Organically Integrated Project Delivery of a Mission Driven Team

An exploratory study on managing the MOR TUDelft during the Solar Decathlon Europe 2019

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TU Delft

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An electronic version of this thesis is available at http://repository.tudelft.nl/.

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Now that this master thesis is complete, it is time to write the very first page of the report, the acknowledgements. A word that I can barely spell correctly, but thanks to the marvels of modern technology, I do not have to worry about it.

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Grazie,
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"Paddle your own canoe; don't rely upon other people to row your boat. You are starting out an adventurous voyage from the stream of childhood, along the river of adolescence, out across the ocean of adulthood to the port you want to reach.

You will meet with difficulties and dangers, shoals and storms on the way. But without adventure life would be deadly dull. With careful piloting, above - board sailing, and cheery persistence, there is no reason why your voyage should not be a complete success, no matter how small the stream in which you make your start."

Lord Robert Baden-Powell, Rovering to Success, 1922

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1 Executive Summary

Throughout our studies, the topic of sustainability is addressed multiple times and under multiple perspectives, but it is often difficult to grasp the challenges and opportunities that a "sustainable" design entail. It is thanks to projects such as the Solar Decathlons that graduate students can experience first-hand this reality. Participating in a Solar Decathlon is to be considered the most valuable learning experience that a graduate student can undertake; starting from a conceptual idea and bring it all the way to the construction of a fully functioning, full scale, housing prototype is a complete experience difficult to obtain in any other way. It is about this complete experience and the author's experience that the following pages of this report will talk about.

Looking at the case study of the MOR Team, representing the Delft University of Technology at the Solar Decathlon Europe 2019, this study answers to the following research question:

In the context of volunteer-student led AEC projects, what are the characteristics and functions of coordination, capable of improving the performances of the team, and those covering these roles?

What follows is a series of summaries of each chapter of the research, adapted from those in the report itself.

Research method

The research is defined as a qualitative study, which follows an inductive approach to an exploratory case-study, where patterns are deducted from collected data to generate possible research paths and insights. Building on this definition, the answer to the main research question has been developed following a four steps process:

1. Collection, development, and study of the available data.

2. Identification of the key coordination topics of Organisation, Motivation, and Mission; followed by the development of hypothesis on the selected topics.
3. Discussion and reflection on the topics and hypothesis with a sample of key team members through semi-structured interviews.
4. Final study of the combined available and collected data through the interviews, leading to the development conclusions and recommendations.

The competition and the team

The Solar Decathlon: A student-based competition to design and build the most sustainable housing unit possible. Initiated by the US Department of Energy in 2001, it is now a global phenomenon with editions virtually touching all the continents of the world. It first landed in Europe in 2010 with the first edition in Madrid, and it is today stewarded by the Energy Endeavour Foundation, an entity tasked with ensuring the continuation and growth of the competition in Europe.

The Solar Decathlon Europe 2019: Hosted by the city of Szentendre, in Hungary, it saw ten competing teams building their prototypes at the Solar Village in July 2019. The focus of this edition, together with the classic concept of a Solar Decathlon, was on the renovation of existing buildings.

Volunteer Students: Given the focus of the competition on students, the teams competing in a Solar Decathlon are formed by higher education students, taking the competition as either an extracurricular activity, as it is most often the case, or as a coursed offered by their educational institutions. In any case, the students perform the bulk of the work for the competition, from the design phase to the construction phase. In some cases, students are granted credits, incentivising the participation in the project. Teams can either be predominantly run by students, with the advice of faculty staff or managed and coordinated by faculty staff with the bulk of the work done by the students.

MOR: Standing for Modular Office Renovation, MOR was the team representing the Delft University of Technology at the Solar Decathlon Europe 2019. The concept of modularity was applied to the Marconi Towers complex in Rotterdam, therefore focusing on the renovation of high-rise buildings, transforming them from mainly office space to primarily housing with a mixed-use building concept in mind. The fundamental concept of the team's project and mission was the net-positive renovation of the existing built environment asset.
The MOR Team TU Delft completed the competition with an unprecedented number of awards conquered during the competition, including three first prizes, four second prizes, one third prize, and a second-place overall.

The team: Initiated at the faculty of Architecture, the team grew from a dozen students in the early phase, up to more than fifty at its peak. It included several faculties of the TU Delft, with more than twenty nationalities represented in it. Run primarily by students, taking charge for all the coordinating and design aspects; it was joined by two main faculty advisors, with several faculty staff advising the team on specialised aspects. The students gained the support of more than eighty commercial partners to design, build three times, and transport twice across Europe, the fully-functioning MOR Prototype.
The team was organised in up to 10 committees, each of them focusing on a specific area of the project, and coordinated by a committee leader, selected among the students. Later along with the project, once it became increasingly challenging to coordinate given the size and complexity of the project, two changes occurred: The introduction of contents champions, experienced team members that would focus on the strategic moves necessary towards the successful participation at the SDE19 competition; and the introduction of the team board. Formed by six team officers, required and defined in the competition's rules, the board focused on the overall coordination of the team, ensuring its functioning and progress in a coordinated effort.

Collected data

Collected data used to conduct this study can be divided into three areas: Primary data; Reflections and Descriptions; Interviews.

Primary Data: this source included materials produced by the team throughout the project; these include meeting minutes, workshops reports or flipcharts, digital spreadsheets, and team's publications. Finally, it also includes personal notes collected throughout the project.

Reflection and Descriptions: this source of data includes two sets of documents. A series of reflection papers were redacted right after the competition and included initial personal thoughts regarding the team's processes. The next source of data are the descriptions; these documents were redacted throughout the development of this research and are accurate reconstructions of events and facts related to the team.

Interviews: semi-structured interviews that evolved into extended reflections of the interviewees on the topics emerged during the development of this research. The sample of seven team members interviewed included the project architect and engineer, the partnership manager, the HR manager, the construction manager, and finally, two members of the architecture committee.

Research results

The results presented here are based on the outcome of the study of all the collected data, covering the three main topics of organisation, motivation, and mission, as well as three emerging results: the roles within the team, the mentoring and advisory role, and the importance of a shared space.

Organisation: the MOR team emerged as a developing an ever-changing organisation. Based on the experimental attitude of the team, it was possible to develop

a tailored organisational structure capable of adapting to the specific needs of the team along its project timeline.

Motivation: the result of this research is the discovery of an evolving combination of motivation drivers for the team members to participate in the project. Starting from the desire of a hands-on experience of designing and building a sustainable prototype, the project's mission quickly came in addition to the personal motivating factors; culminating with the introduction of a peer motivation aspect to bring the project to its successful completion.

Mission: aspect closely related and interdependent with the motivation drivers, resulted in a variable geometry between the coexisting aspects of the project itself, and the competition in which we were participating as a team, which resulted in an important initiating factor as well.

Emerging results: throughout the interview process a set of relevant and recurring results emerged. Most prominently it emerged an interest in finding a definition for the team roles that would better reflect the needs of the team. Especially with regards with the project architect and engineer role that, due to the growing complexity of the project, they had to increasingly focus on the project management aspects of their committee rather than the design itself.

At the same time, it emerged that the mentoring and advisory role of those supporting the team is a critical aspect that can lead to the success of the project in the competition. Finally, it emerged the importance of a shared space for the team where, since the beginning, it is possible to work on the project together, making the process more efficient and effective.

Results discussion

Discussing the results of this research brought the findings in a dialogue with the relevant scientific literature. It can be argued that the *Organisation* of the MOR Team, based on its characteristics, built a design environment to

be defined as organically integrated project delivery.

With regards to *Motivation*, the combination of personal and team's motivation drivers evolved throughout the project and worked in a variable geometry with the *Mission* of the team; therefore the combination of strong motivations and mission are to be considered the main drivers for the team's successes.

When discussing *Roles*, the difference emerges from the scientific literature, in the case of our volunteer-based team, the so-defined "chief executive level" of the organisation was shared between those team members tasked with the "senior management" level of the team itself. Another critical aspect in this area of the research is the allocation of responsibility within the team, with the emergence of the committee-leader role as a "facilitator" and "coordinator" of the team members' responsibilities. Based on this concept, new definitions for part of the key team's roles were developed. The definitions are as follows:

Team Leader: Or team manager, is the student tasked with the overall coordination of the team, overseeing its organisation, and drive towards the achievement of the project mission. Ensures that the organisation answers to the needs of the team and that information is shared appropriately.

Project Manager: team member responsible for the overall execution of the project, ensuring its progress towards the achievement of the team's goals and its efficiency.

Project Architect: team member responsible for the architectural design management and coordination. Ensures that the architecture divisions are effectively reaching the goals necessary to achieve the project mission.

Project Engineer: team member responsible for the engineering design management and coordination. Ensures that the engineering divisions are effectively reaching the goals necessary to achieve the project mission.

Finally, the research discussed and confirmed the importance of a *shared common space* for the team, accentuating the need for this space since the early phases of the project; concluding the chapter with a short discussion on the importance

of appropriate forms of *mentoring*. Although falling outside the realm of knowledge of the author's field of study, appropriate mentoring is to be considered a crucial aspect of the team's success.

Conclusions and recommendations

What this research has resulted in is an accurate account of the coordination processes underwent in the MOR team, and most importantly, it is an interpretation of these processes from a management sciences perspective. What emerged from this master thesis is the recognition of the Solar Decathlon teams as a precious research laboratory where it is possible to observe management in action. In other words, by expanding the current research and by broadening the spectrum of teams studied, it is possible to compare and learn from comparable projects, performed in a comparable timeline, and with comparable organisations, thus giving management sciences a laboratory-like environment for the observation and study of management practices.

Researching on a personally conducted work is uncommon, and in this case, it certainly provided its fair share of challenges. But it is through the research method employed in this master thesis that it was possible to answer to the main research question:

In the context of volunteer-student led AEC projects the characteristics and functions of coordination, capable of improving the performances of the team, and those covering these roles are:

An organically integrated project delivery, an evolving combination of motivation drivers, and a variable geometry mission, capable of empowering the team's mission-driven members.

2 Abstract

This master thesis investigated the coordination aspects of the MOR Team TU Delft, a volunteer-students based team, that produced an AEC project for the Solar Decathlon Europe 2019 (SDE19) competition.

With a closer look at the aspects of organisation, motivation, and mission, this researched provides an objective account of the characteristics and functions of coordination that aided this team in producing an award-winning project. It is thanks to the study of the available documents, the personal notes of the author, and the interviews with some key members of the team that this research highlighted how a mission-driven team developed an experimental attitude toward an Organically Integrated Project Delivery.

The organisational and coordination aspects of Solar Decathlon teams it is not yet a widespread area of research; therefore, this master thesis conducted an exploratory case study that followed an inductive approach. Among the results mentioned above, this work highlighted how the study of volunteer-students based teams, competing in the various Solar Decathlons, can become an exciting area of study for management practices within AEC projects. The peculiarities of these projects have the potential to provide tangible and comparable results in the study of design and construction management. It is thanks to these considerations that this research asks for the development of further studies, with the effects of both further validating the results here presented and to further expand the body of knowledge on this typology of projects.

3 Introduction

It was around September 2017 when a handful of students, just arrived at the Faculty of Architecture and the Built Environment of the TU Delft, started hearing from their peers or lecturers that some years previous, a group of students and faculty advisors successfully participated in an international competition known as the Solar Decathlon Europe.

Fast forward to August 2019, and this handful of TU Delft students along with others that joined along the way, some faculty advisors and some commercial partners, were reaching eight podium positions out of ten during the Solar Decathlon Europe 2019 in Szentendre, Hungary.

The team, known as MOR Team TU Delft, reached this impressive result thanks to the passion, commitment, and ideas of its several members and supporters. How was this result achieved?

Starting from the experiences undergone by the team, the interest of this case study based exploratory research lies into the reconstructing, understanding, and reflecting upon the coordination dynamics and processes that were developed throughout the lifecycle of the MOR Team TU Delft. Providing at the same time an objective account of the case study's history, as well as exploring possible opportunities for future research on a new and understudied topic such as the development of student-based volunteer teams; and finally to pin-point relevant recommendations for prospective competitors in the Solar Decathlon challenges.

The project is an example of *shared leadership* environment within a *flat organisation* in *integrated project delivery* (IDP).

An integrated construction team as defined in "The extent of team integration within construction projects" (Baiden, Price, & Dainty, 2006); with leadership competencies as defined in "Relationships Between Leadership and Success in Different Types of Project Complexities (Mueller, Geraldi, & Turner, 2012).

The MOR Team TU Delft was a student-led, volunteer project, aimed at designing, engineering, funding, and building a fully functional housing prototype to compete in the Solar Decathlon Europe 2019. MOR is an acronym for Modula Office Renovation, the core concept of the team's project for the competition. Characteristics of this team, among others, were its international background of team members, counting 20 nationalities in 53 students; most significant was the team's aim to concentrate all the work on the students: from the design to the coordinating aspects, with the advice of faculty staff. Although not falling within the scope of this research, this organisational aspect of the MOR team was a characteristic that set it apart from other SDE19 teams. It is common practice for the Solar Decathlon teams to be either fully crewed by students, or coordinated by faculty staff with the students taking the competition as a university course.
The student-based Solar Decathlon competition is widely considered the ultimate competition for sustainable solar-powered and highly-performing houses.
Peculiar to this competition is the actual realisation of the fully-functioning prototype building, assembled in 15 days in an ad-hoc village together with all the competing teams where, subsequently, the students compete in 10 different categories. Hence the *decathlon* word, with the 11th unofficial competition category being *team management*.

Throughout the experience of the MOR Team TU Delft during the Solar Decathlon Europe 2019, the team members have had the opportunity to learn and experiment first-hand the differences between leadership and management, forming and coordinating a design and construction team from the ground up, in a short and fast-paced period.

The experience in a solar decathlon team is to be considered substantially different from a traditional and professional work environment, in this setup, the focus of the project is heavily shifted towards the experimentation within the built environment, and most importantly towards the learning experience of the competing students. However, because of the student-led nature of the work, the equally inexperienced level of the participants, and its voluntary basis, this project

highlighted dynamics otherwise more difficult to pinpoint in less heterogeneous and spontaneous working groups.

In the study of this project, attention has been paid to the macro-topics of *Organization, Motivation,* and *Mission.* It was by looking at these areas of interest that it was possible to reach an answer to the research's central question:
In the context of volunteer-student led AEC projects, what are the characteristics and functions of coordination, capable of improving the performances of the team, and those covering these roles?

To quote Mueller, Gerardi and Turner: "processes are essential to success of non-repetitive operations, but it is people that make these processes work" (2012).

With regards to the scope of this thesis, and being the study of Solar Decathlon teams a relatively new and understudied topic, this research focused on a specific timeframe and a set of aspects.
Given the time restrictions connected with the development of a master thesis, and with any research in general, it appeared clear that it was not possible to study all the several aspects concurred in the lifecycle of the analysed team. Furthermore, at the same time, it emerged that it would not have been possible to study several Solar Decathlon teams and reach a satisfactory result within the timeframe of this research. This was primarily due to the under-researched area within which this research is looking into.
For the above mentioned reasons, it was decided to focus the attention of this exploratory exercise into the experiences of the MOR Team TU Delft, of which I have been involved as team manager, and therefore being highly knowledgeable of its processes and functioning. This, as it is presented in the following chapters, presented advantages and disadvantages. However, overall, this knowledge resulted in a lead in the depth of understanding of the project and its team members.

While developing the research, it also appeared clear that, while the competition days in Hungary in July 2019 were the most critical time for the team members. What was the most appropriate time for the development of the team itself were the two years before that moment, being the time in Hungary an "execution" of

what was prepared before that time as the team members themselves have also pointed it out.
For these reasons, this research has focused on the team's development process up until the actual competition days; referring to them, but focussing on understanding the process that led to the construction and competition days. The focus of this research is in the fours semesters that incorporated the design process of the MOR Team.

With regards to relevance and importance, this research aims at exploring a novel area of study attractive under a series of aspects: Primarily as a learning experience for students; as a teaching opportunity for faculty members; as a cooperation exercise between students, faculty, and professionals; and finally as a laboratory where to study design and construction management practices.
Furthermore, at the same time, the peculiarity of this project is given by the substantial absence of contracted staff members, that professionally develop the project, given by it being run by volunteer students. This aspect makes those tasked with coordinating the team efforts, to forcefully, if solely rely on the motivation of the mission-driven team members to continue and drag forward a challenging project such as in this AEC example. In this way, aspects otherwise forced by the use of managerial hard-tools such as contracts, here are not available; therefore, the coordinators must solely rely on soft-skills while delivering an integrated AEC project.
In conclusion, this research area can be very much relevant when studying management practices, both from a volunteer point of view and from an integrated AEC project delivery perspective. Furthermore, at the same time this objective account and reflections upon such a long and complicated experience are of relevance for those undertaking this challenge as students, faculty advisors, and professionals; pin-pointing a series of lessons learned on coordinating and mentoring such team.
Lastly, this research builds upon the knowledge pool created by the Solar Decathlons in general. Not focussing only on the technical or science-communication aspects, but as well on the pedagogical aspects of this competition; taking into

consideration the organisational aspects of the teams competing in a Solar Decathlon, and the roles of the team members as described by the competition's rules against the applied version of those same roles. Finally, in proposing an alternative definition for part of the critical team's roles; definitions that can help future competitors to frame better the work of the students covering those roles.

With regards to the structure of this report, the following pages will first introduce the research method employed to answer the main research question. Following the research method chapter, the competition and the team in its reconstructed functions and processes are presented. The report will then move forwards with the introduction of the collected data that contributed to the reconstruction of the case study, as well as the data collected for the following phase of the research.

Finally, the research results are presented, followed by their discussion, culminating the report with the final chapter, including the conclusions, recommendations, and reflections.

In this research, it has been decided to use only the first name of the participants in the project.

4 Research Method

The study conducted in this somewhat lengthy period has taken several windy roads until the reaching of the results presented in these pages. Started towards the end of the experience with the MOR Team, during the construction phase of the prototype, the research was developed in the summer of the competition, and subsequently in parallel with my second Master of Science in Architecture.

This master thesis aimed at finding a possible answer to the following question: **In the context of volunteer-student led AEC projects, what are the characteristics and functions of coordination, capable of improving the performances of the team, and those covering these roles?**

The answer was looked for in the study of a specific case, of which the author was an integral part. Having the author been an active part of the project, as will be later discussed more in-depth, pushed this research towards an unconventional approach. At the same time, it gave this study a unique perspective into the functioning of a complex team - such as the one analysed in the case study.

The "contextual nature of the case study and its strength on addressing contemporary phenomena in real life context" (Meyer, 2001) is what led towards the use of this methodology.

Given the voluntary-based experience underwent by the studied team, a "research from the inside" allowed for a first-hand extended reflection on the team's processes and experiences.

According to Hancock and Algozzine, the "three major types of case study research design are exploratory, explanatory, and descriptive" (Hancock & Algozzine, 2011).

This study took the form of a qualitative, exploratory case-study research to provide some insight into an under-researched topic and, in other words, a niche area that only relatively recently has started to become a possible area of study. An exploratory case-study is "often a prelude to additional research efforts" (Hancock

& Algozzine, 2011), while an exploratory question can be any of the following research methods: survey, experiment, archival analysis, history, and case study (Yin, 2014); but it is the "contextual nature of the case study and its strength in addressing contemporary phenomena in real life context" (Meyer, 2001) that has confirmed the suitability of the method employed for this research.

As later discussed in this report, the Solar Decathlon, as a student-based competition, only started in 2001, while reaching Europe in2010, therefore the quantity of students and researchers connected to this topic is still relatively small. However, as already presented in the previous chapter of this thesis, the topic of how groups of students do organise their group work voluntarily, to produce professional-level work is of particular interests for those of us who study the ways in which people act to produce the built environment where we live in today.

Once again, the specificity of this area of study led the researched to use an exploratory approach, to conduct a case-study, with the ultimate goal of providing some possible directions in which the scientific study of the Solar Decathlon teams will proceed; as it will be later presented in the last chapters of this master thesis.

In conclusion, this research aims at interpreting reality, to make available and reflect on the formative experience underwent by the author and his team.

Finally, definition of the broader approach followed to reach this result was developed. This definition summarises the key concepts and approaches taken for this research and recite as follows: **A qualitative study, that follows an inductive approach to an exploratory case study, where patterns are deducted from collected data to generate possible research paths and insights.**

Not a standard methodology:

As a generally accepted rule, conducting scientific research on personal work should be avoided. In a case such as the one studied in this thesis; an ideal approach would be that of looking at the team from the outside, possibly preparing the research methodology in advance, in order to engage in the analysis while the studied case is developing. Strictly following a research methods manual, such as

Social research Methods (Bryman, 2016), also used to develop this approach, would not be possible in this particular case.

The idea of studying the processes developing within the team, emerged well after the beginning of the team's work, while the author was involved in managing the 50 plus students team.

For this reason, by the time this research stared, it was no longer possible to employ a more traditional approach towards this research, hence the need to develop a strategy that would allow this study to reach the necessary criteria of reliability and validity necessary for a master thesis.

A qualitative study:

The research here presented takes necessarily the form of a qualitative study. Its primary goal was to provide an account of the processes that the team underwent throughout its lifecycle, understand the reasons moving these team, as a working group of people, in a very specific direction, taking into account the peculiarities of the project, the competition, and especially those involved in making this happen. This thesis is, essentially, research on an extended reflection of this experience, started from an effort of reflective writing (McGuire, Lay, & Peters, 2009).

