demand for the product, how it could be improved and how much the product could be sold for. The participants consisted of 25 people in the age range from 18 - 25 years old students, since this is our target group. A survey like this was essential in order to ensure that the product would create value for its users, before it could be produced in large quantities. This is also a way of communicating with the stakeholders while the project is in its planning phase.



Figure 4: Picture used in the survey.

The survey made the group confident that potential end-users would find the concept interesting and the average score on this question was 7.44/10.



Figure 5: Survey Results 1

Most of the 25 participants agreed that this product would be fun to have at a party and the average score was 7.96/10.



Figure 6: Survey Results 2

We also asked the participants for feedback on how we could re-design the prototype. The comments were mainly related to the lack of colors, but some made concrete suggestions for improvements and how this could be done. This was very helpful and provided useful information for the group members in charge of the design. Some participants wanted a nozzle/tube down towards the shot glasses as well as different materials, which was considered when the final renders were produced. However, this nozzle-design cannot be produced by a 3D-printer. The survey also made it clear that all problems related to spillage had to be eliminated in order to sell this product.

An important success factor in such a product-based project is that the product can be sold at a profit. In the survey the participants were presented with a prototype made of plastic, which has low production costs when produced in large quantities. 40% answered that they would be willing to pay 100 – 150 NOK, and 48% would pay even more.



Figure 7: Survey results 3

Product value for the users

The product prototype had some problems with spilling liquid, but it did save time for the users. The user could either be someone working at a bar or any group at a party. Besides doing the job of pouring shots quicker and more comfortably, it also has a "fun factor" as all the guests wanted to gather around the table where the dispenser is seated, place their shot glass under it and in that way creating a fun mood. As the shots will be ready quickly and at the same time no one will be left waiting for a glass.

The funnel was intended to ensure less spilling when pouring and deliver an even flow to the glasses on all sides of the shot dispenser. Less spilling means less drink going to waste and money saved. This feature only worked partly because the liquid had to be poured somewhat carefully and in the middle of the funnel to avoid spilling. Therefore, in terms of not spilling, the product did create some value to the end-user as it is harder to miss when using the dispenser.

An added feature in the lower part of the dispenser, the foot, created a way to easily carry multiple glasses at once. This is a practical feature and a more comfortable way to transport glasses around, this is especially valuable for any waitress working at a bar. With our product one avoids going back and forth with 6 glasses, possibly losing some of them and breaking them. With all the glasses safely put on the table, the foot also has a second feature: by carefully sliding the dispenser in a circle after the glasses have been filled the glasses will perfectly skate all to separate sides. The practicality and comfort did create value for the end-user.



Figure 8: Holding multiple glass.

Implementation of feedback in revised prototype

With the feedback gathered from our surveys, we decided to implement the feedback into a revised design. This design has not been physically made due to time constraints; however, the prototype was updated with inspiration from the feedback. This new design has three new or changed design features. The first is a t-shaped coupling mechanism to ensure the correct placement for the dispensing holes and glasses to line up. The second changed feature is the geometry of the funnel. By steepening the wall angle and reshaping the outlet, we can minimize uneven pouring and splash back. The third and last design feature is the guided outlets, the newest version of our product has a tubed funnel to guide the liquid straight down in the glasses. This feature will help with the original design's biggest drawback, the splashing of liquid when poured quickly.

This new design is not very 3D-printing friendly, however it is suitable for the plastic injection molding we imagined a final product would be produced with.



Figure 9: Render of design with implementation of feedback

Lessons learned

The market research was important in the further development of the product. The research gave us useful information about improvements that had to be made in order to make the product more attractive for customers. We have discovered that market research is an excellent way to communicate with the target group and include them in the product development phase. This is the group that eventually is going to buy the product and it is therefore helpful to let them influence the features and what improvements that needs to be done in order for better and making them able to have an influence on what features they like and what features needs to be improved for them to buy the product.

We had initially planned to use relatively short time on modeling the product, we thought it would be straight forward due to the simple design. The plan was for everyone in the group to design a model, and then vote on the best design to develop further. The modeling was more challenging than expected, so we ended up with two candidates. We chose the most suitable one and made the author our Head of Design, this person was tasked with refining the design and later implementing feedback. Putting one person in charge of the design speeded up the process, but at the cost of not involving the other group members.

The market research was important in the further development of the product. The research gave us useful information about improvements that had to be made in order to make the product more attractive for customers. We have discovered that market research is an excellent way to communicate with the target group and include them in the product development phase. This is the group that eventually is going to buy the product and it is therefore useful to let them influence the features and what improvements need to be made for them to purchase it.