The research process

What follows is an explanation of the research process subdivided in steps. It is to be stated that the research has not followed a strictly linear process, but rather a continuous critical evaluation of each step. Nevertheless, it is possible to subdivide this research process in four steps.

Step 1

Given the circumstances of this research, a significant amount of time has been dedicated to the reconstruction of the events and causes that led to the processes described in the next chapter of this report.

While working in the team, when possible, we took meeting minutes and

personal notes. It is from these documents that it was possible to reconstruct the most relevant events occurred throughout the two years lifespan of the project. In other words, looking into the team's files, it was possible to collect the necessary information, necessary to reconstruct the stories that led to important decisions within the team, relevant events, and team members relevant to those decisions or events.

Starting from this collection of descriptions, it was possible to pinpoint a series of events, decisions, and most importantly the underlying topics of *organisation, motivation,* and *mission*, topics that became the three fundamental areas on which this research is focused.

Step 2

The following step of the study concentrates on developing a series of hypothesis, based on the collected and reconstructed information.

It must be underlined that the development of hypothesis in this research has not been a linear process, conducted in one specific moment. Like the research itself, it has been a design-like process, a reiterative endeavour of collecting, building, reasoning on data, meanings, interpretations, and reflections. As a matter of fact, throughout the study, the "completion" of each phase, or section of the research has been named as *preliminary results*, in other words, each stage of the thesis tried to answer at the following questions: where am I at now? What does it mean?

This can be very well considered one of the reasons for defining this thesis, as an exploratory work, where no clear path was visible. However, instead, it was necessary to reflect on the travelled path and hypothesise where and how to move forward towards the next stage of the research process.

Step 3

Moving forward, the next stage has been, from the data, reflections, and hypothesis, to develop a series of interviews with fellow team members in which to recall, reflect, and evaluate the team's processes.

At this point, it is important to underline that not all the team members were

interviewed. From the 50 plus students participating in the team's activities, seven were interviewed. This can appear as a relatively low number, but several vital motivations drove this decision.

First of all, as it will be further explained in the next chapter of this thesis, one of the main reason for choosing a restricted number of people for this phase of the research was the functioning of the team itself.

While the team members were at its highest peak over 50 students, from the initial dozen of "founding members", with the proceeding of the project, a handful increasingly took the roles of decision-makers. As it will be further explained later in this report, the decision-making processes within the team were gradually streamlined towards a more, although flat, hierarchical structure. This was due, among many other reasons, to the different availability of time for the team by its members. Few of the team members were considered full-time focused on the project, and in this case, the role of these team members was naturally less focused on decision-making, while instead focused on production.

For the scope of this research, it seemed more appropriate to reflect with those team members that, in different ways, were connected to the development of the team's processes, functioning structure, overview, decision-making. In the case of the last two interviews, the above were often cited as instrumental for the successful production of the project itself. It is, therefore, clear that more people were equally fundamental to the success of the team. The sample (see chapter 6 of this report), in its nature, aims at representing the team in its different complexities and peculiarities.

Undoubtedly, another important factor in deciding to sample the team instead of an interview process involving all the students was given by the scope of a master thesis itself. The requirement of finishing within an acceptable timeline, with a reasonable amount of workload, pushed towards the decision of discussing and evaluating the team processes with a restricted number of fellow team members, nurturing a more in-depth conversation, rather than a larger number of interviews, risking a somewhat level of superficiality. It is also important to underline the fact that part of the interviewees was suggested throughout the discussion with the other team members.

As already mentioned, the goals of the interviews were to reconstruct and, more importantly, to reflect on the team's processes. Therefore, instead of opting for a strictly structured interview, it was decided to develop them into a loosely structured conversation.

This meant, in any case, preparing an interview protocol with a series of formulated questions, based on the project's timeline, while looking at specific topics.

Opting for a semi-structured interview, or better, a semi-structured conversation, led the interviewees to underline aspect that would have otherwise remained hidden to the eyes of this research.

While developing the backbone of these discussions, trough the interview protocol, the aim was to formulate a series of questions, that when possible would trigger a more in-depth reflection.

Looking back at the interviews, it is now possible to notice that they went from a more structured form to a more in-depth conversation, increasingly focused on perceptions and reflections, rather than the reconstruction of events. Furthermore, it can be speculated that this change can as well be bestowed to the different personalities of the interviewed team members.

Step 4

Towards the end of the interview process, it was necessary to make sense, in a structured form, of the data collected until that point. To do so, it was decided to make use of the program Atlas.ti.

Although not strictly necessary, this tool proved to be helpful in merging all the collected data into one platform and to cross-examine the different sources. By doing this, it was possible to pinpoint the relevant topics better, connecting similarities, and underlining differences.

The method used has been that of coding, to categorise and harness meanings within the collected data. This thematic analysis permitted to identify recurring themes and patterns.

It is from this point that the conclusions and recommendations are drawn.

The coding and the used software were not strictly necessary but were useful in grasping more in-depth meaning from the collected data. The software was

therefore used a tool to make sense of the collected data, rather than as an analysis tool capable of providing a tangible result; it was used to better see through and between the data sources.

Validation

To conclude this chapter of the employed research method it is crucial to make some considerations regarding the validation aspects of this study.

The solar decathlon as a competition concept is about to enter in its twenties years, and what has been usually researched on the projects made by solar decathletes all around the globe has been focussing on the projects themselves, especially on a technical level. What instead emerged from this study are the several interesting aspects in the realms of coordinating, managing, and leading such team through the course of the project. As of today, it proved challenging to find published material regarding the functioning of SD student-based volunteer teams. Therefore this research is exploring an under-researched area of study. Given this, and the limitations in the scope of a master thesis, it remains challenging to validate the results comparing them to previous or similar studies. What this situation opens instead, is the possibility in future studies to compare the work of different teams.

Nevertheless, the data here collected, and the results here presented are the result of careful reconstructions and interpretations of the data, and such result would not have been possible without the in-depth knowledge gained while being part of the actual project.

To find further validation of the results on the specific team, instead, it will be necessary to expand the scope of the research and to include a broader sample of team members, students and equally exemplary faculty advisors and professionals involved with the project. Moreover, moving the research forward discussing the results, would be possible to proceed even further as including a quantitative approach towards the validation of the results of this study.

In conclusion, the findings here presented are to be considered the first step of

what can become an exciting area of research and experimentation in the realm of design and construction management, as well as learning tools for those involved in the projects.

To summarise

The research here presented is defined as a qualitative study, that follows an inductive approach to an exploratory case-study, where patterns are deducted from collected data to generate possible research paths and insights. Building on this definition, the answer to the main research question has been developed following a four steps process:

1. Collection, development, and study of the available data.
2. Identification of the key coordination topics of Organisation, Motivation, and Mission; followed by the development of hypothesis on the selected topics.
3. Discussion and reflection on the topics and hypothesis with a sample of key team members through semi-structured interviews.
4. Final study of the combined available and collected data through the interviews, leading to the development conclusions and recommendations.

This four-steps exploratory case-study method has been employed to answer the following main research question:

In the context of volunteer-student led AEC projects, what are the characteristics and functions of coordination, capable of improving the performances of the team, and those covering these roles?

5 The Competition and the Team

This study investigates the story of the MOR Team TU Delft competing in the Solar Decathlon Europe 2019 in Szentendre, Hungary. As previously mentioned, the research will focus on the four semesters leading to the competition, since the initiation of the project back in September 2017 until the construction phase in spring/summer of 2019, leading to the competition days in Hungary.

Aim of this chapter is to present the context in which this team was formed, presenting the competition in its principles and peculiarities, for then moving on to presenting the subject of this case study: the MOR Team TU Delft. The chapter will then present the project and the results obtained in the competition, and finally presenting the team in its processes and organisational structures.

The content of this chapter has been built on the work done by the Energy Endeavour Foundation and the SDE19 organisers with regards to the Solar Decathlon as a competition. At the same time, the specifics of the MOR team are based on the documents that as a team we built throughout the lifetime of the project, from dissemination material presenting the project, to team meeting minutes, as well as personal notes of the author. This set of data is defined in the next chapter as *primary data*.

In conclusion, the following pages are an accurate reconstruction and presentation of what the competition that we took part in, what our project was about, and how we functioned as a team.

The Solar Decathlon

With its beginning in 2002, the Solar Decathlon is an international competition firstly initiated by the United States Department of Energy. In its almost twenty years of existence has evolved into a global level phenomenon

inviting teams of university students to design and build fully functioning and operable housing prototypes to build the ultimate sustainable living environment. With its roots in the development and showcase of solar technologies, it is now a platform for holistic, sustainable solutions for our built environments, a platform for experimentation and research, as well as a unique training ground the future professionals of the built environments.

The competition challenges higher education students, together with faculty staff from their home institutions and professionals to design, fund, and build fully functional dwelling units. To do so, the teams have approximately two academic years, in which they take the team and the design from its conceptual and research phase, to the actual application of the designed solutions. The buildings prototypes are then assembled by all the participating teams in what is known in the European edition as the Solar Village. Here the students have approximately ten to fifteen days to build the houses from the ground up, from bare ground to the fully functioning building. After this challenging construction phase, the teams compete in the ten contest of the Solar Decathlon (the specific contests of the SDE19 will be introduced in the next section of this chapter), with a mixture of measured and jury-based contests.

The competition challenges the students and their support staff in optimising technical and architectural, as well as enhancing their teamwork, managerial and fundraising skills, integrating the different backgrounds and knowledge of those involved in the team.

As of today, the global attractiveness of the Solar Decathlon has reached hundreds of academic institutions, thousands of students, and countless commercial partners. The competition was held eight times in the United States, four times in Europe, two times in China, twice in Latin America, once in the Middle East, and one edition in Morocco. Currently, there are five editions taking place or being organised in the U.S, in Europe, China, Latin America, Middle East, and India.

It is a growing phenomenon, evolving with each edition, and touching a growing number of students, researchers, professionals and the general public (Energy Endeavour Foundation, 2020).

The Solar Decathlon Europe and the 2019 edition

As mentioned in the previous section of this chapter, the Solar Decathlon as competition took place in Europe four times, with a fifth undergoing at the time of the writing and to be held in Germany in 2022. Taking the name of Solar Decathlon Europe (SDE), the European edition initiated in 2010 with a first competition held in Madrid. It is today stewarded by the Energy Endeavour Foundation (EEF), a non-profit entity aimed at bridging, channelling, and collecting the "efforts of diverse groups and parties across Europe and around the world, all engaged in resource responsibility, behavioural change, tomorrow's green-energy workforce and our circular economies" (Energy Endeavour Foundation, 2020). Designated by the U.S. Department of Energy the EEF serves as the official link between the SDE editions, designating and stewarding the host cities, as well as custodian of the SDE competition rules. The designated host city and its consortium are then organising and providing the necessary resources for the specific SDE edition to occur, with the EEF stewarding their work.

The 2019 edition, in which the MOR Team competed, was organised in Szentendre, Hungary, with the lead of EMI, a certifying body focused on the built environment.

Each edition of the Solar Decathlon Europe, and Solar Decathlon in general tries to address the challenges of sustainability in the built environment from a slightly different perspective, at times putting more the accent on materials aspects, the urban aspect, or such as was the case for the SDE19 edition, on the building renovations aspects. As it is tradition, the SDE organisers allow the teams involved in the competition to choose between tackling challenges specific of their home countries, or instead specific to the host city. In the case of the SDE19 edition, the focus point was the latter, the renovation of existing buildings, either specific to the Hungarian built environment or to that of the competing teams.

Here below are reported the peculiarities of the Solar Decathlon Europe 2019 edition, as published in version 3.0 of the SDE19 competition rules (Solar Decathlon Europe 2019, 2019):

"The SDE19 will maintain the key features of the Solar Decathlon, namely the 16 university Teams, the ten contests, the contest period of 9 days and the 16 days for exhibition and evaluation time with a prize-giving ceremony on the 15th competition day, which will be on Saturday, July 27, 2019.

However, we would like the Competition to evolve, providing an opportunity for a longer-lasting result,

an option for visitors to appreciate the results through an extended period, and the emphasis on a competition

scope for the most urgent challenges. The following new measurements will be introduced:

The scope of the contest is a value-added renovation of an existing building. Teams can choose:

• renovation of the traditional rectangular ground floor building model with brick wall either

with concrete flooring or without heavy flooring solution.

• A roof-top apartment built on the site with other indications of the context (augmented / virtual reality, etc.).

• A renovation project to solve typical problems in the country or region of the Team.

• Any other proposal to solve specific local challenges that could enrich the SDE community.

The competition and evaluation will take place in July, but the houses should be designed and built for all four seasons.

The issues of heating and cooling should be addressed, as well as the summer overheating. There are a low-temperature heating and cooling network in the

contest area, which could be used for the houses as well as a smart grid to provide and distribute energy.

Teams are allowed to design their installations, taking into account the heating and cooling network. They should reflect it in their project documentation, Project Manual and Project Drawings, to be evaluated in Contest 3 by the Jury.

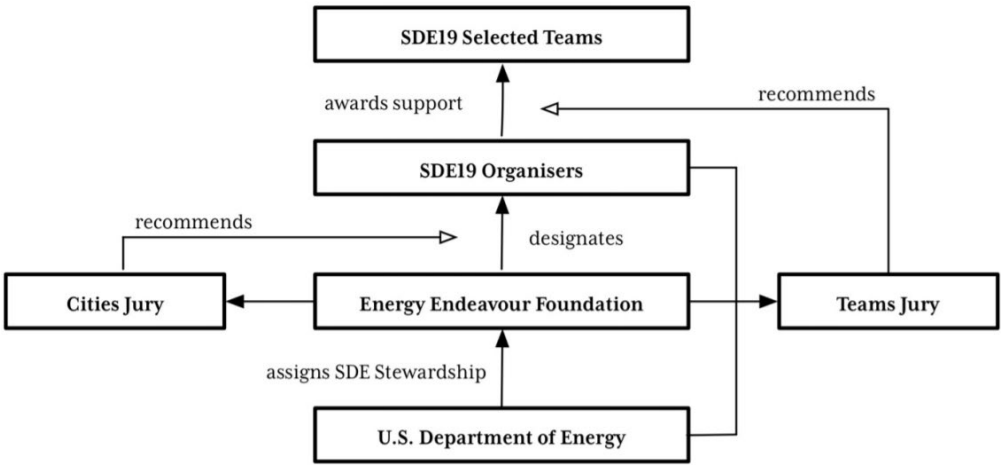
However, the houses will not be connected to the Low-temperature district heating and cooling networks during the Competition Weeks.

After the prize-giving ceremony, the houses will remain for two more months until the end of September. This will allow a more significant number of visitors, who may not have the opportunity during the 16 days of the exhibition, to see the results of the Competition. It is planned to lease approximately 10 of the houses for the following one or two years creating a long-term visitor centre of innovative Net Zero Energy Building (NZEB) housing cluster.

During the extended exhibition period, the Teams will be allowed to connect the houses to the LTDHC network and to study the advantages of it. The data obtained can be used for scientific research, studying them in comparison to the results obtained during the Competition Weeks (without connecting to the LTDHC network)".

Initially, the teams participating in this edition of the Solar Decathlon were 16, out of which only 10 made it to the competition days in Szentendre. As it can be imagined, not all the teams competing in a Solar Decathlon succeeds in the challenging task of building a team, producing a design, and finding the necessary institutional and financial support. With projects always in the hundreds of thousands of Euros, and at times also entering the seven digits mark. The competition days in the host cities are to be understood as the display of the two years' work necessary to reach that point; it is the play after the rehearsals.
A further and more detailed explanation of the Solar Decathlon Europe competition can be found in the article: "Experiences and methodology in a multidisciplinary energy and architecture competition: Solar Decathlon Europe 2012"

(Navarro, et al., 2014), where the SDE12 edition is introduced in great detail, and the competition process is explained, introducing the concept of contests in the SDE, as well as introducing the work of the students involved in the competition.



SDE19 Authority Chart - SDE19 Rules V3.0

Volunteer-students

As already mentioned in this chapter, and the earlier sections of this report, this student-based competition is focused on higher-education students. Teams are organised in different ways, according to the need of the teams. However, the constant is that the students are doing the bulk of the work, bringing the day to day tasks forwards, performing the competition's tasks, as well as being the builders of their prototypes; aspect genuinely unique for this competition.

Although not within the scope of this research, based on the experience gained during the competition, it is possible to say that not all the teams were organised and coordinated almost entirely by students. For some teams, the students were organised and coordinated by the academic staff; for others, the responsibility for the project was as much as possible on the shoulders of the students.

The project of the MOR team for the Solar Decathlon 2019 was conducted and performed almost exclusively by students, with the support of academic staff, within the competition known as *faculty advisors* and the involvement of professionals from sponsoring organisations.

Faculty advisors and sponsors were fundamental for the overall success of the project, nonetheless the day to day work, organisation, coordination and direction of the team was the sole responsibility of the students.
Participation in the project was grated solely voluntarily. Although students may have earned ECTS for the project, this has proven to be a sign of support for the work performed, rather than a motivating factor. The number of ECTS achieved, in reality, is out of line with the effort required for the project, although on some occasions, necessary support. Students were taking up this project along their studies, making use of their free time. It is from this aspect that comes the definition of volunteer-students.

A volunteer-students based project means that for those involved in the project, it is not always possible to devote the same time and deliver the same quality to the project. Being them students implies that are often relatively new to the topics that they are required to be working on.

Because of its volunteer nature, each team member is pushed to work from personal or external motivations, rather than a contract. More, especially when it comes to the available management tools, for primarily student-based teams, those involved in the management of the project cannot rely on the so-called *hard-tools*. Instead, they can only rely on their *soft-skills* to keep the team members on the project and keep the project moving forwards. This specificity sets this project apart from most AEC projects that, of course, rely on leadership and personal motivation as well but are indeed not deprived of the *hard tools*.
In conclusion, what is important to point out is that the students involved in this types of projects are always highly motivated and driven students, capable of taking the responsibility of delivering a highly professional project, with little experience and in their spare time. To do so, it takes a special kind of student, the *Solardecathlete.*

MOR

Started with the beginning of the Academic Year 2017/2018, MOR was the student-initiated team that represented TU Delft at the Solar Decathlon Europe 2019. As customary for the Solar Decathlon Europe competitions, the race for the teams starts two years in advance, with a submission of the proposals, known as D#0, in early autumn. With the beginning of the new year follows the announcement from the edition's organisers if the applying team has been selected or not. From this moment onwards, the selected teams officially begin the competition developing their projects and submitting an updated set of documents, known as Deliverables (D#1 to D#7). These Deliverables allows the teams to develop their projects along a somewhat similar timeline. Requiring further progress with every Deliverable, the organisers use these documents to provide feedback to the teams and to make sure that the projects can be as much as possible ready once the competition on the ground starts the following summer. Here below, it is shown the competition's schedule of deliverables, giving an understanding of the competition's timeline requirements along the design process and after the competition.

To follow this timeline, and to be ready to submit the project proposal in time, teams are initiated with the beginning of the Academic Year. The same happened for our team when within the first few weeks a few students from the faculty of Architecture and the Built Environment of TU Delft initiated the discussion with other students about the option to form a team to participate in the SDE19 competition.

This initial phase was primarily student-driven and supported by some faculty staff. A trait that will follow the team throughout the life of the project, together with an entrepreneurial mindset and the keen interest from all the team members to challenge and push the boundaries of what was considered possible to do. The team started with a dozen student from the master track of Building Technology and a few from the master track of Management in the Built Environment. The team included at its peaks more than fifty students from several faculties of the

TU Delft, as explained in more depth in the following pages of this chapter.
The MOR team was one of the ten teams able to reach the competition days in July 2019. By the end, securing an overall second position, with eight podiums out of ten contests, four first prizes, and a special recognition by the organisers for breaking the record of most awards won in any Solar Decathlon. The team could score such a high level of success thanks to its members' commitment to the project and the team, securing the support of a staggering number of commercial partners, and by always looking for better and more innovative solutions to every aspect of the project.

The following pages of this chapter will introduce the team's project, together with its vision and mission statements. It will then move forwards to the description of the team itself, by looking at its organisational structures, the team members, and the processes that occurred throughout the team's lifecycle, giving an accurate reconstruction of the team as a successful organisation, capable of producing an award-winning project. This reconstruction, as previously mentioned, is based on the author's personal experience as a team manager and the team's documentation.

Rule 25 _ Schedule of Deliverables

Table 26. Schedule of Deliverables.

Deliverable #1	**Schematic Design Documentation & Dissemination Materials**	**30 / 03/ 2018**
Electronic File	Press Release #1	
Electronic File	Project Manual #1	
Electronic File	Project Drawings #1	
URL	Preliminary website	
Deliverable #2	**Design Documentation & Dissemination Materials**	**30 / 07 / 2018**
Electronic File	Press Kit #1 and Press Release #2	
Electronic File	Project Manual #2	
Electronic File	Project Drawings #2	
Electronic File- CD/DVD	Audiovisual #1 - (5 min. presentation of project)	
URL	Team website	
Deliverable #3	**Design Development Documentation & Dissemination Materials**	**03 / 12 / 2018**
Electronic File	Press Kit #2 and Press Release #3	
Electronic File	Project Manual #3	
Electronic File	Project Drawings #3	
Electronic File	Electric and PV Chart and Checklists	
Electronic File	Workshop Documentation	
Electronic File- CD/DVD	Audiovisual #2 (updated version of Audiovisual #1)	
Model	Architectural Model	
Deliverable #4	**Construction Documentation & Dissemination Materials**	**15 / 03 / 2019**
Electronic File	Press Kit #3 and Press Release #4	
Electronic File	Project Manual #4	
Electronic File	Project Drawings #4	
Electronic File	Electric and PV Chart and Checklists (Updated)	
Electronic File	SDE19 Solar Village Visiting Guide information	
Electronic File	Design Approval Documents	
Deliverable #5	**Updated Construction Documentation & Dissemination Materials**	**26 / 04 / 2019**
Electronic File	Press Kit #4 and Press Release #5	
Electronic File	Project Manual #5	
Electronic File	Project Drawings #5	
Electronic File	Electric and PV Chart and Checklists (Updated)	
Hard Copies	Design Approval Documents	
Deliverable #6	**Design Adjustments Documentation & Dissemination Materials**	**31 / 05 / 2019**
Electronic File	Press Kit #5 and Press Release #6	
Electronic File	Project Manual #6	
Electronic File	Project Drawings #6	
Electronic File	Electric and PV Chart and Checklists (Updated)	
Electronic File	Jury Reports	
Electronic File- CD/DVD	Audiovisual #3 - (5 min. presentation of final project)	
Hard Copies	Design Approval Documents	
Deliverable #7	**As Built Documentation & Dissemination Materials**	**25 / 10 / 2019**
Electronic File	Press Kit #6 and Press Release #7	
Electronic File	Project Manual #7	
Electronic File	Project Drawings #7	
Electronic File	Electric and PV Chart and Checklists	
Electronic File	SDE19 Official Dissemination Materials	

SDE19 Schedule of deliverables – See SDE19 Rules V3.0 for higher resolution

The MOR Project

Together with every deliverable for the competition, the team was submitting together with other documents: a project manual describing all the aspects of the design and its scientific research background, a set of project drawings, and a press kit, aimed at providing the necessary information for the general public to know

the project. The following pages contain a detailed description of the project in its entirety, as published in the last deliverable of the SDE19 competition, as part of the Press Kit number 5. These pages were entirely written and edited by the team members, with several of us contributing at different stages to the document's writing and editing process. Undoubtedly this is the best and latest available description of the project:

"It is our team's vision to create a future-proof built environment, that gives back to its surroundings more than it takes away from it.

In the quest to make our vision a reality, MOR, or Modular Office Renovation, has committed itself to develop a strategy for renovating underperforming office buildings into net positive multi-purpose buildings. Our mission is to renovate these inefficient office buildings into net positive and affordable rental housing for starters. In order to make our design future-proof, we propose an adaptable and modular solution with multiple functions within the building. Our solutions are able to react to the change in user needs as well as the continually changing market conditions. We are convinced that this type of intervention will have a positive local and global impact on the long-term viability of our surroundings.

MOR aims to create a renovation proposal focused on net-positivity in five aspects: energy, air, water, biomass, and materials. Only through holistically addressing these five net-positivity aspects we can hope to achieve social, economic and environmental prosperity as the pillars of sustainability.

In the Netherlands, there are currently around 34.6 million square meters of office space with an energy label worse than C, which is about 44% of the total Dutch office stock, or the area of 4,845 football fields.This alarming number of buildings failing to meet European legislation regarding efficiency requirements for energy, water, materials, and more, are negatively affecting the efforts towards reaching the 2050 sustainability goals in Europe. The energy inefficiency phenomenon is present in large urban landscapes with a lot of economic activity such as the Hague, Rotterdam, and Amsterdam, in which 1.4M, 1.16M, and 2.5M square meters of office space respectively have an energy label lower than C[3]. In addition,

according to the newly amended Building Decree (Bouwbesluit) no office stock with an energy label worse than C can be used for that purpose from the year 2035.

Economically speaking, both the owners of these properties and the government are at a loss. Whereas the former are losing money maintaining the buildings and spending large sums on energy bills, the latter are missing out on the revenue from these undesirable properties in the form of property sales and taxes. Hence, the dormant economic potential of the energy inefficient office building stock is tremendous, especially considering that many of those buildings are centrally located.

From an ecological standpoint, these office buildings are unfavourable, as they are unable to meet the new stricter European legislation regarding energy consumption, water use, embodied materials, and more, as well as with the rising energy prices. In this state, these buildings are not contributing positively towards achieving lower energy consumptions and CO2 emissions within the built environment. This means that the old stock of office buildings will have to be upgraded to remain relevant, useful, attractive, and lettable.

Social issues related to the presence of inefficient office buildings become apparent when since many of such offices are left vacant. The repercussions of this state of affairs can be summarised by the broken window theory[6], which suggests that signs of abandonment, disorder and neglect within the urban environment trigger more disorder and neglect, while at the same time stimulating undesired criminal behaviour. Due to this, the neighbourhood may feel less attractive and unsafe. Therefore, renovating these office buildings and making them more attractive can aid in inhibiting these negative behaviours.

In addition, making buildings energy- and resource-efficient can help increase energy access and reduce energy poverty for lower-income residents, which results in improved health, productivity and comfort within the entire neighbourhood.

Meanwhile, the Dutch housing market continues to grow stronger, with the average purchase price of all dwellings rising by 7.44% during the second quarter of 2017, the largest rise in more than 16 years[7]. As the housing prices are rapidly increasing, the available affordable housing stock is dramatically decreasing; most notably in the big cities where the supply does not meet the demand. This shortage of availability can be attributed to the trend of decreasing number of residents per household[8]. More and more people decide to live individually, and therefore the housing need will rise even more in the coming decades.

The lack of availability of owner-occupied housing at an affordable price has led to a shift in the mindset of the starters' demographic group (young professionals, recent graduates, and more, 25-35 years old), who are moving away from long term financial commitments and are opting for renting instead. This choice to rent instead of owning a property is coupled with the new lifestyle choices of starters who want to remain flexible in their movement and have the ability to change location after a certain period of time due to new job opportunities or other developments in their lives[12].

One of the previously mentioned cities facing both problems of inefficient office building stock and skyrocketing increase in housing prices is Rotterdam. We focused on this city as it has one of the lowest energy efficiency rates for office buildings in the Netherlands and an equally unfavourable trend of housing price increases.

MOR is tackling these two challenges by working towards the renovation of underperforming office buildings into affordable housing and flexible workspaces for starters, a group that is highly affected by the current building stock shortage.

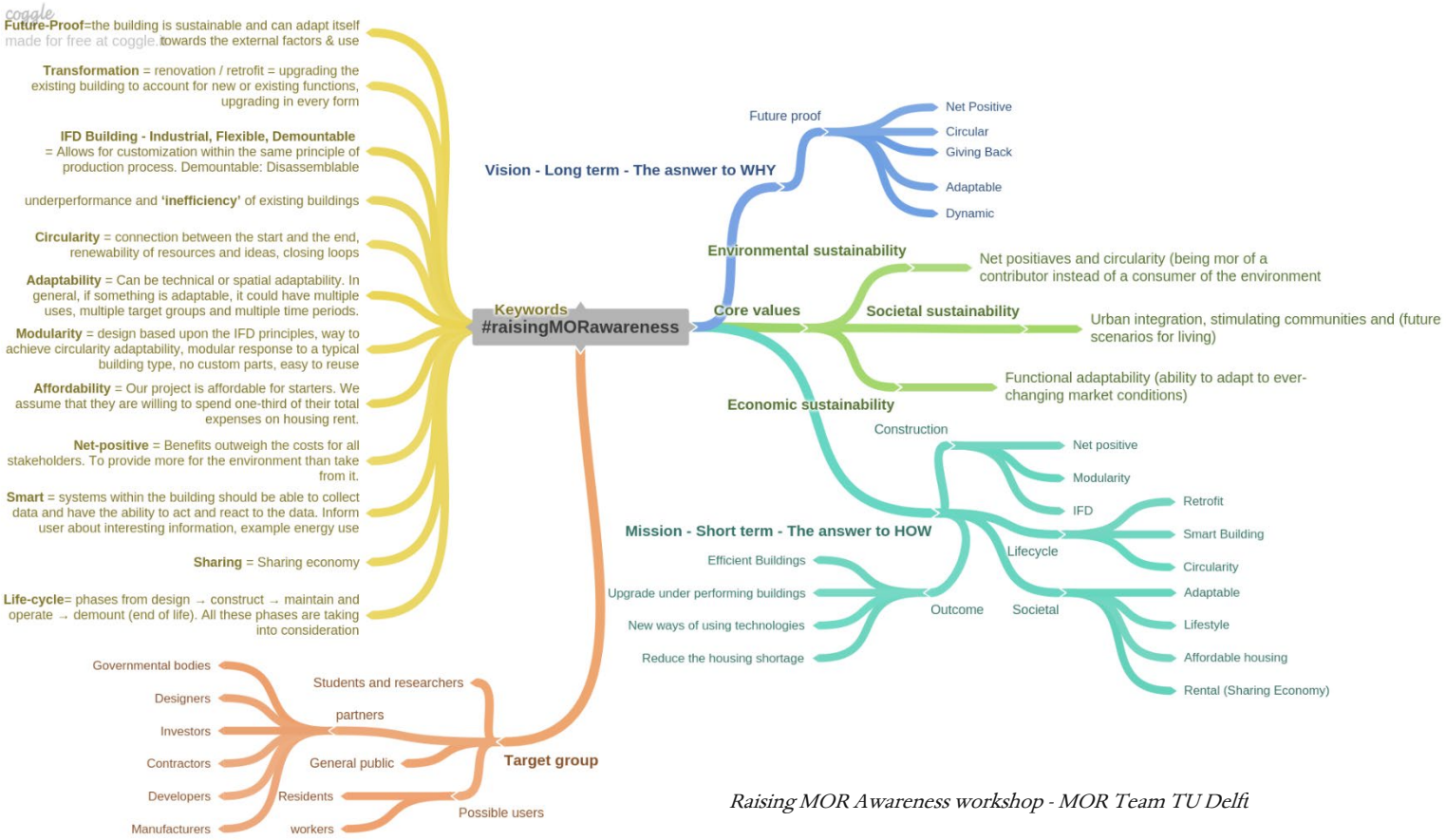
To develop and realise this ambitious goal, the MOR team has been studying the Marconi Towers in Rotterdam, a three-tower development part of the Europoint Complex. It features a typical office building typology of the 1970s in the Netherlands, and is currently abandoned, which makes this site highly relevant for the application of this renovation strategy.

The building will be transformed from an inefficient office building to a multi-purpose apartment building that is net-positive regarding energy, water, air, biomass and material. The multi-purpose building will be a mix of apartments, communal areas and working spaces. The modular and flexible approach in this project demonstrates itself in four different types of modules that can be rearranged according to the demand and typology. These modules include a facade module, a wall module, a kitchen/bathroom module and a bedroom/workstation module. In accordance to some predictions that the office market will recuperate, and office space will again be needed, the project uses a flexible concept that can easily transform the new apartments back to offices. However, it is also possible that a change in the housing stock, tenants living styles, or particular urban conditions may force the typology of housing to change, to which it could be easily adapted with our concept.

Within the concept we present two different types of dwelling typologies: a self-contained apartment and a co-living apartment. The self-contained apartment can host up to three different types of households which we named live, live & grow, and live & work. All of these self-contained apartments include private zones (bedroom/ workspace) and facilities shared with other cohabitants (kitchen and bathroom). The live & grow units additionally contain a private garden, which acts as a buffer zone between inside and outside, but most importantly brings light and air to the building's interior, contributing to a healthier and more pleasant space on a building scale. The live & work unit type is characterized by an addition in the form of a 'work pod' below or above the apartment, which serves as a private workplace within the office floor. It is connected to the living unit above it or below it via an internal staircase. The second typology, the co-living apartments or live & share, aims at providing more affordable dwellings by sharing facilities and living rooms with more than two other occupants: the household varies between four and eight inhabitants. These apartments go beyond living together and sharing space, therefore promoting interaction, a sense of community and shared responsibility

By introducing this concept, MOR can mitigate the negative economic, ecological and societal effects of underperforming building stock, while at the same time providing more housing to foster sustainable urban densification. Ultimately, these buildings will shift from being contributors to the problems of unsustainable resource consumption and inadequate urban services to becoming part of the solution" (MOR Team TU Delft, Press Kit #5, available in annexe A to this report).

The above-reported presentation of the project, as already mentioned, is the latest version that was made available to the public through our press release and that



Raising MOR Awareness workshop - MOR Team TU Delfi

was used to develop the SDE19 Visiting guide (SDE19, 2019). It was therefore developed towards the end of the project, while the first construction of the prototype was already undergoing in the Netherlands. However, what were the driving principles that brought the team forwards and guided the design decisions for this project?

In the third semester of the project, as it will be further explained in the following chapters of this report, the team was undergoing a restructuring effort to finalise

the design and to be capable of reaching the competition with the best project and prototype possible. It is in this period that a series of meetings and a workshop were organised to reassess the state of the design. This design reassessment was necessary to clarify and fix the core values, and fundamental concepts of our project after the research phases underwent during the first and second semester of the project.

The result of this series of meetings and the workshop was summarised in a spidergram including all the critical aspects of the team's project. Visible at the end of this paragraph, and at annexe B to this report, the spidergram was necessary for the team to fix the project's concepts and to then further refer to it when in need to take a design decision.

The outcome of this spidergram was the formulation of the team's vision and mission statements:

Vision: *"We envision a future-proof built environment that gives back to its surrounding more that it takes away from it."*

Mission: *"We develop a modular design strategy to transform inefficient office buildings into net-positive and affordable housing for starters."*

The team: numbers, phases, organisation, roles, tools.

Within the ten contests included in the Solar Decathlon Europe 2019, it is not included the team's management challenge. The following pages aim at describing the team in its numbers, describing the size and composition of the team; in its roles and functions; in its organisational structures from the early phases of the team up until the beginning of the competition in July 2019; and in its tools employed by the team to coordinate the works.

Numbers

The team fluctuated in dimensions and expertise involved. Starting from a team of approximately 20 students, mainly from the master track of Building Technology of the Faculty of Architecture, to 53 students involved from 14 different disciplines at its maximum number, together with a varying number of faculty advisors involved. It is interesting to note that most of the students who joined the team already in the early phases remained to the end of the project.
In the final phase of the project, without considering the possible specialisation within different master tracks, and previous studies, 7 TU delft master tracks were represented, with:

28 students from Building Technology
8 students from Management in the Built Environment
6 students from Architecture
4 students from Sustainable Energy and Technology
4 students from Building Engineering
1 student from Urbanism
1 student from Energy and Process Technology

One important aspect to note in the team (that played a considerable role) is the composition of the team itself. Although rather heterogeneous with regards to the studies backgrounds, and with all the students being part of the same university, it strikes as peculiar the presence in the same team of 21 nationalities. This necessarily played a defining role in the functioning and coordination of the team, dealing with cultural differences as well as personalities, at the same time bringing an exciting and diverse set of perspectives. Although of extreme interest, it is not possible in this study to understand the specific impact of so many different cultural backgrounds. Laying on the outside of the field of knowledge of the author, it is nevertheless clear that this aspect played a significant role in the team, and at the same time provided an excellent social group for several students that recently arrived in the Netherlands for their studies. Furthermore, as it will also be stated in the recommendations for the further research section of this report, it will be

interesting to compare this type of international Solar Decathlon Team with others teams from a more homogeneous background.
The nationalities represented in the MOR Team TU Delft, according to the available documentation were as follows:

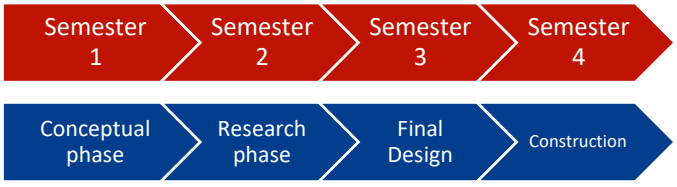
10 from the Netherlands
7 from India
5 from Italy
4 from Canada
4 from Greece
3 from Serbia
3 from Turkey
2 from Belgium
2 from Cyprus
2 from Germany
2 from Mexico
1 respectively from Austria, Brasil, Colombia, Ecuador, France, Spain, Sri Lanka, Taiwan, United States of America

To complete the picture of the team's numbers, it is also important to point out two more aspects, the involvement of academic staff in the project and the support received from the commercial partners.
Within the University and throughout the project according to the available documents 31 between professors, researches and PhDs have somehow been involved in the project, providing valuable feedback on several different parts of the project. Two were the leading faculty advisors that followed the team daily; this role is further explained in the following section of this chapter.
Finally, the specificity of the Solar Decathlon as a competition, requires the support of the commercial and professional world, along with the academic one, to successfully address the challenges of designing and building, in our case three times, a fully functioning prototype.
This support was built by the team, gathering 87 partners that joined the project with monetary or in-kind support, supplying materials or professional advice. The

overall cost of the project, comprising not only materials but also logistics and advisory hours from academic staff and professionals, entered the seven digits mark. The final number, not made available to the public since it would require a lengthy, and in the scope of this research, unnecessary detour, gives an understanding of the size of the project. On a side note, it is also interesting to note that the final cost of the project was relatively close to the initial appraisal prepared when applying for the competition in October 2017.

Phases and Organisation

Regarding the structure of the team itself, similarly to the variability in numbers of team members, it has followed an evolution and continuous experimentation. The team went from a generally flat structure at the beginning of the process, to a more hierarchical organisation, although not being the correct word given the attitude of the team, as it will be further investigated and explained thanks to the results of this study. Nonetheless, the decision-making process has always aimed at remaining inclusive and collegial.



Study focus and project phases – Own illustration

The focus of this research has been directed on the four semesters that led to the competition, as seen in the figure here presented. Starting with the conceptual phase in the first semester of the project, this first period of the team included all the work necessary for the successful application to the competition. In this period, what mattered the most was the production of innovative and creative solutions. However, most importantly, the focus of the entire team was on finding the right challenges to tackle with possible solutions. The guidelines of the competition were instrumental in guiding the team towards the decision of focusing on a renovation project.

A research effort from the team characterised the second semester of the project; the interest was on rooting the project in solid scientific foundations, while at the same time further cementing the proposed design solutions. In this phase, the

interest was still very much focused on the "case study" of the project, the Marconi Towers, while at the same time the concepts of the prototype to be built were taking shape. During the third semester, the final design phase began, together with the restructuring of the team, and an increase in the number of students, that in this phase reached its peak. It is in this period that decisions were beginning to be finalised, while the attention of the team was as much as possible, shifting towards the prototype to be built within a few months. During this semester the earlier mentioned workshop where a final vision and mission statements were developed was held.

Finally, the fourth and last semester object of this study coincided with the finalisation of all the decision and the first assembly and disassembly phase. In this semester, the team worked hard to meet all the necessary deadlines to make the prototype a reality. It shifted from a design team to a construction team, physically building and then disassembling the prototype, making it ready to be transported and then re-assembled on the competition site in Hungary, at the Solar Village of Szentendre.

Solar Village in Szentendre, July 2019_Photo credit SDE19

From the first to the second semester, and committees introduction.

With regards to its organisational structure, the beginning of the project, from September to November 2017, the team was characterised by a flat structure where all the work was developed in smaller groups, while at the same time discussed in a collegial meeting. Such meeting was held at least weekly, structured with a simple agenda and not limited with regards to the finishing time.

Although undoubtedly not efficient, this loose and flat structure, allowed the team to reach a more shared vision of the project, as it will be later expanded upon in this report.

Following the first submission (referred to as Deliverable 1), the team divided into the so-called *committees*, groups of students coordinated by a committee leader, tasked with the development of the design of specific areas relative to the project. In the interest of this research, and based on a team's internal subdivision, the committees are divided into four groups: Engineering design, architectural design, functional design, and organisational committees.

These subgroups generally remained the same until the end of the project, growing and diminishing in sizes, as well as merging and further subdividing into different areas of interest. This is especially true with regards to the organisational committees as it is soon to be explained.

Within the engineering design area, three committees existed: Building physics and performances (BPP); Electrical and mechanical design (EMD); Structural design (SD).

Architectural design, although being essentially one committee was divided into Architecture and Neighbourhood integration.