In the product-testing phase a new feature was also discovered, the leg of the dispenser was able to grab on to six shot glasses. This could be a helpful feature for carrying glasses to the table, but this feature would take time to perfect. In the end it was decided that this feature would not be expanded any further, because at this point we ran short on time. From this we learned to limit the size of the project according to the deadline.

In real situations, like the one we did this project, not all group members have time to put their full focus on this project. Which we might have planned for in theory. In most projects people have other tasks or jobs to do and can only put so much of their time into each project. This led to the project stretching over a longer period than first planned.

Reflection

Time estimates

The time estimates were challenging to make. In the pre-report time estimates were to some extent made with the fictional case in mind and failed to differentiate enough between fictional full-time employees and busy students. The time estimates we made show this clearly. We made these estimates based on an assumption that the members would focus much more on the project at hand in this period. But during the period this project went on, the group members did not have time to only focus on this project. This led to the project extending over a longer period than planned. In terms of keeping to the time schedule and produce/test the prototype before the deadline, the project was considered a success.

Production cost

The cost of production compared to the price of the product is low if mass produced. The final product would be produced by injection molding, which is a suitable production method to make the product in large quantities. In the long run this method is cost effective since the same mold can be used multiple times. According to market research, end-users are willing to pay 150, - NOK on average.

Group chemistry

Our main problem with the group was the individual time schedule of the group members. It was challenging to arrange meetings, and often people could not attend the meetings. Due to this, it was hard to keep up with what had been done, and what needed to be done. Even with these challenges the group work well together and overcame challenges by brainstorming and discussing opportunities.

Project success factors

To measure our success, we need to look at multiple factors. Some of the most important success factors for this project was to set reachable goals, involve end-users, communication, and to keep a schedule. There are more, but these factors had huge impact on if the project would succeed. We set ourselves a goal to create a functional prototype. To fully create a finished product ready for the market would be to aim too high, and impossible for us to accomplish within this deadline. To make sure the product would work like we intended, we would like to think that we made a good effort asking the end-user for feedback and implementing this in our product. The communication in the group was not always at its the best. Due to different time schedules the flexibility was challenging and it was difficult to arrange meeting where all members could attend. This often led to delays, and task not being completed in time. This also led to us not being able to keep our original planed schedule.

With our group consisting of 5 mechanical engineer students, we had experience in designing and producing products. This knowledge about modeling software and 3D-printing contributed significantly to both designing a prototype and producing a working prototype. The project would hardly been a success without some of our members skills in Computer Assisted Design software.

Appendix

Appendix 1: <u>https://ntnu.blackboard.com/ultra/courses/_37263_1/cl/outline</u>

Appendix 2: Pre-report (below)

Product is physical and shown in video presentation.

Pre-report for the Project Assignment

TPK5100

Date: 22.09.2022

Group 25 members:

- Morits Halkjelsvik
- Andre Haave
- David Kandal
- Håvard Sutterud
- Ole Halvor Simonnes
- Marius Heggdal Olsen

Introduction

In this project-based assignment we chose A -the Product-Based project. We have created a case that we will base our project on, we will then design and build the product prototype, an invention to fill multiple shot glasses at the same time. We think that the prototype will provide high value for the company and eventually the end user.

The case

NordicLambo is a Norwegian company producing beer funnels and other products used by partygoers. The company was started in 2016 with a simple drinking funnel produced by two guys using a 3D-printer and simple hand tools. The funnel quickly became a local success, and over two years the two founders worked hard to supply an increasing national demand for their beer funnels.

In 2018 NordicLambo carried out a product development project "FunnelX" to be able to respond to a market opportunity involving large orders of beer funnel sales through retailers. The FunnelX project led to a more cost-effective way to produce larger numbers of funnels, which was achieved through hiring engineers with experience with design, 3D-print and injection molding, which was needed to complete two child-projects; "prototyping"-project and "full scale production"-project. In addition to the child-projects handled mainly by the engineering team, the parent-project FunnelX contained two main deliverables; "market research" and "supply chain design" handled by a new marketing department and NordicLambo's administration.

NordicLambo has now started a new product development project named ShotX, focused on developing a product used by partygoers to automatically pour shots into multiple shot glasses.

Considering that NordicLambo now is an organization with a large part of their employees being engineers, the company now wants to copy the success from FunnelX, and the same engineering team is now tasked with completing the prototyping sub-project contained within ShotX. NordicLambo as a company is focused on maintaining a social work-environment by extensive use of their own products, therefore the organization has kept its employees and maintained the organization from FunnelX in 2018.