The here defined "functional committees" were two: Materials & Sustainability, and Viability. The last one, focusing on the financial feasibility of the case study project, became a separate committee during the third semester of the project, being in the first year part of a larger management committee, then further divided in Partnerships & finance, and Project management. These last two committees are categorised as organisational, with this group including also the public

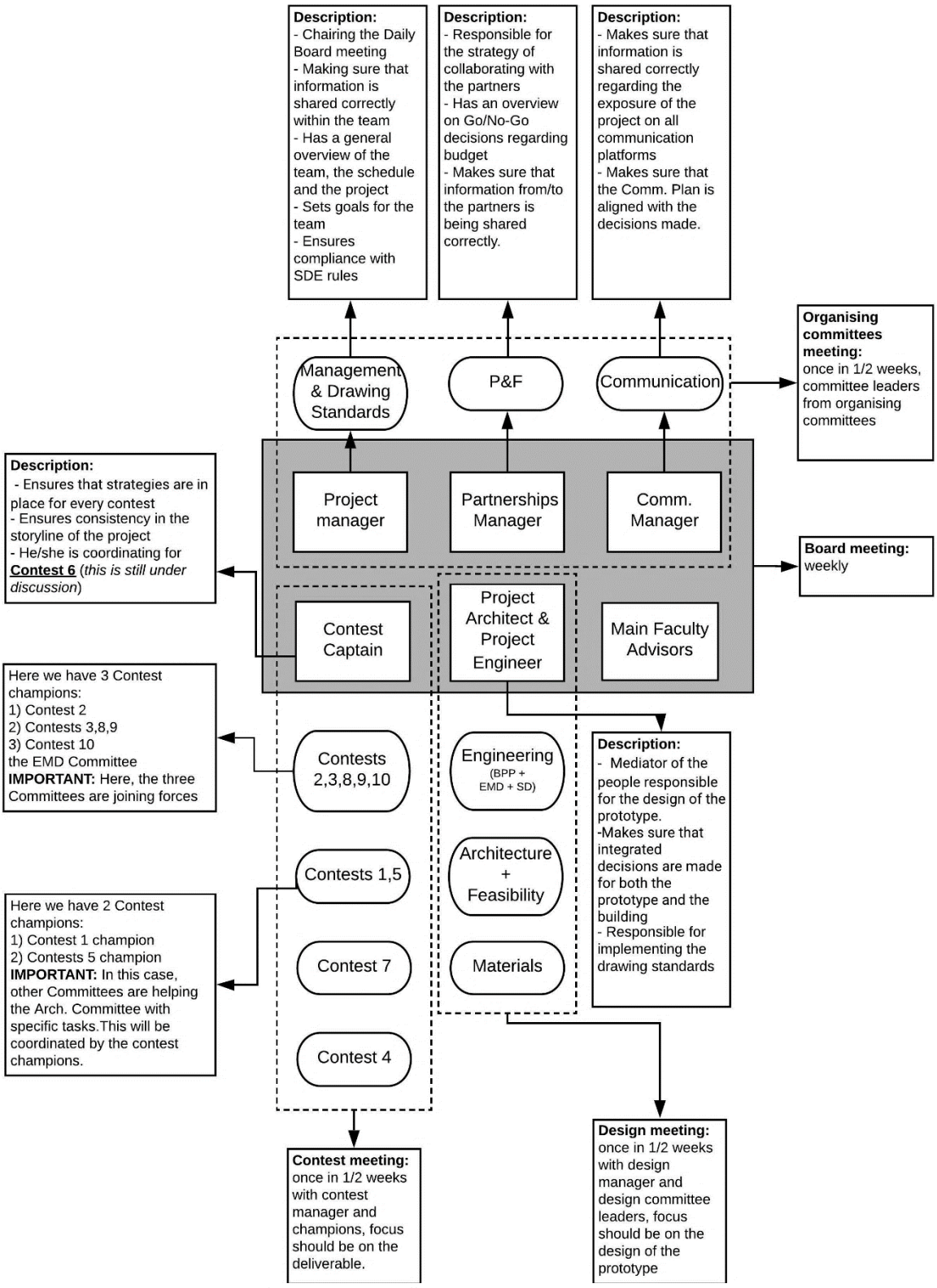
relations and communications committee, focusing on the communication with the public as well as branding. While Partnerships and finance made sure that the project was gaining enough external support, as well as later in the project procuring the necessary materials, the Project management committee was tasked with the overall organisation of the team. Including the internal communication strategies, as well as all the coordination efforts between committees and in general within the team, the project management committee took care of the recruiting and HR aspects of the project, the communication with the organisers, and the construction management.

From December 2017 to the summer of 2018, the team worked in these committees in a generally disconnected way. Each committee was mainly focused on preparing a base of knowledge necessary to develop different design options. This step was considered necessary to develop a cohesive and robust project, and this period saw a large production of concepts. At the same time, it saw a general estrangement between the different committees. During the second semester of the project, the decision-making process was still taken in a fully collegial way, in lengthy and loosely structured meetings, open to all the team members and generally attended by most of them.
If this period saw parts of the team moving at different speeds than others, it served to produce the body of knowledge necessary to finalise the design in the next phases.

From the third to the fourth semester, restructuring and completing.

Below are presented two schemes: The first one representing the final structure of the MOR team, and the second one representing three abstract levels of the team (Organizational, Operational, Strategic).
These organisational schemes were the result of a long series of meetings started during the third semester of the competition. At this point, the team returned from the summer holidays, the work had to begin again, and a few people did not commit for the second year of work on the project. For these and other reasons,

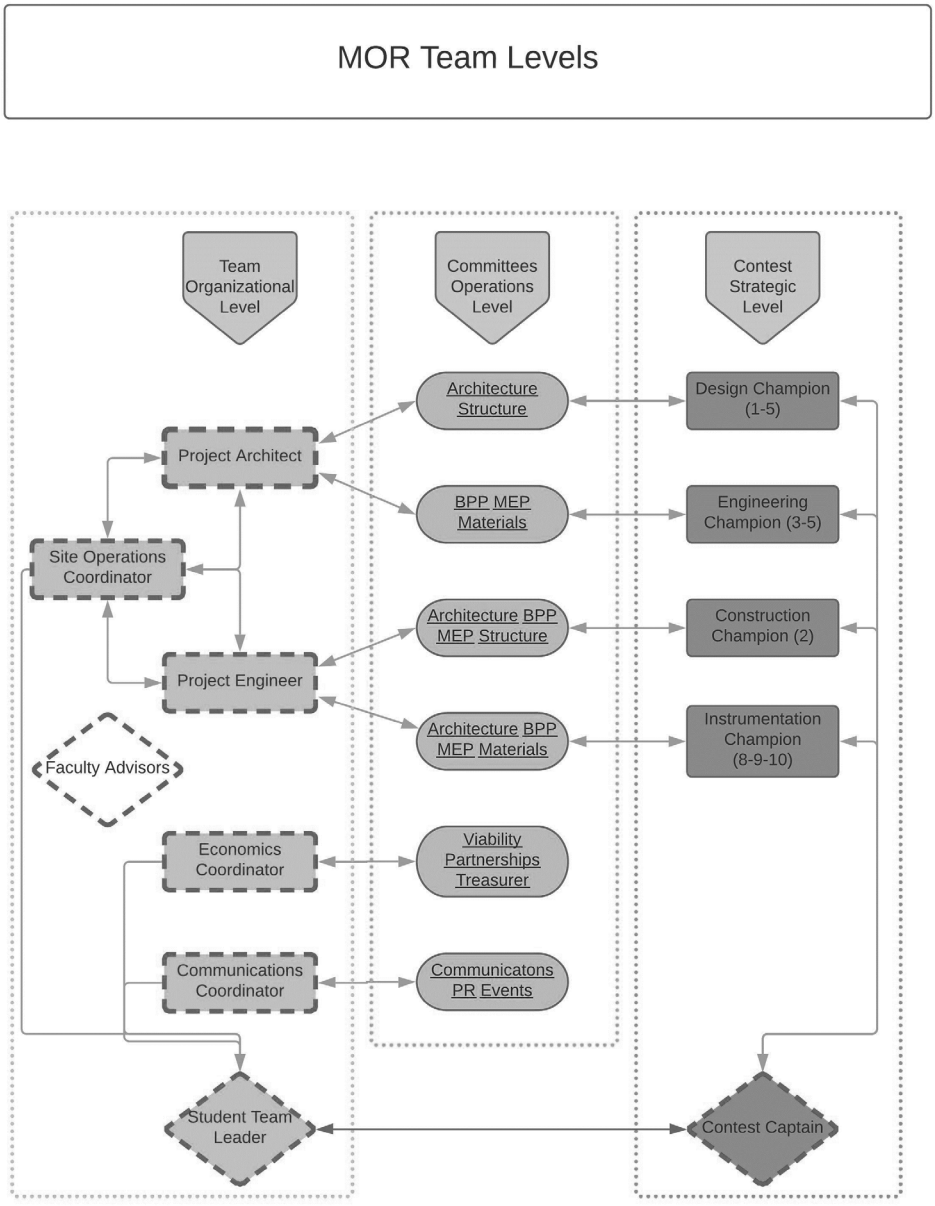
the team required a restructuring work; therefore several scenarios and options were made from the management committee, for then being discussed during an



MOR Team Organisational Structure - Own Illustration

open workshop with the rest of the team. The goal for these exercises was to find

an organisational structure capable of reaching definitive decisions for the design and the team in a more efficient way. The previous two semesters were essentials for cementing the concepts of the project. However, given the fast-approaching of the competition, it resulted necessary to make a change in the team. It was necessary to organise the work of the team better.



MOR Team Organisational Level - Own Illustration

In the schemes above, it is possible to see at the strategic level, the introduction of *Contest Champions*. The competition is organised in 10 different contests, in the case of our team, there were overlaps between contests and committees. The

intention behind the formation of this group was to coordinate better the strategic decisions regarding the specific needs of each contest. More on the roles of *contest champions* will be introduced in the upcoming section of this chapter.

Plenary team meeting_ MOR Team TU Delft

The third semester of the project, from September 2018 to January 2019 as explained saw a reorganisation of the team, to reconnect the different committees and to reach a final, unitary project. This phase saw substantial growth in the number of team members as well as a formation of a few new committees, and the formation of a "team board" responsible for the general direction of the team. The latter, visible in both presented organisational schemes, was formed by six team members and the two leading faculty advisors. Remaining open to all the students if wanted, the board meetings became the place for sharing and coordination of critical decisions, while leaving the necessary discussions more at the committee level. This improved the coordination and efficiency of the team but saw an exponential increase in my role as team manager. Again, the next section will provide further information on this regard.

It is any way at the end of this third semester that the team reached a definitive,

and shared vision for the project, as well as an essential close up to the final design of the prototype that would be built in the upcoming months.

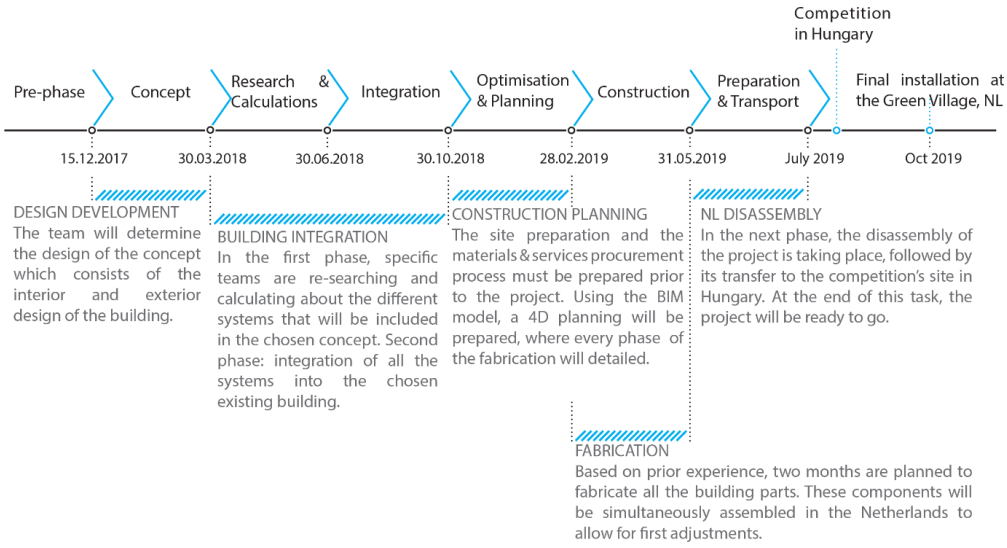
Assembly of the prototype's concrete structure _ MOR Team TU Delft

The fourth and last semester studied in this research saw the transitioning from a design team, to a production team; with the focus on transforming the design developed in 3 semesters into a built product to showcase in Hungary in July 2019. This phase was probably the most structured period for the team and saw a general professionalisation of the team members as well as the integration with the commercial partners involved in the project. This being true at least until the beginning of the construction phase in the Netherlands when the work shifted from a design and research approach to a construction site work. The implications of this change are further discussed in the research results and discussion sections. However, the team in this phase kept the committee-based organisation, but the construction operations layer was added. For this layer, the students were subdivided into two shifts of around 20 students each. Each shift would work one day, with the second shift following in the next day. On the construction site, each shift had a Site Operations Coordinator, and at least one Health and Safety Officer

(A definition is provided in the next section of this chapter). Along with these figures, other students with the necessary qualifications would take up one or the other role when the situation required it. It is to be noted that, while one group was on site, the other was working on the project and the redaction of the necessary and final documents for both the construction site and the competition.
During the first construction phase, not all the design work was completed; therefore, it was necessary to continue it, and at times decisions were taken on the spot at the construction site.

None of these phases of the team is to be considered sharply divided or straightforward, but they have to be seen as constant experimentation, especially from a management perspective. As it was made clear from this research, the team constantly evolved and grew throughout the project, both in numbers and professionally.

Finally, below is presented the expected project's timeline, with the expected or fixed milestones. This timeline was developed at the beginning of the project and subsequently updated throughout it. Its primary purpose was to set a backbone timeline for the project, rather than fixing hard deadlines. Nevertheless, it gives an exact and visual representation of the project phases as seen by the team during before and during the project.



Project Timeline - MOR Team TU Delft

Roles

This section of the case study chapter is aimed at explaining the different roles and functions that were used to bring the team forwards and to compete in the Solar Decathlon Europe 2019 successfully. The next three subdivision will list and briefly explain the roles of committee leaders and contest champions; the official SDE19 roles, known as team officers, and the board members roles; finally, it will briefly present my roles throughout the project as team manager.

Committee leaders and contest champions

Starting already during the early phases of the project, the team dived itself in committees. A term commonly used in the Netherlands, in our case, was used to determine a group of people working on a broader area of the project. They can be defined as sections or divisions, but the term stuck when we decided to select a committee leader for each section openly. The selection was made in one of the early meetings with all the team and followed a few steps set up by the management committee. To divide the team members according to their favourite area of interest, a spreadsheet was shared with the team members, where they could mark their preferences. A maximum number of people per committee was discussed with the team, followed by a subdivision of the team members according to their preferences. We asked them to submit at least three options in order of preference.

The following step resulted in the newly formed committees to propose a student that would serve as a committee leader. At the beginning of the project, we aimed at changing committee leader every quarter or semester; it is interesting to note that many of the committee leaders remained the same throughout the entire project.

As a leader, the role was to coordinate the work of each committee, making sure that the goals set by the team were achieved. A strong accent was put on the coordinating aspect, as we aimed to avoid that a few students would decide for the rest of the team. This was especially important during the formation of the group, as it was vital to retain the students despite the difficulties of the project.

If this was the role of the committee leaders, during the third semester, the complexity of the project grew, the team grew in numbers, and it became ever more important to pay attention to the requirements of the competition, the rules as well as the strategies to maximise the points to be gained during the competition days. It was to answer to these needs that the role of contest champions was created. One student per contest, along with their role in the committees would: take up the role of making sure that we were complying to the rules of the competition; making sure that our strategies were maximising the points to be gained; and finally, make sure that the dissemination material and explanation of the project for each contest was made in the best way possible. Furthermore, they were not committee leaders, so they would be able to relieve some of the pressure, allowing the leaders to concentrate on the coordination of the project and tasks to be completed.

Team officers and board members

If the roles mentioned above were based on the internal needs of the team and were general roles, the competition required a specific group of students from the team to represent the team in several areas officially. The SDE19 rules define these roles as Team Officers (Solar Decathlon Europe 2019, 2019). The following list of team officers roles and description is an extract, in alphabetical order, from the competition rules:

Communications Coordinator: Team member responsible for the Team's communications with the media and for developing all the communications materials (please refer to the Graphic Chart & Brand Manual), including updating information concerning the communications activities through the SDE19 WAT; works in conjunction with the SDE19 Organisers to coordinate the Team's interactions with the media.

Contest Captain: *Team member responsible for the Team's primary strategies and coordination of Tasks Contests; is also responsible for demonstrating the compliance of equipment and appliances with the Rules.*

Electrical Engineer: *Team member responsible for completing the Electric and PV Chart and Checklists and working in conjunction with the SDE19 Organisation electrical engineer to interconnect the house to the grid on SDE19 Solar Village. Must be a licensed professional, which approves and signs the house's electrical systems (drawings and specifications).*

Faculty Advisor: *Team member who is the lead faculty member and primary representative of a participating school in the project; also provides guidance to the Team on an as-needed basis throughout the project. Responsible for signing the official document certifying the compliance of the codes of the country of origin.*

HS Team Coordinator: *Team officer who is responsible for developing and enforcing the Team´s Health &Safety Plan during the Competition phases, assembly and disassembly of the houses. See Rule 52.4.1 Team members in charge of Health and Safety.*

Instrumentation Contact: *Team member collaborating with the SDE19 Organisers'instrumentation Team to develop a plan that accommodates the equipment used to measure the performance of the home during the Competition.*

Project Architect: *Team member responsible for the architectural design effort; license not required.*

Project Engineer: *Team member responsible for the engineering design effort; license not required.*

Project Manager: *Team member responsible for the planning and execution of the project.*

Safety Officer: *Team member responsible for the safety measures observance during the event. See Rule 52.4.3 Safety Officers.*

Site Operations Coordinators: *Team members responsible for developing and enforcing the Teams' Site Operations Plan during the Competition phases, assembly and disassembly of the house.*

Student Team Leader: *Student Team member responsible for the coordination among the Team. Ensures that official communication from the SDE19 Organisers are routed to the appropriate Team member(s).*

Structural Engineer: *Team member responsible for approving the house's structural systems; license required.*

This list of roles was mandatory to with regards to the competitions, but within the team, it was used to define the role and tasks of specific team members. Team officers were often committee leaders when the role would overlap with that of coordinating a specific committee; at other times, they were team members that took care of specific tasks along the way of the project. In some instances, one person covered more than one team officer role.

It is from the pool of team officers that the team board was formed during the third semester of the project. The board was formed initially by six students, then in practice reduced to 5, with the participation of the two leading faculty advisors in the team, Andy and Peter.
The six students in the board were: me as the team manager; Anna as Project Architect; Okan as Project Engineer; Siem as Partnerships and Finance Manager; Nienke as PR and Communications Manager; and Ivan as Contest Captain.
The role of these students was to centrally coordinate the team, ensuring its progress and well functioning. It was at the board level that team-wide decisions were discussed and when necessary taken. Design decisions were almost exclusively taken that the committee level, or between committees, but organisational decisions were taken at the board level.

My roles

Joining the team during the very first meetings, and having just started the Management in the Built Environment (MBE) master track, my role in the team has always been focused towards the overall coordination of the team. Starting in the role of committee leader of the project management committee, together with other MBE students during the first year, we focused on designing the

organisational structure of the team. While learning along the way what project management is, and trying to apply what we were learning in classrooms to the team. Within the project management committee, we would also take care of the initial financial aspects, as well as an initial investigation of the viability aspects of the entire project. In this first year, I also took up the role of Contest Captain, being the person within the team that studied and knew the most about the rules of the competition.

During the changes occurred in the third semester, my role changed from that of committee leader. At this point, the committee had been subdivided in different ones, and a few key people in the committee left the team; for these reasons, it was down to two students: Kosmas and me. Later on in the semester, another student, Momir, joined the management group.

With the knowledge of the overall project and processes, and most importantly of the competition rules and as having become the point of contact between the team and the SDE19 organisers, my role started to include that of Student Team Leader. At this point, my official roles, as defined by the competition, were: Student Team Leader, Project Manager, and Contest Captain. At this point an attempt was made to leave the role of Contest Captain to another student: Ivan.

Proving as not as effective as anticipated, Ivan went back to focusing more on the architectural design aspect. This decision was taken to make better use of the personal skills of each student. This resulted in me taking back the role of Contest Captain for the overall aspects, with the adequate control and day to day actions at the committee level picked up by the newly formed group of Contest Champions.

It was in the transition between third and fourth semester, with the necessity to begin the construction planning aspects, that the management committee with Momir joining us from the Structural Committee, began to work on the Construction Management and Health & Safety aspects of the project.

Kosmas, helping me in the project management aspects, took the lead in the Health & Safety area; Momir and me took charge of the Construction Management aspects, with the role definition according to the competition's

nomenclature of Site Operation Coordinators. In this role, we would effectively plan the entire construction and deconstruction processed both in the Netherlands and in Hungary, as well as the logistics to and from the competition. On the construction site, we were coordinating the works, solving problems, managing the site logistics, and when necessary taking the final decision on design aspects. This was always done in collaboration with the responsible team members, but on site, we were the two making the final calls.

In summary, throughout the project, my roles were: Project Manager, Student Team Leader (Combined in Team Manager), Contest Captain (shared with the Contest Champions and later on with the Instrumentation Contact and Project Engineer: Okan), and Site Operations Coordinator (together with Momir).

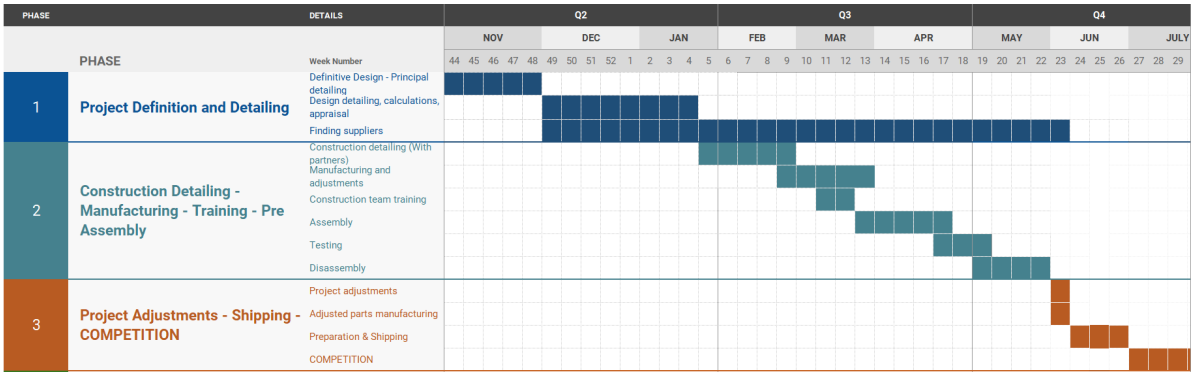
Tools

To conclude the picture of the MOR Team presented in this chapter, it is important to give a brief look to the *tools* employed by the team to coordinate its work.