The engineering team tasked with the prototyping project consists of the following members:

- Morits Halkjelsvik
- Andre Haave
- David Kandal
- Håvard Sutterud
- Ole Halvor Simonnes
- Marius Heggdal Olsen

The Product

The product enables the user to fill 6 shot glasses at the same time. This dispenser pours and evenly distributes the beverage in an awesome and entertaining way. One goal of the project is that the product stands out compared to other similar products on the market.

The target group (consumer) is mainly students, young adults and party-goers in general.

Rational

NordicLambo have found an opportunity in the market for its new product. The Norwegian market is lacking this kind of product, and NordicLambo has decided to design its own product to take a market share. The prototyping project is intended to make sure that the product idea is actually feasible, before designing and procuring full scale production contracts.

Benefits

The product is a time saver, everybody puts their shot glass under the product and instead of filling the shot glasses one by one, everyone will be filled at once. This will save time for "the butler" and the drinkers.

It is a more comfortable and fun way of pouring drink into multiple glass. When filling up all the shots in one pouring you reduce arm fatigue and it sets a fun mood because all the chuggers must gather around the product and the drinks will be ready at the same time, leaving no one left behind.

Reduces risk of spilling by increasing the area of pouring target. The average shot glass is small and will often lead to a lot of spilling when trying to pour drink into it, especially when there are more glasses to fill. A bigger hole as pouring target will because of less spilling also reduce the long-time costs of shotting.

An example of benefits for the company is that the prototyping project will reduce the risk of major economic losses in the parent project.

Stakeholders

We have identified the following stakeholders, under communication plan we will elaborate further.

- The company (NordicLambo)
- The workforce (engineers)
- The consumer (end user)
- Regulatory requirements
- Production facilities (Make NTNU)
- The market department
- Retail distributors

Risk Assessment Plan

Unavailability of 3D-printers

A risk with catastrophic severity is that we might be unable to get access to 3D-printers. This would make us unable to make the prototype thus making it impossible to test the product.

But the possibility of this happening is quite low because we have "MAKE NTNU" as well as 3D-printers on Verkstedteknisk. To be certain that this is the case, we should try to book the printers ahead of time, so we can be certain that we have an available printer.

Failure to Design a Functional Product

Another risk in this category is being unable to design the product in a way that is possible to print or that the product fails to function. This is also in the low probability category as we have multiple employees with mechanical engineering backgrounds that have extensive experience with 3D-modeling and printing. To lower the risk of this failure happening, we will assign someone experienced to lead this part of the project.

Failure to Procure Required Materials

A risk with moderate severity is that we might be unable to find the correct material. It is essential that we find a material that is non-toxic as the product will be used to pour beverages. This possibility of this happening is also low, as the common PLA material is highly available. This is something we can check early in the project to prevent this failure to happen.

Completing the Project after deadline

Finishing the project too late might cause finished product to be released after the optimal time according to the marketing team. This might cause the company to miss out on this period of increased sales. This doesn't affect our finished prototype but might be affect the company down the road. A well-planned time schedule is an important tool to prevent us from going past the deadline.

Production Errors in 3D-printing

The combination of borrowing 3D-printers and producing relatively complex parts increases the probability of errors occurring during 3D-printing. Even a slight error during this process will force us to start the printing process completely over, which will take several hours. To address this probable issue, we should assign more hours in the time schedule to this process.

Required Skills

The skills required in order to produce this type of product is knowledge within the use of CAD-programs, as well as the use of a 3D-printer to make prototypes of the product. In this project the group will use SolidWorks to create a 3D-model of the product because this is a software the group members have experience with. It will therefore not be necessary to obtain knowledge from external sources in this part of the project. The model will funnel the liquid evenly into the placed glasses. A general understanding of the market is also important to ensure that there is demand for the product. Since none of the members of the group has any experience with market research, external knowledge is needed. This is important to ensure that there is a demand for the product.

Project breakdown structures

The project breakdown structure of the prototyping project is illustrated in Figure 1.

The project breakdown structure for the parent project is defined in Figure 2. Although this was not mandatory content for the pre-project report, we wanted to build a fictional case for our prototyping project, so that the work with the project gives the group members a more realistic experience. The additional WBS serves the purpose of giving the group members a common understanding of the total company organization.



Figure 1: project breakdown structure of prototyping project(our project).