Within the team, there were two vital elements for the share of information between members. The first one was the messaging platform Slack that we used as a primary communication tool; the second one was a shared Google Drive where all the documents were uploaded and where everyone would have access at any time. Both Slack and Google Drive remained in use in the team from the very beginning to the end of the project, both allowing to organise and structure the content and the communication channels per topic of relevance.

Upon these two main tools, the team decided to use BIM software as the main design instrument. Although outside of the scope of this research, it is possible to see from the available documents that employing a BIM software with so many inexpert users did not result as effective as expected.

Finally, the team also experimented with the use of several *project management software*, such as Asana or Trello. However, in the end, the most used *project management software* has always been a shared spreadsheet. Below it is possible to see two examples of these working spreadsheets: The first one presenting the project's timeline, and the second one showing the open tasks in the architecture committee.



Project's working timeline - MOR Team TU Delft

Drawings are considered **DONE** once they are placed complete on **SHEETS** with **DIMENSIONS** , PROPER **LINEWEIGHTS** and **DESCRIPTIONS OF MATERIALS**!

CATEGORY	Number	Revit_Code	TASK DESCRIPTION	PERSON RESPONSIBLE	COMMENTS	STATUS	DEADLINE	date of last edit
			Update HSB WALLS drawings (add connections, check outlines, check prefabricated parts)			in progress		
		L100				in progress		
		L070_H00	Facade details	Fatima (2D)	Material descriptions are missing (for D4)	in progress		
		L070_H01	Connection between foldable glass door and HSB wall		needs manufacturer info	in progress		
		L070_H02	Connection between foldable glass door and HSB wall		needs manufacturer info	in progress		
		L070_H03	Corner connection between facade and HSB walls	Margot	Sheet L070_H03 South-East Corner 1	done (6.3.)		
		L070_H03.01	Connection between south overhanging fake beam and facade	Ivan	to be added to a sheet	done in Revit		06-03-19
		L070_H04	Electrical room details (Cladding,wall detail, bracing, finishings, electric room covering doors, connection to the main entrance door)	Margot	Sheets L070_H04 Electrical Box Interior 1,2,3	sheet ready		
		L070_H05	Entrance door and connection of the installation room (Cladding detailing)	Laura		in progress		
		L070_H08	Fake column detail	Ivan	to be added to a sheet	done in Revit		06-03-19
		L070_H0x	Shading details	Laura / Anna				
		L070_H09	Sliding partition detail					
scale 1:5/ 1:10		L070_V01- De	Roof detail 1 ("Dependent 1")	Margot	Sheet L070_V01 Roof Detail 2	done (8.3.)		
		L070_V02	Floor detail and facade to foundation slab detail (How is the facade supported on the concrete foundation slab)	Fatima (2D)		in progress		10-03-2019
		L070_V03	Roof detail (to show the joint between two Kingspan panels)	Margot	Sheets L070_V03 Roof Detail 2 and L070_02 Roof Plan Kingspan	in progress		
		L070_V04	Connection between exterior wall, foudation slab and insallation room					
		L070_V05	Roof drainage detail (plus connection of the exterior wall to the installation room and shading structure)	Margot		done (10.3.)		
		L070_V06	Floor detail_entrance door	Laura				
		L070_V07						

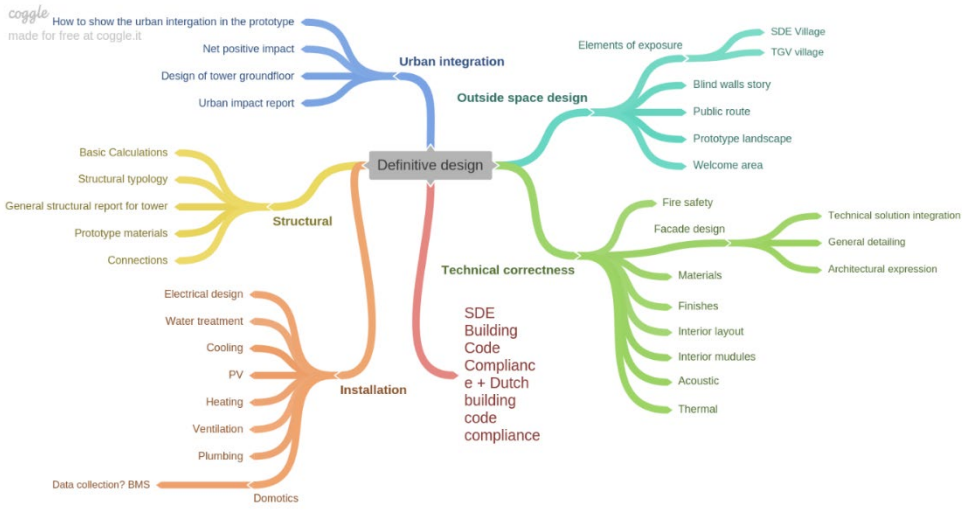
Architecture Committee working spreadsheet - MOR Team TU Delft

As discussed earlier in this chapter, during the third semester of the project, the team had several discussions and workshops regarding the project itself and the team structure. In this period, an essential management tool that was used during some design meetings and team workshop was the creation of spidergrams using a software called Coggle.it. These schemes were projected and updated live with the team members. Below is one example: a scheme representing the content of the final design. Earlier in this chapter, another scheme was presented, showing the result of the #raiseMORawareness workshop, where we regrouped the team and reviewed the fundamental concepts of our project.

Give the nature of this software it was possible to keep track and record of the discussion while the team had it, openly showing the result and the connections being made between the different elements and aspects of the team.

Finally, it is made available in annexe C to this report an example of a board meeting report. This, based on the agenda of the meeting, was compiled with the results of the board's discussions and later stored in the shared drive and made available to the team.

Besides, through the use of Slack, it was my responsibility to share a weekly update regarding the state of the project, what each committee was working on, what were the challenges, and what were the successes.



Definitive Design Coggle - MOR Team TU Delft

With the weekly updates, the meeting reports, and the other means of sharing information, a large team of students could communicate a keep the project moving forwards.

To summarise

The Solar Decathlon: A student-based competition to design and build the most sustainable housing unit possible. Initiated by the US Department of Energy in 2001, it is now a global phenomenon with editions virtually touching all the continents of the world. It first landed in Europe in 2010 with the first

edition in Madrid, and it is today stewarded by the Energy Endeavour Foundation, an entity tasked with ensuring the continuation and growth of the competition in Europe.

The Solar Decathlon Europe 2019: Hosted by the city of Szentendre, in Hungary, it saw ten competing teams building their prototypes at the Solar Village in July 2019. The focus of this edition, together with the classic concept of a Solar Decathlon, was on the renovation of existing buildings.

Volunteer Students: Given the focus of the competition on students, the teams competing in a Solar Decathlon are formed by higher education students, taking the competition as either an extracurricular activity, as it is most often the case, or as a coursed offered by their educational institutions. In any case, the students perform the bulk of the work for the competition, from the design phase to the construction phase. In some cases, students are granted credits, incentivising the participation in the project. Teams can either be predominantly run by students, with the advice of faculty staff or managed and coordinated by faculty staff with the bulk of the work done by the students.

MOR: Standing for Modular Office Renovation, MOR was the team representing the Delft University of Technology at the Solar Decathlon Europe 2019. The concept of modularity was applied to the Marconi Towers complex in Rotterdam, therefore focusing on the renovation of high-rise buildings, transforming them from mainly office space to primarily housing with a mixed-use building concept in mind. The fundamental concept of the team's project and mission was the net-positive renovation of the existing built environment asset.
The MOR Team TU Delft completed the competition with an unprecedented number of awards conquered during the competition, including three first prizes, four second prizes, one third prize, and a second-place overall.

The team: Initiated at the faculty of Architecture, the team grew from a dozen students in the early phase, up to more than fifty at its peak. It included several faculties of the TU Delft, with more than twenty nationalities represented in it. Run primarily by students, taking charge for all the coordinating and design

aspects; it was joined by two main faculty advisors, with several faculty staff advising the team on specialised aspects. The students gained the support of more than eighty commercial partners to design, build three times, and transport twice across Europe, the fully-functioning MOR Prototype.

The team was organised in up to 10 committees, each of them focusing on a specific area of the project, and coordinated by a committee leader, selected among the students. Later along with the project, once it became increasingly challenging to coordinate given the size and complexity of the project, two changes occurred: The introduction of contents champions, experienced team members that would focus on the strategic moves necessary towards the successful participation at the SDE19 competition; and the introduction of the team board. Formed by six team officers, required and defined in the competition's rules, the board focused on the overall coordination of the team, ensuring its functioning and progress in a coordinated effort.

6 Collected Data

While developing the conceptual phase of this thesis, it appeared that being that munch involved in the MOR team would have given space to both advantages and disadvantages.

While this aspect created not few difficulties in reaching an as much as possible objective account and interpretation of the reality occurred within the team, it allowed having direct access to all the data collected or developed by the team throughout its lifecycle.

Being part of the team, and being the team's manager, gave me access to all the information that we stored in more than two years of the project. This included above others, minutes of most of the meetings, work-in-progress documents, conceptual schemes, emails and messages.

The in-depth knowledge of the team's document permitted, at the same time, to rebuild relevant information starting from partial or unorganised data.

From this point, it was possible to rebuild a complete story of the case study here analysed.

These, together with the reflections redacted right after the conclusion of the competition in Hungary, concurred in the development of the necessary steps for reaching the results presented in this report.

In the following paragraphs, the different typologies of collected data are presented.

Primary data

With this term, it is indicated the documents developed throughout the lifetime of the MOR Team, from its foundation in September 2017 to the end of the competition in July 2019. These include meeting minutes, personal

notes and work sessions, schemes, and written communication through emails or messages.

Since the beginning of the project during all the official meetings, we developed the habit of taking minutes. This was primarily done to keep those who could not attend the meeting informed, as well as to keep track of the project's decisions. Official meetings included work at the committee level, as well as design meeting and board meetings. With this source, it was possible to have a clear and objective account of the events that were taking place at the time of the project.

Together with this valuable source, during working sessions or short meetings, we would take short notes or memos that were, again, shared on the team's cloud drive. This type of notes are short and difficult to understand taken out of their context; therefore, in-depth knowledge of the team resulted useful towards the understanding of this data source.

As the team manager, my role required attending several different meetings; therefore, it was essential to keep personal notes throughout the day. These notes were then used to redact and share general updates for the team. For this reason, another important source of data from which this research builds upon is the several hundred pages of personal notes taken throughout the entire lifecycle of the team.

Upon minutes and notes, several flipchart posters with sketches and schemes were kept. These last items were also crucial for the reconstruction of the team's processes, mainly regarding decision-making stages. An example can be found in the spider grams used to redefine the team's values during the third semester of the project.

Finally, the last source of primary data used for the development of this thesis is the several emails and messages shared with the team, which would include general updates and noteworthy news for students, faculty advisors, and partners.

These sources were all together instrumental in providing a base for understanding the team's processes, decisions taken, and the story of the team itself.

Reflections and Descriptions

R, after the competition, in August 2019, it was important for me to take note and reflect on the event recently occurred. It was an account of events, conclusions, and reflections developed right after the heat of the moment.

At this point, there was the intention of developing a study on the team's process and experience, but it was still unclear how to proceed. It is in this context that these series of documents took the form of sense-making (Weick, 1995), and reflective writing (Moon, 2013). They had the purpose of fixing on paper some perceptions, feeling, and accounts of what I experienced as manager of the MOR team. It was a first attempt at understanding the reality of the process in its entirety.

These documents were then left untouched for the following academic semester. Once this research was re-started, these reflections were looked with a different perspective and, for how much is possible, with the eyes of the researcher rather than those of the team member.

In conclusion, they became a data source from which it was possible to extrapolate relevant pieces of information, again to build a picture of the team's reality.

Building on the previously presented data sources, the descriptions are a series of documents aimed at objectively describing events and processes that occurred in the team's lifecycle.

These documents were redacted a few months after the completion of the project and were the last step before the beginning of the interview process with my former teammates.

Interviews

As already described in chapter 4 of this report, the descriptions served as a base to develop the interview protocols as well as to better pin-point the topics to be discussed and reflected on with the interviewees.

This source of qualitative data was collected during semi-structured interviews,

that given the current circumstances, were almost always conducted through a video call. While in some occasion were conducted in person.
Given the personal connection with the interviewees, and the reflection about a shared experience, it was possible to go well in-depth in the discussed topics. This aspect resulted in an advantage for this unusual type of research.

As earlier mentioned, the interviewees were selected for their roles and work within the team. Here follows a description of the interviewee's role and reasoning behind their selection for this research.

The Interviewees

Okan: board member, project engineer, and one of the founders of the team. Throughout the project, he remained one of the most informed and involved students with regards to the overall engineering aspects of the project, often merging them with architectural decisions. In charge of the technical aspects of the project, he also became the responsible person for the testing period throughout the competition days and gained an in-depth knowledge of the competition's technical requirements. As a board member and early initiators of the team was somewhat pushed in a management position within the team, although not particularly enjoying it, while preferring to focus on the design aspects of the project. As a manager he often favoured a more hierarchical and structured organisation, favouring his type of work method.
After the competition I often had the chance to evaluate and reflect upon the team's experience, being both of us extremely involved in the team, and at the same time having experienced high level of stress until the end of the project.

Anna: project architect and one of the founders of the team, she led the architectural design since the beginning of the project, all the way to the end, taking care of the biggest committee within the team. Starting from a very sceptical position against the managerial aspects of the team, she ended up being a key coordinator throughout the project's development. She was highly appreciated within her committee, and as a board member she mostly focused on the design-related aspect, not often engaging in general management issues.

Within her committee, she managed to create a very flat organisation and an open environment that was capable of favouring the design process. At the same time, during the interview, she pointed out that she often ended up having to complete tasks on her own, or with the help of one to two fellow committee members.

Kosmas: Part of the management committee since the beginning of the project, he joined the team at its formation. Throughout the project, he always took care with me of the managerial aspects of the team, always being part of all the research and development of our management practices and tools. Since the early stages of the project, he mainly focused on the human resources aspects, coordinating the team members' selection processes, as well as at times solving internal clashes. In the later stage of the project, he took care of the entire development and coordination of the health and safety aspects of the construction phase. As a fellow management committee member, he always worked with me throughout the entire project. With him, we developed and researched all the project-management related aspects, often looking back at the relevant scientific literature and organizing workshops to finalise the decisions with the other team members.
While I was attending all the meetings possible and was keeping track of the project, he always provided a real help and support for my work; helping me and other team members to look at each situation from different perspectives, and to help to solve particularly complex situations.

Momir: Construction manager and one of the founders of the team, he started as co-lead of the structural committee. In this role, he placed the foundations of the project's engineering aspects, as well as providing important and relevant information for the design. Not being a civil engineering student, once made possible, he left the committee and joined the management committee. At that time, only me and Kosmas were left in the committee; therefore, help was of utmost importance. Together with me he developed the entire construction management strategy. Together we then coordinated all the construction phases of the team until the end of the competition in August 2019.
Although being primarily responsible for the construction-related aspects of the project, he immensely helped Kosmas and me with the overall management of

the team. Within the team, he became a key decision-maker and had a very clear picture of all the aspects of the project.

Siem: Joining at the first intake of new team members, since the beginning he was involved in the partnership and financial aspects of the project. His main task was to promote the project to possible partners and to make sure that the team had enough funds to bring the project to its completion. With this role, he had less focus on the competition's requirements, given the need to make the project relevant to the team's partners.
As part of the team's board, he has always been very much interested and involved in the overall managerial aspects of the project. His role required connecting all the aspects of the project with the relevant commercial partner, and where necessary help the team to decide upon certain products that were made available to us. Our roles were often overlapping and at times clashing, given the different main objectives. Mine being more focused towards the competition itself. At the same time being both vocals about the overall management of the team and with different opinions about the coordination styles, we often had our differences. Nonetheless, we both had the overall view on the project and were able to take the necessary steps and decisions towards the successful completion of the project.

Laura: Joining at the beginning of the second year of the project, she was part of the architecture committee. She joined the team in the transition phase between initial design and final design, therefore taking part in finalising all the architectural design aspects of the project, on both theoretical levels, and on a practical level for the prototype itself.
While being part of the architectural committee, she quickly became a reliable and vital part of the committee and the team, only increasing during the construction phases. The team perceived her as Anna's main collaborator in making the architectural design proceed forward. Within the scope of this thesis, she can be considered as part of the team's middle management.

Margot: One of the founding members of the team, was together with Momir, one of the initiators of the engineering aspects of the project while working in the structural committee. She then moved to initiate the façade design and engineering aspects of the project, for then moving on towards the design of the prototype's roof. She, therefore, covered many different but critical areas of the project, often initiating that specific aspect. Thanks to this, she was highly knowledgeable of most of the team's design and engineering aspects. Throughout the last year of the project, she also took an important role, together with other team members and me, in relation to the competition's contests compliance, making sure that our design was respecting the relevant rules and that our project manual was helping us towards the successful representation and explanation of the project. As for Laura, she can be considered, in the scope of this research, as part of the team's middle management.

Many more team members had a fundamental role during the project. However, this sample gives a good look from the perspective of the key decision-makers, being formed by part of those team members that throughout the project took various degrees of responsibility, aiding the team itself towards its successful finish line.

In conclusion, the data collected or developed throughout this research was looked at as a relevant and objective interpretation of reality, necessary to develop a series of recommendations for further research, as well as lessons learned to be shared with the interested readers.

It is clear that, as already underlined in the previous chapters of this report, this research had by necessity followed an unorthodox path also concerning with the data collected. The peculiarities of this situation required a tailor-fitted approach toward the data to be collected and studied.

Nevertheless, it is with this unorthodoxy in mind that it was possible to conduct such an exploratory study.

To summarise

Collected data used to conduct this study can be divided into three areas: Primary data; Reflections and Descriptions; Interviews.

Primary Data: this source included materials produced by the team throughout the project; these include meeting minutes, workshops reports or flipcharts, digital spreadsheets, and team's publications. Finally, it also includes personal notes collected throughout the project.

Reflection and Descriptions: this source of data includes two sets of documents. A series of reflection papers were redacted right after the competition and included initial personal thoughts regarding the team's processes. The next source of data are the descriptions; these documents were redacted throughout the development of this research and are accurate reconstructions of events and facts related to the team.

Interviews: semi-structured interviews that evolved into extended reflections of the interviewees on the topics emerged during the development of this research. The sample of seven team members interviewed included the project architect and engineer, the partnership manager, the HR manager, the construction manager, and finally, two members of the architecture committee.

7 Research Results

In this chapter, the research results are presented. Starting from the primary data collected throughout the team's lifespan, the reflections, and the interviews, it was possible to reconstruct the story and the processes of the MOR Team. To do that, as already pointed out in the fourth chapter of this report, a series of steps have been followed. One of these was the development of the hypothesis regarding the three core topics around which this research is built. These topics, being Organization, Motivation and Mission, were the focal points of this study. It was about these macro-topics that the interviews conducted with fellow team members were looking to reflect upon. However, as an exploratory study allowed, these conversations led to the finding of other and relevant results, out of the above mentioned three areas of investigation.

In these following paragraphs I will be presenting what were the findings regarding the topics of Organization, Motivation and Mission, against the previously developed hypothesis, along with the results emerged from this exploratory research, that can be described as going beyond and expanding the initial understanding of the team's processes.

This chapter will not provide an answer to the research question, but will instead objectively report the findings. Where relevant, it will introduce the reader to the appropriate state of the scientific literature in the topic's field of study.

The consolidate results here presented are the outcome of several rounds of reflections and the interpretation of the collected data. Starting from the documents and the interview transcripts' initial coding, through the use of AtlasTI software, it was possible to compare the different interpretation and reflections of the interviewees on the discussed topics. Thanks to several rounds of comparison, interpretation, and reflections, it was possible to extrapolate other emerging relevant topics.

Organisation

For the team, it was important to develop a working environment in which it was possible to deliver a complex and inspiring project within a very limited timeframe, limited resources and with a varied team of volunteer students. (With the literature answer to the question: what is intended with the word organisation?)

Reading through the primary data, it was possible to have a first understanding of the working structures within the team; therefore the following hypothesis was developed:

The organisation of the project reflects the attitude of the team. It changed throughout the project, responding to specific needs and developing according to the project phase. The structure was developed by the management team while looking at the scientific literature.

Within this first hypothesis, it is possible to pinpoint a few key concepts: an operational structure tailored to the team's needs; a connection with the team's timeline; a reference to a *team attitude*.

These key concepts were further investigated during the interviews, leading to the interpretations presented in the following paragraphs.

It is interesting to point out at this point that most of the interviewees concluded the talk stating that they would not have done it in a different way if they would have to do the project once again without building on the obtained knowledge, signifying an overall satisfaction and contempt with the team's performances and working habits. Despite the stressful and challenging project, after some time has passed, it is clear that, at least for the interviewed team members, we could organise the team at the best of our capabilities given the circumstances.

Team Attitude

As already emerged earlier in this report, especially when presenting the case study in chapter 5, a trait of *experimentality* characterised the management process. This trait can be interpreted from the reflections on the team's design approaches, integrated design efforts, and decision-making processes.

Especially when talking about decision-making processes, the team rarely followed a linear path, but instead took an organically and reiterative approach towards each decision. This is highly recognisable in the interviews' transcript.

Many times during the interviews, the decision-making process has been described as lengthy and changing in nature, while often decisions were reconsidered at different levels before becoming final (see the interview with Margot).

This has been interpreted both as a strength, as well as a shortcoming for the project. As a strength, because it pushed the team to always look for the best possible answer; and as a shortcoming, because it made the decision-making process more chaotic and less linear.

It is an inquiring attitude of the team that can be interpreted through the study of the collected data. Decisions were often reconsidered and discussed over several weeks, at times reconsidered in the light of newer developments of the project.

Within the managerial functions of the team, this attuite resulted in continuous research for innovative and more functional solutions for the team. This behaviour can be observed throughout the interviews, as well as in the management meeting notes.

The result of this attitude from the management team, resulted at times with a sense of frustration, as it can be seen from the interviews, as an example, with Kosmas and Okan.

From the interview with Kosmas, it emerges a sense of frustration for perceiving the rest of the team as adverse to the status of the management functions; while in Okan's interview can be interpreted a lack in the sense of direction, that according to him should have been given by the management team.

At the same time, in the last interview with Laura - a team member that joined during the last year of the project - and Margot who was one of the founding members of the team; this attitude of experimenting and adapting the managerial processes of the team to the different phases of the project has resulted in a sense of direction and coordination given by the team's managers.

It is with these, at times, clashing opinions that its members perceived the team's experimental attitude, concluding nonetheless with an overall contempt with our

practices, despite difficulties and challenges, that we always successfully handled and overcame.

Tailored structure

As already introduced in the case study chapter, where I presented the different phases of the project and the different working structures that we developed throughout the lifetime of the team, an experimental approach was followed for this aspect as well. In connection with the previously presented team's attitude towards the application of inventive solutions, it results clear that specific organisational structures were developed for the team. As it emerged during the conversations with Kosmas and Momir, we always aimed at creating a unique working structure aimed at answering the specific needs of the team. These specific needs were due to the characteristics of the team itself, being this formed by volunteer students, and to the competition's needs for time and official roles.

According to the results, we tailored the team's organisation at two levels: at an overall level, and a committee level.

In the first case, we developed a working structure that answered to the specific needs of the project and of the competition, forming committees that would take care of specific aspects of the project, and later on of specific aspects of the competition. An example of this is the formation of the so-called *contest champions*, a group of students that would study the competition's requirements for each contest, and make sure that our project would aim at maximising the points that we could gain during the competition. As it can be extrapolated from the meeting reports and personal notes, this example did not prove to be highly effective. However, it serves as proof of attention from the team towards developing solutions that would answer to the specific requirements of the project.

With regards to specific solutions at the committee level, it emerged that while the management committee was proposing and implementing new tools, such as Slack, Asana, different shared spreadsheets (see chapter 4), each committee picked and kept one or several tools that were more suitable for the specific needs of each working group.

The examples mentioned above define a working organisation aimed at making

and using an organisational structure, rather than conforming the work to a given structure.

Timeline

The theme of temporality has already been introduced earlier in this report, but at this stage, it is critical to point out the findings emerged after the study of the available documents and the study of the interviews. As can be seen in the table here presented, the organisational structure of the team changed and evolved throughout the project. In each phase of the team, the organisational structure evolved, aiming at better answering to the needs of the team.

In the first phase, the team was characterised by a strong focus on collegial decision making. As it resulted from the interviews, the decision processes here implemented were lengthy. Decisions were taken during a team meeting, including most of the team members, at that time around 20 students. This aspect made the project progress slow, but it resulted in widely accepted and supported principles for the team and its design.

With the continuation of the project, the necessity was found in better organising the work; this led to the formation of the committees; term that would remain with the team until the end of the project. This first subdivision of the team was based on the initial design concepts and the competition requirements.

In this second period of the project, corresponding with the second semester of the academic year 2017/2018, it can be observed a highly creative approach towards the research of design principles and concepts. The team is subdivided into committees, but the decisions were still discussed and debated in large meetings with often over fifteen students taking part to them.

It is while nearing the conclusion of this second semester that it can be interpreted a difficulty within the team to have an adequate flow of information and decision-making processes.

Entering the second year of the project, that would ultimately lead to the competition days in Hungary, the academic year of 2018/2019 started with the need for the team to accelerate the project.

Given the need to find a more fluent and adequate organisational structure for

the team, and the vital need for faster decision making processes, it was once again decided to move forward the organisation of the team towards its next phase.
Initiated by the management committee, the new organisational structures were developed and discussed during team meetings to reach improved working processes.
The result was a structuralising of the team, with added committees that would better answer to the need of the project, more decision-making delegated to the individual committees, and the introduction of a team board. The outcome of this restructuring of the team was a highly effective team organisation, defined during the interviews as *professional*. This, although it was done at the expenses of the collegial decision-making process that allowed the team to build the solid foundations on which its principles were based. At the same time, it required a strong effort from the management committee and the board members to keep the team all on the same page, ensuring that the internal communication was occurring at its best possible form and that the workflows were proceeding.
With the start of the construction phase, during the fourth semester of the project, the team once again had to adjust its processes, this time primarily driven by the needs of the construction site, and especially by the lack of time of the management team to contextually ensure the flow of communication, and the management of the construction site.
The last evolution of the team's organisational structure was formed around the needs of the construction site, the formation of site-shifts, and the necessity for immediate and definitive decisions. Regular meetings at this point were not scheduled anymore, except for committee work, and informal decision-making processes were occurring on the construction site according to the needs of the time.
If this appeared as a chaotic phase, in reality, it was perceived as a well organised and managed phase, effective and as much as possible efficient. It is also in this phase the team became a more cohesive group, better equipped for the competition days of the SDE19.

Period (semester)	S1	S2	S3	S4
Organisation highlights	Initiators team, from no sub-groups to initial setup of committees / design conceptualization / management experimental phase	The team is formalizing / decision making is still collegial / primarily research phase / conceptual design / perceived as a slow-paced period	Formalization / board is introduced / beginning of finalizing decisions / we reach 54 students	Finalization of the design / beginning of construction phase / fast paced / quick decision making
pros	Everything is discussed / team's foundations are shared by all the team / informal setting	Creative phase / decisions are still collegial	Increased efficiency in decision making / design progress / sense of direction	Fast decision making / collaboration between team members / focus on finishing
cons	Lengthy meetings / lengthy decision-making process	Difficulty in taking decisions / organizational structure becomes cumbersome	Compartmentalization of the team / increased complexity in keeping everyone informed and on board	Few people taking decisions / time pressure
Comments	At the same time this slowness allows for all team to be on-board, the foundations of the team am widely shared and accepted by all the team members that decide to continue with the project.	Conceptual aspects of the design take place in this phase. Here are the foundations for all the future decisions. At the end of this semester the design concepts are presented to the public for the first time. We have a solidified idea.	Formalization and team size require an active approach towards internal communication. Finalization of design concepts and principles, necessary to move towards the construction phase	By this phase, the get it done attitude takes over, there are no more formal board/meetings. The team is proved by the years of work, but it solidifies as a group of people thanks to the construction phase.

The examples here mentioned, define a working organisation aimed at making and using an organisational structure, rather than conforming the work to a given structure.

Motivation

Hypothesis: *The main motivation factors for the team members were firstly driven by the project itself and then by the personal interest in completing the project.*
The competition brought us together but was soon put aside as a motivating factor.

The hypothesis above was developed, as for the others, throughout the first phases of the research, after an initial phase of reflections aimed at developing a way to capture and understand the processes undergone by the team throughout its lifecycle.

In the hypothesis a strong accent was put into the sequential aspects of different motivating factors, starting from the competition as an initiating factor for the team and its members, finishing with the competition days in Hungary as the key binding a motivating factor to keep the team moving forward. As expected in the development of the hypothesis, these assumptions were partially correct. Thanks to the further investigation during the interviews, it was possible to discover a more complex and integrated set of motivating factors for the team members.

If it is true that one of the initial motivating factors for the team itself to be formed was the SDE19 competition, it also appeared clear that the driving interest that brought many of the team members to join, was their personal interest towards the topic of sustainability in the built environment, and the possibility to work hands-on in the design and the actual construction of a building. As already highlighted in chapter 4, the (self)construction of the full scale and a fully working prototype is a unique aspect to this typology of competition, a unique opportunity

for students to be hands-on with what they otherwise only see on their computer screens.

The appeal that these aspects have on the students drives them towards the competition and therefore, towards the team. In conclusion, the starting reasons behind the choice of joining such teams have to be found in these three aspects: the competition, the personal interest on sustainability, and the opportunity for hands-on design and first-hand construction.

In the first hypothesis - and its consequentiality - it was assumed that the motivating factors were, essentially, replaced first by the interest in the development of the project, then by the project completion, and only at the end by the competition days themselves. Once again, this is partially true, and the further study and investigation revealed a more complex motivational structure. Instead of single and consequential factors, these were coexisting in most of the cases, with importance depending from team member to team member. As an example, my motivation has always been leaning more towards the competition, while Siem's motivation was always leaning more towards the project itself. However, according to the other interviewees, the main motivating factors of project and competition were always coexisting.
What also emerged from the research is that, over time, another fundamental motivating factor emerged: peer motivation.

At first sight, this aspect was overlooked from the research, but during the interviews, it clearly emerged as being probably the fundamental motivating factor for the team members to continue the work despite the various moment of stress that was inevitably caused by the project. Anna's, Laura's, and Kosmas interviews prominently highlight this aspect. The latter, being Kosmas responsible for the HR aspects of the team, highlighted the fact that, given the circumstances, as a team we overlooked the team's relationships cultivation, focusing mainly on the execution of the project. In a retrospective analysis done with him, we realised that the team as a whole should have paid more attention to the active development of interpersonal relations within the team. Within the team, according to

the interviews, the interpersonal relationships between team members became more robust, in a general sense once the construction started. As it will be discussed later in this chapter, the fact of being, to a certain extent, in the same place during the construction phase here in the Netherlands, implemented series of team-building processes that until that point we did not have. It needs to be clear that this aspect should not be seen as a mistake from the team, but it was the result of the intense focus and commitment that most of the team members had, as well as the shortfall of time that this project connected with the master studies bring, resulting in a lack of attention towards team building activities. However, during the conversation and reflection with Kosmas, it emerged that HR and team building activities are indeed important aspects for a team, especially if student-volunteer based.

Finally, as a motivating factor it did not emerge from this study the prominence of ECTS (Credits) being awarded to the students to participate in the project. Touched as a topic in the interviews, it was always discarded as a motivating factor. It resulted instead as a very welcomed helping factor for the most involved students, helping them to devote the necessary time to the project.

Period (semesters)	S1	S2	S3	S4
Hypothesis	Competition as a joining factor	Project development - personal interest	Project completion	Competition in Hungary
Result	TRUE + personal interest of sustainability + hands-on construction	Project and competition coexisted	Peer motivation at its peak	Peer motivation at its peak

Mission

Defined by Winch in his Managing Construction Projects book as "the overall strategic intent of the project" (Winch, 2010), in the case of this research differs from the project's mission as stated in the 5th chapter of this report. What is instead intended here is the team's mission for the project, in other words, what was to be delivered, what was our strategic intent with the team competing in the Solar Decathlon Europe 2019.

As for the other central concepts of this study, the topic of *mission* within the team was first hypothesised as follows:

The team's mission changed throughout the project, firstly focusing entirely on the design itself, then shifting towards complying to the competition's rules, and finally on the need to build it on time.

As for the previous section regarding *motivation*, also, in this case, the developed hypothesis is to be considered partially confirmed. Thanks to the further study of the available documents and the interviews with the fellow team members, it was possible to uncover a more profound and complex evolution of the team members' mission.

With the regards to the team itself, as already presented in chapter 4 of this report, it was stated that our mission was to *"develop a strategy for renovating underperforming office buildings into net positive multi-purpose buildings"*. This is undoubtedly true with what concerns the design product that we were delivering, but if this is true for the design product, for the team members, the mission has indeed changed or coexisted in two specific topics: the project that we were developing and the competition in which we were participating in.

Initially, it was hypothesised that design and competition were two separate and consequential mission aspects for the team members involved in the project; instead, it emerged that these two aspects were co-existing and interdependent. As it can be interpreted by the interview with Okan, for example, it was not possible to divide competition and design because both aspects would not have existed without the other. In different words, it was not possible to have the "MOR project" developed without the SDE19 competition, and although - as mentioned in

Siem's interview - at a particular stage we decided to finish the design and the prototype even if the competition would have been cancelled, it cannot be disputed that without the competition in the first place the project would not have happened, and many of the team members would have lacked the motivating factor necessary to continue the work with the team.

What is also convincing, as it can be understood from the interpretation of documents and interviews, is that the two aspects of project and competition resulted as main mission drivers in a variable geometry way. This means that depending on the stage of the project and of the competition, one or the other resulted as primary or secondary mission driver.

Unfortunately at this stage it is not possible to accurately indicate the exact timeframes in which these mission drivers geometries were varying and how, but this would emerge with a closer and more widespread investigation, including as many team members as possible and focusing on this specific aspect. In any case, thanks to this exploratory study, it is possible to determine the existence of this mission here defined as "a variable geometry"; and it is possible to highlight the fact that the two main mission drivers of project and competition were strictly and fundamentally interdependent.

Regarding the two previous sections, it is possible to say that *motivation* and *mission* within our project were near related aspects, and therefore they were not independent variables. Instead, with regards to design and competition focus they were interdependent; with them being at the same time motivating factor and means of reaching a result: the successful participation in the competition, and the successful development of a project. In conclusion, these two topics are to be looked as a synergy of goals and means to reach them, rather than different aspects of one project.

Emerging Results

In this last section where the research results are reported, it is possible to point out that, given the exploratory nature of this research, other interesting and relevant aspects emerged from the study of available documents and interviews. The most relevant prominently emerged in during the interviews, at the beginning without an intention from the author, but as a salient topic for the interviewees, as it can be found for example in Okan's and Anna's interviews. After better highlighting these aspects, it was as well possible to read their importance in the available documents. The three prominent emerging results were: the definition of roles within the team; the mentoring and advisory role; and the importance of a common space.

Roles within the team

Already introduced in the case study chapter and in the previous paragraphs of this chapter, the team members official roles were adapted to the team's need and possibilities in the different phases of the project. In any case, they were, on a first instance, based on the roles presented in the competition's rules. What emerged from this study is that, according to our organisational structure, and our volunteer-students status, the official roles required by the SDE19 organisers were not necessarily adapted to the specific needs of a team such as ours. Especially when considering that the team members had no, to little, professional experience. What emerged from the conversations with fellow team members is that the roles, as defined by the organisation, were not readily recognisable from the volunteer-students themselves. Below is recalled an extract from the SDE19 Rules version 3.0 describing four *Team Officers* roles:

Project Architect Team member responsible for the architectural design effort; license not required.

Project Engineer Team member responsible for the engineering design effort; license not required.

Project Manager Team member responsible for the planning and execution of the project.

Student Team Leader Student Team member responsible for the coordination among the Team. Ensures that official communication from the Organisers is routed to the appropriate Team member(s).

With these short definitions, the organisers intend to leave the teams the opportunity to define their roles within their organisations without necessarily steering them towards a specific direction. What it emerged from the research instead is that, given our lack of professional background, such short definitions did not help the team while defining its working structure. In the specific, it can be interpreted from the interviews that the roles mentioned above should be defined as a coordinating function. For example, in the interviews with Anna and Okan, we concluded that their roles of committee leaders or team officers should have been defined more as a coordinating role, closer to a project manager role. In the case of the *project architect* and *project engineer* as a coordinator or project manager of the team's architectural designer or engineering aspect. What can be concluded is that these two roles were to be defined as *specialised project management*, therefore giving it a clear direction towards the coordination of such areas of the project.

According to the SDE19 rules, the student team leader focuses on the coordination and the communication within the team as well as with the organisation, and the project manager is responsible for the execution and the planning of the project. Within our team, these two roles were considered as overlapping, but after the experience gained throughout the project and the conduction of this research, it is possible to conclude that, although very much connected, the two roles are indeed separate.

The coordination and communication aspect of the team leader role implies a connection with the team members, and an overall look on the team and the team's project. The project manager role, on the other hand, is more related to the correct and timely execution of the tasks that the team is performing. Again, these two aspects are connected, but they reflect different perspectives. For example, in a planning perspective, if a task is running late, a quick solution might be the reshuffling of tasks between team members available, or the addition of new team members. In a team leadership perspective, for the same problem, rather than merely reshuffling the tasks between the team members it would be more important to pay attention to the motivation and the commitment of the

team members to the project.

It is clear that these two types of actions are closely related, and generally can be combined. On a student-based volunteer project, the action must tend towards a leadership approach rather than a managerial approach. In our case, having a flat organisation, meaning that the act of reshuffling tasks and team members was virtually not possible, there was no leverage for imposing such a decision, but it was instead necessary to coordinate and mediate between the team members, and rather than sticking to a predefined plan, re-plan the project in order to match the workforce that the team was capable of putting on the table at that specific time.

It is interesting to point out that a similar approach has been proved to be necessary even during the most structured part of the project, the construction phase. This procedure has certainly slowed down and made less efficient the process, but it allowed the team to remain more connected to the project and the team itself.

As emerged from this study, and as it was hypothesised, as a team, we fell short a defined middle-management layer that, despite the several attempts, found difficulties to be adequately implemented. However, what has been concluded during the interviews is that the role of committee leader or team officers should be leaning towards a coordinating role, essentially a project management role. This aspect, as it can be interpreted across all the interviews, was not exact for the team, but throughout the project, these roles had to necessarily shift towards a more coordinating approach once the number of team members was growing, and especially with the increase of the project's complexity.

Mentoring and advisory roles

Another prominent topic that emerged during this study is the differences perceived between the types of mentoring of various faculty advisors or advisors coming from the partners' companies.

In our team, these two types of figures had a similar role o mentoring the team throughout its processes. Firstly with the faculty advisors during the research and early execution phases and later as well with professionals coming from our commercial partners that would support the team members in different aspects of the

project.

As it emerged during the competition and confirmed with the study of these research materials, each team competing in the SDE19 had a different approach with regards to the role of mentors and faculty advisors. Although not within the scope of this research, it is possible to assert that the teams competing in the SDE19 can be divided into two approaches with regards to the role of faculty advisors: those initiated and managed by faculty staff, with the students taking the Solar Decathlon as a class during their studies; and those initiated and organised entirely by students, taking the Solar Decathlon as an extracurricular activity. This research does not intend to further investigate this aspect in greater detail for reasons already introduced in the fourth chapter of this report. Nevertheless, during the interviews, a keen interested in the interviewees emerged in evaluating the *mentoring approach* that the different professionals or faculty staff employed while working with us as a student team.

As defined in the SDE19 rules, the Faculty Advisor is a "team member who is the lead faculty member and primary representative of a participating school in the project; also provides guidance to the Team on an as-needed basis throughout the project. Responsible for signing the official document certifying the compliance of the codes of the country of origin".

Leaving aside the technical aspects of officially representing the participating school or the signature on official documents, what was interesting for the students involved in the project was the approach towards *providing guidance*. With regards to this aspect, they expressed an interest in understanding how to make better use of the knowledge of our mentors.

As it can be imagined, each mentor had a different and personal approach towards the collaboration with the students involved in the project, as well as different expectations from different team members. In a team such as our one, therefore primarily organised by volunteer-students, it was highlighted that a mentoring approach was the most effective and appreciated by the students involved with that particular professional or faculty staff, rather than a passive advisory role. What can be interpreted, is that the team members were at times looking for a

coaching and mentoring attitude, capable of letting us develop the project but mentoring us in taking the necessary steps towards a decision.

The importance of a common space

Already widely discussed and researched in academia, the importance of a common space for the project team to meet, interact, work, and celebrate the various aspects and stages of the project was a recurring theme in our project as well.

Starting from the beginning we aimed at having a common place where to meet, and at stages, we had the opportunity first to have a garage space and later on, only in the last semester of the project, an office space. Both were located on campus and resulted rather useful; unfortunately, they were all temporary solution and, in the first case, shared with other groups. What was possible to reconstruct from the studied documents is the practically constant recurrence of this topic in the team's discussion. Since the beginning of the project was indeed a need for the team, never fully resolved until, according to the interviews, the beginning of the construction phase in the Netherlands and later on during the competition days in Hungary.

What was experienced, according to the results of this study, was a sudden increase in ease of decision making, trust, and confidence in the other team members, a more organically and less mechanic work with the opening of the construction site in the Netherlands. This, according to the interviews, is the result of the ease of meeting and finding the other team members on-site, and at the same time, the visual result of almost two years of work.

Regarding the topic of a team' shared space, at this stage of the research, it is difficult to make the distinction between the possible drivers for the team's motivating factor to accelerate the work. It is not clarified if this was warranted to the effect of experiencing and seeing the project being built first hand, or instead, down to the emerging of the construction site as our team's common meeting space.