Figure 2: project breakdown structure of fictional parent project; "Shot dispenser 9001"

Project schedule

The work packages illustrated in the work breakdown structure are shown in table 1, along with preceding activities, duration and a character of which they later can be represented when a network-schedule is created.

Work package	Character	Preceding activity	Duration (days)
Map competition and existing products	A		2
Interview of end-users	В		2
Assessment of available prototype	С		1
manufacturing methods			
Prototype modeling, 3 different models	D	A, C, D	4
Selection of best model alternatives	E	D	1
Prototype redesign	F	E	2
3D-Print of first draft	G	F	2
Testing, internal	Н	G	1
Feedback from end-user (user-test)	1	G	2
Design improvement	J	Н, І	2
Final print	К	J	2
Final testing	L	К	1
Demo	M	К	1
Production of free samples (hypothetical)	N	К	3
Produce short promotional video	0	К	4
Finish	Р	L, M, N, O	0

Table 1: project schedule, containing workpackage, abbreviation, preceding activities and estimated duration.

Success Factors

- A working prototype
- Positive feedback from testers
- Completing the project on schedule
- No injuries or deaths
- Positive experience for employees
- Production of prototype samples

The most important factor for success is to create a functioning prototype. Without this the whole project will be a failure.

Positive feedback from the end users is also critical for the project's success. If the targeted group doesn't review the product in a positive way, there is no reason to mass produce the product. This means that the project must determine the optimal product properties, in addition to designing a prototype fulfilling an adequate amount of these properties.

It's important to complete the project before the deadline, due to an opportunity with "Fadderuka 2023" and "UKA 2023" which will be an important marketing opportunity for NordicLambo. It will also take time to get the prototype out in the marked.

Ensuring a positive experience for the employees involved in the project is important to NordicLambo because being able to use the same project engineers for future developments and projects is valuable. Not only must the workers survive and not be injured, but having fun is also of value. The marketing department has also expressed a need for a small number of copies of the final prototype, intended to be used for further market research. Therefore the project must deliver 10 copies of the prototype when the design is finalized.

(Note: This task is fictional, and will only be simulated.)

Roles and responsibilities

- Project manager (PM) Morits
 - The project manager is responsible for managing the project.
 - Also responsible for communication with Nordic Lambo management and available workforce.
- Head of design (HoD) Håvard
 - \circ The head of design holds the main responsibility of design and design changes.
 - No communication responsibility with stakeholders.
- Production manager (PrM) David
 - The manufacturer's job is to ensure the availability of manufacturing facilities when needed by the project. PrM is also responsible for ensuring quality and optimizing costs related to production of prototypes.
 - PrM is responsible for communication with Make NTNU
- Test engineer (TE) André
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- Market analyst (MA) Marius
- -
- Lead concept engineer (LCE) Ole

Communication plan

Each stakeholder group needs to be communicated with differently.

- G1:
 - The company (NordicLambo)
 - The workforce
- G2:
 - o Regulatory requirements
 - Production facilities (Make NTNU)
 - Retail Distributors
- G3:
 - The end-user
 - The market department
- G4:
 - There are no stakeholders in G4, or rather those how are in this category, have negligible interest and influence in the project.

We will divide the stakeholders into 4 different groups.

G1 to G4. We will have a separate strategy for each group, and if it is necessary during the project, it will be created alternate strategy for specific stakeholders.

G1:

This group is the most important. Stakeholders in G1 have huge influence and interest in the project. To satisfy this group, meetings with updates will be arranged weekly. If something unforeseen happens, G1 will be informed at once. We will also listen to their ideas and demands.

G2:

G2 also have huge influence on the project. But their interest is low. The strategy is to meet this groups needs and demands, but we will not inform them on everything happening in the project.

G3:

This group have little influence, but they have an interest in the project. This group will be monitored and informed during the project.

G4:

At this time in the project, we have no stakeholders in the low influence and low interest category. This might change over time.

Therefore, our strategy will be to only monitor this group, if any stakeholders is found during a later time.

Stakeholder	Communication	Timing	Format	Distribution	Person
	frequency			channel	responsible
NordicLambo	Weekly	Monday	Project update,	Meeting,	PM
Managment			budget	email	
Workforce	Weekly	Monday	Project update	Meeting,	PM
Consumer	Specific	During/after testing	Survey, promo	Email	MA, TE
Regulatory	Specific	Before testing	Test plan/application	Email	TE
Make NTNU	Specific	Before printing	Printer booking	Website	PrM
Market department	Weekly	Monday	Project update	Meeting, email	MA
Retail	Specific	Before design	Prototype	Meeting	MA
distributors		changes	changes		