However, as stated several times from the interviewees, the experience of having first no common space, then a small office space, and finally a common space on the construction site resulted in an ever-increasing integration of the project and

its team members. It was concluded that, by having a common fixed space, a meeting place, since the early stages of the project would have made the difference in the project development processes, and especially in the team-building aspects, as already mentioned in the previous pages of this chapter.
The difference made by a recurrent space for the team was especially seen during the competition days in Hungary, where the team was living and working together. The interviewees recognised this as the time when the group was mostly perceived as a team, and where the students harvested the results of their hard work of the previous years.
In conclusion, what emerged from this research, is once again the proof of how a common space, especially for a volunteer-student based team can make the difference in various areas of the project, therefore contributing to the successful and enjoyable progress of the project and those involved in it.

As an exploratory study, this research focussed on finding and highlighting those areas of the team's processes that made the difference in the successful completion of this project.
By studying its organisation, motivating drivers, and mission factors it was possible to understand that management, or better coordination, efforts undertaken by the team members were always aimed at creating the best possible conditions for the team members to thrive. What emerged, is a management attitude aimed at shaping and looking for tailored solutions to an ever-evolving process, strongly leaning towards the available soft management tools.
To conclude this section of research results, it is interesting to point out that, during the interviews with fellow team members, when reflecting on what we could have done differently, the answer has always been unanimous. If we undertook this competition again, without the obtained knowledge until now, we would repeat this format, despite the difficulties and challenges. After a few months from the completion of the last assembly, once again in the Netherlands, the former MOR team members remain satisfied and impressed of the results that we managed to obtain, and realise that our processes were the possible correct answer to the needs of the team and the project.

To summarise

The results presented in this chapter are based on the outcome of the study of all the collected data, covering the three main topics of organisation, motivation, and mission, as well as three emerging results: the roles within the team, the mentoring and advisory role, and the importance of a common space.

Organisation: the MOR team emerged as a developing an ever changing organisation. Based on the experimental attitude of the team, it was possible to develop a tailored organisational structure capable of adapting to the specific needs of the team along its project timeline.

Motivation: result of this research is the discovery of an evolving combination of motivation drivers for the team members to participate in the project. Starting from the desire of a hands-on experience of designing and building a sustainable prototype, the project's mission quickly came in addition to the personal motivating factors; culminating with the introduction of a peer motivation aspect to bring the project to its successful completion.

Mission: aspect closely related and interdependent with the motivation drivers, resulted in a variable geometry between the coexisting aspects of the project itself, and the competition in which we were participating as a team, which resulted in an important initiating factor as well.

Emerging results: throughout the interview process a set of relevant and recurring results emerged. Most prominently it emerged an interest in finding a definition for the team roles that would better reflects the needs of the team, especially with regards with the project architect and engineer role that, due to the growing complexity of the project, they had to increasingly focus on the project management aspects of their committee rather than the design itself.

At the same time it emerged that the mentoring and advisory role of those supporting the team is a key aspect that can lead to the success of the project in the

competition. Finally it emerged the importance of a common space for the team where, since the beginning, it is possible to work on the project together, making the process more efficient and effective.

8 Results Discussion

The research started with the aim to understand better and evaluate the experience of managing a student-volunteer based AEC project; with the goal to find out what were the characteristics and functions of leadership and management capable of leading the MOR team to the successful results that it obtained during the Solar Decathlon Europe 2019 competition. The case study was reconstructed based on the available team's documents and personal notes. These were collected in the over two years required to take the project from its very first initial stages back in September 2017, to the third and final assembly of the MOR prototype in the premises of TU Delft campus in the winter of 2020.

Although this was the official conclusion of the project as a student-based team, this research has focused on the two years that saw the development of the project from its concept stage to the beginning of the competition in Szentendre, Hungary, during the summer of 2019. The decision to study this timespan was on the fact that, according to the documents, the experience and the reflections with my fellow team members, the competition days marked the beginning of an *execution* phase of all the preparatory work that was done in the previous years. The necessity of finding an appropriate scope for this master thesis also concurred in the decision of focusing on the design phase of the project, leaving the exciting period of the competition days hopefully to further research.

One aspect that remained outside of this research, probably due to the set up of the research, as look from the inside, is the understanding of how much and what role played the composition of the team. It remains to be understood what role played the international aspect of the team, being it composed by students from twenty nationalities. With this research, it was not possible to properly understand this aspect, but as it will be discussed further along the report, a broader study of solar decathlon teams, and a comparison between them, could in fact reveal important results from this characteristic of the MOR Team.

While in the previous chapter, the research results were presented, these following pages aim to evaluate such results, discussing their meaning, importance, and relevance. By using a similar structure as the previous chapter, the results will be evaluated per topic, to establish correlations between them. It will then conclude with two sections of recommendations for who is taking part, preparing, or aiming to compete in other Solar Decathlon or similar competitions, and for possible future research. As already allowed to be seen in the previous pages of this report, and as stated at the beginning of this research, the goals of this work included the intention to explore the possibility for future study. Thanks to this research, it was possible to unveil several intriguing research areas connected with such competitions and team. The SD projects are therefore valuable research subjects not only on technical aspects, as it appears in the existing literature about the Solar Decathlon competitions but also from the managerial and pedagogical perspectives that these projects can bring to the surface. The need for professional-quality execution of an AEC project, done by volunteer students highlights those skills and tools required to coordinate and lead complex projects, solely counting on what in literature are typically called soft skills.

Organisation

The research firmly focused on the organisational aspects of the team, as these can be well reconstructed and discussed with the available data and with the results reported in the previous seventh chapter.

The theme of *experimentality* can be observed across several areas in the project. As previously mentioned, this trait was the result of the team's managerial attitude to adapt to what we were learning throughout our studies and our research to the specific needs of the team in the competition. The constant search for management innovation was one of the main drivers of the team's management committee, defined as a "marked departure from traditional management principles, processes, and practices" (Hamel, 2006), in our case innovation was a constant revaluation of our management processes. Not necessarily the invention of new

management tools or processes, but the constant search for improved versions of our organisational structure and our workflows. Retrospectively, as a management committee, we were studying our team and unconsciously looking for an answer to the questions presented in Hamel's 2006 article for the Harvard Business Review:

- Who owns the process?
- Who has the power to change it?
- What are the objectives?
- What are the success metrics?
- Who are the customers of this process?
- Who gets to participate?
- What are the data or information inputs for this process?
- What analytical tools are used?
- What events and milestones drive this process?
- What kind of decisions this process generate?
- What are the decision-making criteria?
- How are decisions communicated and to whom?
- How does this process link to other management systems?

This exercise of constant study of our team led us to constant innovation in our processes. A few examples were the followings: the implementation of new aid software for project management tasks, such as was the case with Asana, a better communication platform with Slack, or sharing and coordination tools developed by us through Google Sheets. This aspect, for example, was presented in the *Tools* section of this report, in chapter 5.

The results indicate that this attitude towards innovation was present in the design aspects of the project as well as the managerial aspects. It can be concluded that what made the organisation of this project successful was its attitude towards embracing innovation, adapting to the needs of the team and being capable of forming an *organically integrated* project delivery environment. Building on the definition of integrated project delivery (IDP) these are described as: "a project

delivery method that integrates people, systems, business structures and practices into a process that collaboratively harnesses the talents and insights of all participants to reduce waste and optimise efficiency through all phases of design, fabrication, and construction" (Eckblad, et al., 2007). On this definition, the results of this research allow concluding that the MOR's project delivery is to be considered an *Integrated Project Delivery* with an experimental attitude, answering to the needs of each part of the team: an *Organically Integrated Project Delivery*.

What also emerges from the results is a level of complexity with regards to decision making within the team. Contrary to regular professional projects, a volunteer-students led team, comes with complexity in establishing a hierarchy, and therefore a decision-making flow. The documents and the interviews pointed out that the decision-making processes were often lengthy and seldom definitive, only with the establishment of a more structured organisation and workflow the decision-making process became increasingly linear. This last aspect came at the expenses of the broader team, which became more distant from the collegial decision-making process that characterised the team in the first semesters of the project. The collegiality in decision-making resulted as necessary when laying the foundations of the team and its project's principles. However, once the need for increased speed in the project's processes arose, it was clear that the collegiality needed to make space to a more streamlined approach. Once again, this fact goes to indicate that the organisation of team MOR was driven by a principle of adaptability, capable of innovating its processes at the needs of the team.

Motivation and Mission

When it comes to the topics of *motivation & mission*, by looking at the results, it is possible to affirm that, similarly to the results obtained by Jeworrek and Mertins in their working paper "Mission, motivation, and the active decision to work for a social cause" (Jeworrek & Mertins, 2019), one of the key motivating factors for the team members of MOR to remain and to get involved in the project were the team's missions. Equally, the project's mission statement,

or the team's mission of successfully competing in the SDE19. It does not surprise then that these two aspects, as shown in the previous chapter, were strictly correlated.

Along with the project's and team's missions, the results also show that if joining the team was often driven by personal motivating factors, when it comes to continuing the project, and especially leading the project forwards through challenging periods; the key driver was the sense of responsibility between peers. As already highly studied in IDP related studies such as "Symbiotic Relationships between Integrated Project Delivery (IDP) and Trust" (Pishdad-Bozorgi & Beliveau, 2016), "Making sense of the multi-party contractual arrangements of project partnering, project alliancing and integrated project delivery" (Lahdenpera, 2012), or "Transitioning to Integrated Project Delivery: Potential barriers and lessons learned" (Ghassemi & Becerik-Gerber, 2011), the interpersonal relations and the commitment of key players are of uttermost importance. What this research adds is that building on the interpersonal relationships and commitment of key players, forms a sense of responsibility towards the project and the team itself, building resilience towards the challenges of delivering the project.

What can be concluded in the areas of motivation and mission within a volunteer-students based project is that these two aspects are to be considered as closely related and interdependent, both heavily concurring to the successful results of the project. It can be argued that, this conclusion can be confirmed thanks to the volunteer basis of the project, therefore removing the incentives of remunerations or contractual forms, and exposing that success was possible thanks to motivated and mission-driven volunteer-students.

Team Roles

Following Winch's manual, Managing Construction Projects (2010), three levels of leadership and needed when managing organisations: an organisational level, the chief executive role, a senior management role coordinating the principal divisions of the organisation, and a team leadership role, coordinating

the various units which make up the organisation.

Within this division, it is possible to recognise these levels in the MOR team organisation as well. Nevertheless, it is also important not to confuse the volunteer-based structure of our organisation, with the business organisations usually studied in the scientific literature.

If we apply this subdivision of leadership roles to the MOR team, it is possible to recognise the team leadership role in the *committee leaders*, the senior management role in the board members, being it formed by the Project Manager, the Project Architect, the Project Engineer, the Partnership Manager, the Communications Manager, the Contest Captain, and the Student Team Leader. Finally, it can be argued that the chief executive level was, in principles, to be recognised to the team board itself.

If we then strictly apply the definition and division of leadership roles provided by Winch, my role as Team Manager, including the roles of Student Team Leader, Project Manager, Contest Captain, and Construction Manager, was, in reality, a chief executive-level given the main focus on the overall organisation. The problem with this definition lies in the implied hierarchical structure of these roles, that as pointed out by the results, it was not wholly present within the team. A stricter hierarchical structure emerged in the third and fourth semesters of the project, which boosted the decision-making process, but at the same time seriously risked alienating parts of the team. It becomes then of crucial importance, in these types of projects, to properly balance the need for a hierarchical structure, with the need of collegiality required in a volunteer-student based team.

Another point of criticality is the allocation of responsibility within the team. Within the team, this aspect was taken care of by a vote-based system, where the team members would appoint one of us to a specific responsibility role, from the committee leaders to the team officers. What remains to be understood is how much this democratic-like procedure empowered the team members appointed to specific roles. In this aspect, it can be interpreted from the discussions with the team members that, especially during the early stages of the project, the roles were not clearly understood, or interpreted.

What prominently emerged from the interviews, was the need for a middle-

management role, which in its principles should have been covered by the committee leaders. What was understood later in the project, with the increase in complexity of it, was that the committee leaders and especially the project architect and the project engineer, were de-facto more effective for the team when taking up the role of their division's project managers. In this function tasked with the coordination of their divisions, and the empowerment of their committee members, rather than them being the committee members "doing the majority of the work", as stated in several occasions during the interviews.

Finally, based on the research, it can be argued that, within the MOR team, the task of Student Team Leader and Project Manager should not have been taken up by the same person. These two aspects were often contradicting in-nature, the first one focusing on the team and its members, on the functioning of the organisation and its mission. In contrast, the project management roles primarily focus on the progress towards the achievement of specific and measurable goals, focusing on the project above the organisation.

Given the results of this research, it can be concluded that, within a Solar Decathlon project, part of the team officer's roles, as named by the SDE rules, can be defined as follows:

- Team Leader: Or team manager, is the student tasked with the overall coordination of the team, overseeing its organisation, and drive towards the achievement of the project mission. Ensures that the organisation answers to the needs of the team and that information is shared appropriately.
- Project Manager: team member responsible for the overall execution of the project, ensuring its progress towards the achievement of the team's goals and its efficiency.
- Project Architect: team member responsible for the architectural design management and coordination. Ensures that the architecture divisions are effectively reaching the goals necessary to achieve the project mission.

- Project Engineer: team member responsible for the engineering design management and coordination. Ensures that the engineering divisions are effectively reaching the goals necessary to achieve the project mission.

Probably, in this case, the best way to describe the work of those tasked with the coordination of the team is that of *context curators* as beautifully presented by Andrew Chakhoyan in his article for the World Economic Forum *"is the era of management over?"*: "Context Curator" is the term I'd like to introduce to the business dictionary. To lead a project is not to assign tasks and monitor performance, but to empower, to define the broader context, and to organically link the work of one team with the rest of the business. […] Curating the context in which high performers can excel – rather than attempting to manage them – is the key to unleashing their full potential (Chakhoyan, 2017).

Shared common space and Mentoring

Looking at the emerged results, the two topics of mentoring and the importance of a shared common space for the team are here briefly discussed. Do contribute to the success of the team, but they also fall outside the scope of this research.

With regards to the shared working space for the team, this research proves once again that with this types of projects, a shared working space for the team leads to an improvement in the organisation processes and ultimately in the project delivery. As stated by Gale Moutrey in her article following the Steelcase 2014 commissioned survey, a suitable working place amplifies "the performance of people, teams, and organisations" (Moutrey, 2014), a similar conclusion was also drawn by the interviewees during this research, looking at the lack of a shared space in the early phases of the project as a challenging situation for the team, and the changes that being on the construction site, together, made to the team's processes and spirit. Further research would be necessary on this aspect, possibly

looking at the "global coworking movement" (Mayfield, 2018). This would be aimed to develop a strategy for volunteer-student based team spaces made available by the universities. Places where teams working on different competitions from the same university can work together, similarly to the concept behind the D-Dream hall at TU Delft, but capable of accommodating projects beyond the mechanical engineering realm, as it is the case today.

Characteristic	Mentoring in Education: Directive Approach	Coaching in Education: Dialogic Approach	Coaching in Education: Facilitative Approach
Metaphor	Master–apprentice	Partner	Facilitator
Decision-maker	Mentor	Coachee	Coachee
Coach's expertise	Expertise relates to professional practice and professional development	Expertise relates to the ability to coach effectively and to professional practice	Expertise relates to the ability to coach effectively
Coachee's knowledge	Requires the knowledge and expertise of the mentor	Has substantial experience but may require additional knowledge	Has experience, resources, and relationships
Thinking	Mentor does most of the thinking	Coach and coachee think together	Coach creates a safe space for the coachee to do the thinking
Discourse	Advocacy	Inquiry and advocacy	Primarily inquiry
Purpose	Fast-track learning and development	Improve outcomes for educators and learners	Improve outcomes for educators and learners

Comparing coaching approaches to mentoring. Coaching in Education, van Nieuwerburgh C., Et Al.

Lastly, the emerged topic of mentoring within the team resulted as extremely important for the students involved in the project, especially for those in coordinating roles, where they were often in close contact with faculty staff or professionals from the partner companies.

Among many sources, it was interesting to look into the comparison between coaching and mentoring approaches (van Nieuwerburgh, Knight, & Campbell, 2019), and getting a glimpse into this branch of professional coaching, and coaching in education principles.

Although outside the scope of this study, and the author's field of studies, it remains essential for student-volunteer teams to receive the support, mentoring,

and coaching of experienced faculty staff members and professionals, in the best possible way. A best possible way still needs to be adequately studied in this specific area of projects, most likely tailored to the need of the specific team, primarily by faculty staff or, such as in our case, primarily led by students and therefore require a different approach to mentoring and coaching.

To summarise

Discussing the results of this research brought the findings in a dialogue with the relevant scientific literature. It can be argued that the *Organisation* of the MOR Team, based on its characteristics, built a design environment to be defined as organically integrated project delivery.

With regards to *Motivation*, the combination of personal and team's motivation drivers evolved throughout the project and worked in a variable geometry with the *Mission* of the team; therefore the combination of strong motivations and mission are to be considered the main drivers for the team's successes.

When discussing *Roles*, the difference emerges from the scientific literature, in the case of our volunteer-based team, the so-defined "chief executive level" of the organisation was shared between those team members tasked with the "senior management" level of the team itself. Another critical aspect in this area of the research is the allocation of responsibility within the team, with the emergence of the committee-leader role as a "facilitator" and "coordinator" of the team members' responsibilities. Based on this concept, new definitions for part of the key team's roles were developed.

Finally, the research discussed and confirmed the importance of a *shared common space* for the team, accentuating the need for this space since the early phases of the project; concluding the chapter with a short discussion on the importance of appropriate forms of *mentoring*. Although falling outside the realm of knowledge of the author's field of study, appropriate mentoring is to be considered a crucial aspect of the team's success.

9 Conclusions Recommendations Reflections

This research started with the goal of better understanding the characteristics that allowed the MOR Team TU Delft to reach such a successful result with their project for the SDE19 competition. Understanding the characteristics of the team, reflect on them, and save it for future reference were all primary goals of this master thesis. Throughout the development of the thesis, it appeared clear that the study of Solar Decathlon Teams from a managerial and organisational perspective was not yet a research area with available academic sources. What has been until now more commonly published on Solar Decathlon projects is more commonly related to the more technical aspects of the design proposals, with little to no available information regarding the organisational and coordination processes of the team involved in the competitions.

Given the situation, this research leaned towards an exploratory direction, aimed at understanding how the study of a Solar Decathlon team could help build the body of knowledge in the field of design and construction management.

Reaching the goals as mentioned earlier, the study answered the following research question:

In the context of volunteer-student led AEC projects, what are the characteristics and functions of coordination, capable of improving the performances of the team, and those covering these roles?

The answer to the main research question can be summarised as follows:

The main characteristics that made the MOR team a successful participant to the Solar Decathlon Europe 2019 were primarily focused on its approach towards the

organisation of the team. Based on an experimental attitude, the team developed a structure capable of being adapted and capable of answering the specific needs of the team at the different stages of the project. This exploratory attitude was vital element necessary to introduce innovative management solutions throughout the project; This resulted in an Organicslly Integrated Project Delivery, tailored to the needs of the team. Vital to this aspect was its shift of focus from management to coordination, and its balance between hierarchical and collegial decision-making processes.

Furthermore, this research exposed how, in the context of motivation and mission, the main drivers of delivering the best project possible and successfully participating in the SDE19 competition co-existed as both motivating drivers and mission drivers, balancing the need for the competition and the project. What resulted as important was the commitment of the team members to both project and competition, and growing throughout the project the sense of responsibility of the team members towards one another.

It is thanks to this environment that the team was capable of producing a successful and award-winning project.

The previous paragraph is a direct answer to the research question. Furthermore, throughout the research, it was possible to pinpoint several processes and aspects of the team. These resulted valuable in completing the experimental attitude of the students, as well as the realization of how the processes could have been improved. Additionally, it was possible to better define the roles of the team members, making clear for the rest of our peers that management, as intended for this typology of projects is to be considered as coordination between peers.

This research, to a degree, is certainly not complete. However, it does give a good look into the processes that made this project a success. The study sets its roots into the team's documents, and upon those, it builds reflections and consequently discussion with a sample of those team members that were highly involved with the day to day running of the team.

Many more people were critical to the development and coordination of both team and project but given the scope and characteristics of a master thesis, only

formal interviews, or better, conversations with fellow team members were reported. In truth, many more team members, faculty advisors, and professionals that supported our project indirectly contributed to my understanding of the team's processes.
Once required by this thesis to step out, and scientifically study the team, the informal conversations certainly contributed to the clarification of the team's picture presented in this report.

In conclusion, further validation of these results would be beneficial, formally involving all the team members. However, what would be more interesting is to build and collect more studies on different teams, and from this point compare them, finding similarities and differences, reaching a better understanding of how these volunteer-student based AEC projects are organised.

Recommendations for future research

What this research found out in its exploratory work is an area of study fascinating from various point of views and for various disciplines. With its limitations, this master thesis presented the case of the coordination of a successful Solar Decathlon Europe team, that with its student-driven organisation was capable of obtaining impressive results with the project and during the competition.
Based on the results, further studies can be recommended in several areas that are here presented.
In general, it can be concluded that the study of Solar Decathlon teams can lead to adding to the body of knowledge of design project management, and especially in the field of integrated project management. Although in a smaller scale than a regular AEC project, the study of a volunteer-student based team provides an exciting point of view on the coordination of a group tasked with the delivery of

complex project, with the use of soft skills, being absent the use of contracts and remuneration (other than the occasional ECTS study credits).

In general, Solar Decathlon teams are a fascinating laboratory for experimenting with innovative management solutions, as well as observing management in action. The following fixed characteristics substantiate the claim of a laboratory environment:
All the teams are working on projects of similar sizes, with the same competition requirements, and complying to the same rules;
All the teams follow the same competition timeline layout provided by the SD Organisers;
All the prototypes are built at the same time at the Solar Village, providing access to a very close observation of their working processes in the field;
Finally all the teams are primarily formed by students, therefore with a similar background and level of knowledge.

All these characteristics provide a precious platform on which is possible to study project teams with similar but different organisational structures, comparable projects, and comparable timelines.
It is probably the closest possible situation for a laboratory-like, semi-controlled environment study of management sciences.

Moreover, to consolidate the results of this master thesis, further research should be conducted.
Firstly, by expanding the study of the MOR Team by interviewing a larger group of students. Possibly using a quantitative format, and by doing so rooting the results here presented into the statistical data collected from a team-wide survey; including students, faculty advisors, and professionals.

Building on the experience of this research, it would be interesting to expand it to other teams, firstly looking into those competing in a Solar Decathlon Europe, and possibly also to the other editions of the competition on a worldwide scale.
By doing so, differences can emerge from the specific editions, and between teams; highlighting patterns and similarities between management practices.

While for the competition itself, finding out whether teams perform better when primarily organised by students or instead perform better when primarily organised by faculty staff.

In conclusion, it appears that the study of Solar Decathlon volunteer-student based teams has the potential to become an exciting and precious study area in the field of design and construction management.

Lessons learned

Competing in a Solar Decathlon is undoubtedly exhausting, but if done at its fullest potential, it is an unmatchable learning experience for both students and mentors. The opportunity of having full control over a project, from its very conceptual phase to its final construction is a unique experience that is well worth the challenges that it comes with.

What emerged from this research are some fundamental principles that have the potential to be extremely valuable for teams and advisors currently participating in a Solar Decathlon or interested in participating in one. What follows is a summary of lessons learned emerged thanks to this study that, after careful review with other former team members of the MOR Team, are considered as valuable pieces of information of our fellow decathletes.

Starting from its early stages, the project has been organised primarily by students; This meant that as students we were taking as much as possible the responsibility of the project in our shoulders, except where required by the competition, such as in the case of the compliance with the building code, or the approval of the structural calculation, on which both cases we were definitely involved in the entire process. Out of these minimal cases, thanks to the support of our advisors, we were able to fully experience the development of the project, our project. This decision certainly increased the difficulty of the challenge, made it less efficient than what a professional project can be; But it made it our project, and our most complete learning experience possible.

What can be concluded from this research is that, by having the responsibility of the project, we were always motivated to bring it forwards.
What also resulted effective from our team was the exploratory attitude that, as a team, we were able to develop and apply to all the aspects of our project.
This was given by our inexperience with professional AEC projects. However, more importantly, it was given by our commitment towards the project mission, and our willingness to think through our own schemes.
The exploratory attitude however, should be matched at the same time by a willingness to embrace change, always innovating and trying to improve the work of the team.

One aspect that instead should have been better dealt with was managing the expectations on each other.
This statement comes from the reflections made during the interviews regarding the first and second semester of the project.
Without paying attention to this aspect, we started the project with enthusiasm, and subdivided the work according to our interests and aspirations. With doing so, we forgot that at this early stage, we had almost all the same background with a bachelor's in architecture. This, at times, resulted in a mismatch of expectations between, for example, the building technology students, and the management students. The first expecting us to have a background in management and economics, and us expecting them to be already more focused on the technical aspects rather than on the architectural design.
Seemingly of little to no count, it resulted in several misunderstandings that we were able to resolve only later in the project.
Managing the expectations from each other and knowing the background of our fellow team members was a valuable lesson learned for us.

Finally, the last two aspects here discussed that resulted in valuable lessons learned are more related to the practical organisational aspects of the competition.
What emerged from the growth in complexity of the project was the need for a dedicated project manager, rather than one person overseeing the entire

organisation from the team perspective, and the day to day management of the project processes. At the same time, the realisation that with the increase in complexity of the project, the roles of project architect and project engineers by necessity shift towards a project management role. From the committee leaders, this specific aspect was initially not expected, but in the end, it resulted in a necessity in bringing the project forwards.

Moreover, again from a management perspective, a recommendation is to pay close attention to the use of the word "management", as it is often perceived with an implication of hierarchical structure. Instead, as it can be seen from this study, the role is much more focused towards the coordination of the team and the project, where critical decisions are as much as possible taken with the team in a collegial manner. Without the collegiality, a volunteer-student based team would not be capable of overcoming the challenges of participating in a Solar Decathlon competition, and of designing, financing, and building a fully functioning, full-scale housing prototype.

Final remarks

Reaching the results presented in this research has been challenging. Firstly, with the realisation of the need for an exploratory study given the lack of previous works in this area, then by the personal involvement with the team.

Combining several roles within the team in one person has resulted in an exhausting project that certainly made the work on this thesis more challenging than it could have been. Nevertheless, it resulted as extremely important and valuable to build this exploratory work.

Furthermore, it was interesting to reflect and finalise the thought on the coordinating aspects of the project once again; with this process leading to valuable and reassuring results regarding the work of the team's coordinators.

During a project, from its inside, it is complicated to have a clear image of what the effects of our decisions as managers or coordinators are. Nevertheless, it is

from looking at it from the outside, and even better once the project is over, that a clear picture can be seen.
In this case, it was also essential to take some time after the completion of the project, "to let the dust settle down", look back and see the successfully finished project.

Throughout this research process it was also possible to better understand how to research in realm of management sciences and, once again, I believe that the further study of Solar Decathlon teams will not only lead to exciting findings for the teams themselves. It will undoubtedly be exciting as a laboratory study of practices in the fields of teamwork, mentoring, teaching, and most prominently in the field of design and construction management.

Finally, I would like to conclude by stating that the research here presented exceeded my initial expectations.
Initially, the concept behind the thesis was to compare several teams from the SDE19 to build a case study on several teams. The fundamental limitation of this initial concept was the absence of previous studies that would allow me to define the scope of my research better.
Essentially, after the initial phases of the thesis, it appeared clear that within these projects, there were too many concepts to explore. A thesis that would cover several teams at the same time would not have reached the depth and robustness that I required for my work.
Reducing the scope of the thesis to a manageable picture was vital for the research to reach a valuable result. It is my conviction that this research has done so. In the end, just like the MOR project, this study was a process of constant questioning and reflection upon my work. Indeed, not easy, or straightforward, but by looking back between the settling dust, it is possible to see that a long road travelled.

Thanks to the Solar Decathlon project, I was able to see first-hand what I was studying in Management in the Built Environment. Thanks to this thesis it was possible for me to understand and see how these two aspects of study and project were and are correlated. I do feel that coordinating the MOR Team gave me an

intense crash-course on management and leadership; reflecting on studying the work done with my team through this thesis allowed me to have a better understanding of it.
Lastly, researching on personal work, that is connected with so many emotions has been arduous. Nevertheless, thanks to the feedback received from my mentoring team, it was possible to keep moving forwards and reaching this milestone.

What this research has produced is a valuable reflection and study of what managing a volunteer-student based team is about.
Hopefully, it will result useful to other students and faculty advisors that are currently competing in a Solar Decathlon, or to those that will work with such projects in the future.

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Annexes

A: MOR Team TU Delft Press Kit #5

B: Raise MOR awareness scheme

C: Board meeting agenda and report example

Annexe A

PRESS KIT 5
MOR

solar decathlon europe
SZENTENDRE HUNGARY 19

TU Delft

"THERE IS A GREAT NEED FOR THE INTRODUCTION OF NEW VALUES IN OUR SOCIETY, WHERE BIGGER IS NOT NECESSARILY BETTER, WHERE SLOWER CAN BE FASTER AND WHERE LESS CAN BE MOR"

INTRODUCTION

The MOR team represents Delft University of Technology, The Netherlands, in the Solar Decathlon Europe 2019. MOR is a collaboration of students, professors and experts working in the fields of energy, circularity, product development, innovation in technology, finances and architectural design.

The Delft University of Technology is the largest and oldest Dutch public technical university, located in Delft, the Netherlands, providing technical education for the last 175 years. Known for its high quality of education and research, the university was ranked 3rd for the Architecture and the Built Environment curriculum and 4th for Civil Engineering curriculum in 2018[1]. The TU Delft being an internationally oriented university is reflected well in the MOR team, since its members originate from 21 different countries. Across the campus, a large pool of talented students and employees contribute to the conception and implementation of technological solutions for actual environmental and social challenges, from the local to the global level.

With the aim of creating solutions for a future that is socially and environmentally conscious, MOR presents this project manual as part of the third deliverable for the competition.

It is our team's vision to create a future-proof built environment, that gives back to its surroundings more than it takes away from it.

In the quest to make our vision a reality, MOR, or Modular Office Renovation, has committed itself to develop a strategy for renovating underperforming office buildings into net positive multi-purpose buildings. Our mission is to renovate these inefficient office buildings into net positive and affordable rental housing for starters. In order to make our design future-proof, we propose an adaptable and modular solution with multiple functions within the building. Our solutions are able to react to the change in user needs as well as the continually changing market conditions. We are convinced that this type of intervention will have a positive local and global impact on the long-term viability of our surroundings.

MOR aims to create a renovation proposal focused on net-positivity in five aspects: energy, air, water, biomass, and materials. Only through holistically addressing these five net-positivity aspects we can hope to achieve social, economic and environmental prosperity as the pillars of sustainability.

It is worth noting that the TU Delft already has a record of participating and supporting the teams competing in the Solar Decathlon Europe 2019 competition, such as the Pret-a-Loger team of 2014 in Versailles. However, a novelty in this Deliverable is that the MOR team has been granted a Dream Team status, which shows TU Delft's commitment to fostering continuous generations of teams that strive towards a more sustainable and habitable built environment.

1. According to the QS World Universities ranking 2018.

LESS IS MOR

CONTENT

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TOGETHER WE CAN DO MOR.

PROJECT DESCRIPTION

In the Netherlands, there are currently around 34.6 million square meters of office space with an energy label worse than C, which is about 44% of the total Dutch office stock, or the area of 4,845 football fields.This alarming number of buildings failing to meet European legislation regarding efficiency requirments for energy, water, materials, and more, are negatively affecting the efforts towards reaching the 2050 sustainability goals in Europe. The energy inefficiency phenomenon is present in large urban landscapes with a lot of economic activity such as the Hague, Rotterdam, and Amsterdam, in which 1.4M, 1.16M, and 2.5M square meters of office space respectively have an energy label lower than C[3]. In addition, according to the newly amended Building Decree (Bouwbesluit) no office stock with an energy label worse than C can be used for that purpose from the year 2035.

Economically speaking, both the owners of these properties and the government are at a loss. Whereas the former are losing money maintaining the buildings and spending large sums on energy bills, the latter are missing out on the revenue from these undesirable properties in the form of property sales and taxes. Hence, the dormant economic potential of the energy inefficient office building stock is tremendous, especially considering that many of those buildings are centrally located.

From an ecological standpoint, these office buildings are unfavorable, as they are unable to meet the new stricter European legislation regarding energy consumption, water use, embodied materials, and more, as well as with the rising energy prices. In this state, these buildings are not contributing positively towards achieving lower energy consumptions and CO2 emissions within the built environment. This means that the old stock of office buildings will have to be upgraded to remain relevent, useful, attractive and lettable.

Social issues related to the presence of inefficient office buildings become apparent when considering the fact that many of such offices are left vacant. The repercussions of this state of affairs can be summarized by the broken window theory[6], which suggests that signs of abandonment, disorder and neglect within the urban environment trigger more disorder and neglect, while at the same time stimulating undesired criminal behavior. Due to this, the neighborhood may feel less attractive and unsafe. Therefore renovating these office buildings and making them more attractive can aid in inhibiting these negative behaviors.

In addition, making buildings energy- and resource-efficient can help increase energy access and reduce energy poverty for lower-income residents, which results in improved health, productivity and comfort within the entire neighbourhood.

Meanwhile, the Dutch housing market continues to grow stronger, with the average purchase price of all dwellings rising by 7.44% during the second quarter of 2017, the largest rise in more than 16 years[7]. As the housing prices are rapidly increasing, the available affordable housing stock is dramatically decreasing; most notably in the big cities where the supply does not meet the demand. This shortage of availability can be attributed to the trend of decreasing number of residents per household[8]. More and more people decide to live individually, and therefore the housing need will rise even more in the coming decades.

The lack of availability of owner-occupied housing at an affordable price has led to a shift in the mindset of the starters' demographic group (young professionals, recent graduates, and more, 25-35 years old), who are moving away from long term financial commitments and are opting for renting instead. This choice to rent instead of owning a property is coupled with the new lifestyle choices of starters who want to remain flexible in their movement and have the ability to change location after a certain period of time due to new job opportunities or other developments in their lives[12]. One of the previously mentioned cities facing both problems of inefficient office building stock and skyrocketing increase in housing prices is Rotterdam. We focused on this city as it has one of the lowest energy efficiency rates for office buildings in the Netherlands and an equally unfavorable trend of housing price increases.

MOR is tackling these two challenges by working towards the renovation of underperforming office buildings into affordable housing and flexible work spaces for starters, a group that is highly affected by the current building stock shortage.

To develop and realise this ambitious goal, the MOR team has been studying the Marconi Towers in Rotterdam, a three-tower development part of the Europoint Complex. It features a typical office building typology of the 1970s in the Netherlands, and is currently abandoned, which makes this site highly relevant for the application of this renovation strategy.

The building will be transformed from an inefficient office building to a multi-purpose apartment building that is net-positive regarding energy, water, air, biomass and material. The multi-purpose building will be a mix of apartments, communal areas and working spaces. The modular and flexible approach in this project demonstrates itself in four different types of modules that can be rearranged according to the demand and typology. These modules include a facade module, a wall module, a kitchen/bathroom module and a bedroom/workstation module. In accordance to some predictions that the office market will recuperate and office space will again be needed, the project uses a flexible concept that can easily transform the new apartments back to offices. However, it is also possible that a change in the housing stock, tenants living styles, or particular urban conditions may force the typology of housing to change, to which it could be easily adapted with our concept.

Within the concept we present two different types of dwelling typologies: a self-contained apartment and a co-living apartment. The self-contained apartment can host up to three different types of households which we named live, live & grow, and live & work. All of these self-contained apartments include private zones (bedroom/ workspace) and facilities shared with other cohabitants (kitchen and bathroom). The live & grow units additionally contain a private garden, which acts as a buffer zone between inside and outside, but most importantly brings light and air to the building's interior, contributing to a healthier and more pleasant space on a building scale. The live & work unit type is characterized by an addition in the form of a 'work pod' below or above the apartment, which serves as a private workplace within the office floor. It is connected to the living unit above it or below it via an internal staircase. The second typology, the co-living apartments or live & share, aims at providing more affordable dwellings by sharing facilities and living rooms with more than two other occupants: the household varies between four and eight inhabitants. These apartments go beyond living together and sharing space, therefore promoting interaction, a sense of community and shared responsibility.

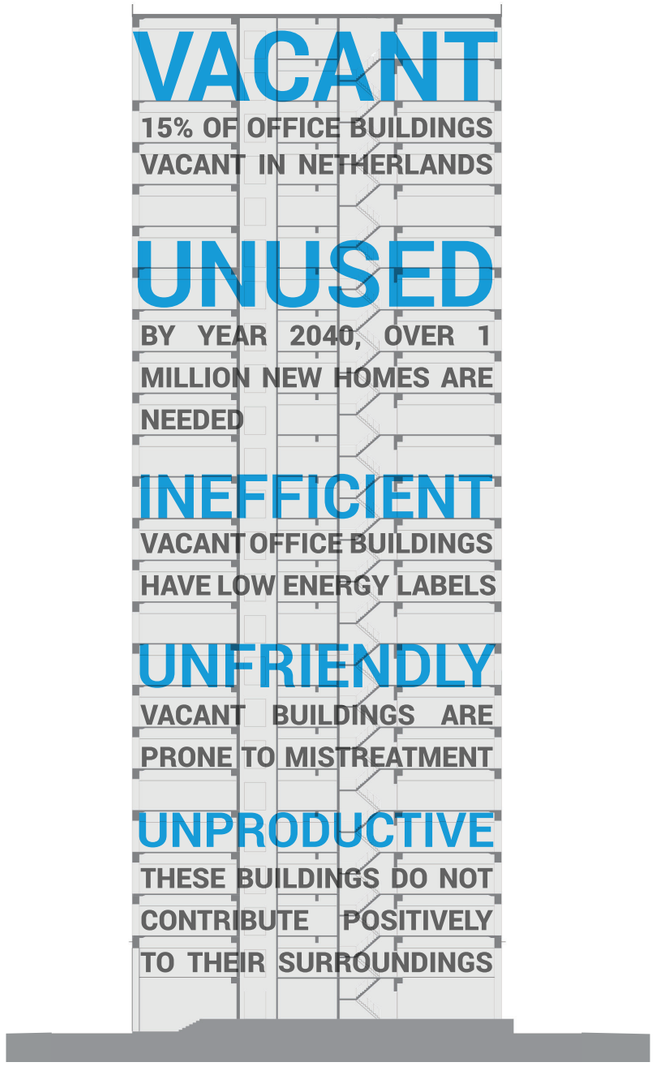
By introducing this concept, MOR can mitigate the negative economic, ecological and societal effects of underperforming building stock, while at the same time providing more housing to foster sustainable urban densification. Ultimately, these buildings will shift from being contributors to the problems of unsustainable resource consumption and inadequate urban services to becoming part of the solution.

GOALS

- DEVELOP A FLEXIBLE SOLUTION FOR RETROFITTING OF UNDERPERFORMING OFFICE BUILDINGS INTO NET-POSITIVE HOUSING FOR STARTERS.

- MAKE THE SOLUTION MODULAR AND INDUSTRIALIZED SO AS TO ACHIEVE COST-EFFECTIVENESS WITH A HIGH MARKET POTENTIAL TO MAKE OUR SUSTAINABLE RENOVATION STRATEGY APPLICABLE ON A LARGER SCALE.

- RAISE AWARENESS OF PROFESSIONALS, THE GENERAL PUBLIC AND INSPIRE THE PUBLIC AUTHORITIES ABOUT THE NECESSITY FOR ENERGY RENOVATION, SPECIFICALLY OF VACANT BUILDING STOCK WITH AN EFFECTIVE WORKING PROTOTYPE.



- PROVIDE AFFORDABLE ACCOMMODATION AND WORKSPACES FOR STARTERS, WHO ARE IN NEED OF HOUSING IN PROXIMITY OF THEIR WORKSPACES IN LARGE CITIES.

- STIMULATE SUSTAINABLE URBAN DENSIFICATION BY VACANCY RENOVATION INTO MIXED-USE SPACE.

- ACHIEVE NET-POSITIVITY IN DENSE URBAN ENVIRONMENTS WITH THE SMART COMBINATION OF CIRCULAR CONCEPTS SUCH AS URBAN FARMING, PASSIVE VENTILATION, GREY WATER RECYCLING, MATERIALS REUSE AND POWER-GENERATING FACADE.

TEAM ORGANISATION

DAILY BOARD

6 STUDENTS + 2 FACULTY ADVISORS

COMMITTEE LEADERS

CONTEST CHAMPIONS

EXTERNAL CONSULTING PARTIES

SPONSORS

FACULTY ADVISORS

GOVERNMENT

MUNICIPALITY OF ROTTERDAM

PORT OF ROTTERDAM (M4H)

COMMITTEES

ARCHITECTURE & DESIGN

BUILDING PHYSICS & PERFORMANCE

ELECTRICAL DESIGN

FEASIBILITY

FUNDRAISING, SPONSORSHIP & FINANCE

MATERIALS SUSTAINABILITY DESIGN

MECHANICAL DESIGN

PROJECT MANAGEMENT & HUMAN RESOURCES

PUBLIC RELATIONS & COMMUNICATIONS

STRUCTURAL DESIGN

URBAN INTEGRATION & NEIGHBORHOOD

PROJECT DEVELOPMENT

COMMUNICATIONS

2017
MOR enters the competition

June 25th, 2018
Meet the MOR Team

September 2018
New and fresh communications team is formed

November 2018
MOR becomes a DreamTeam at the TUDelft

January 15th, 2019
Sponsorship Presentation & Networking Event
TUDelft, Delft, Netherlands

March 7th, 2019
Interest Drinks for new MOR members
TUDelft, Delft, Netherlands

March 27th, 2019
College Tour: Future Living Panel
TUDelft, Delft, Netherlands

June 2019
Visits at the prototype at the Green village
Send off event and press conference with sponsors at the prototype

PROJECT

2017
MOR enters the competition

2018
Concept development
Design development
Preliminary drawings

January 2019
Final Design
Workshop #2 in Szentendre, Hungary

January-April 2019
Preparation of final construction drawings and documentation
Material ordering and Green Village site preparations

April-May 2019
Construction at the Green Village
Delft, Netherlands

June 2019
Disassembly and Shipping to competition site

July 2019
Construction at competition site and evaluation SDE19 in *Szentendre, Hungary*

August-October 2019
Public Exhibit at the Solar Decathlon Village
Hungary

October-December 2019
Disassembly in Hungary and Rebuild in Delft

HOUSE DESCRIPTION

To propose a design which could be easily replicated on existing office buildings, we identified a typology that is common among the building stock from the 70s all over the world. A high rise with 22 levels located in Rotterdam serves as a case study to the address the complexities of the net positive renovation. These living systems will be integrated together, creating cohesive living and working environments.

To start off, our team analyzed the performance of the existing office building. The proposal will then reduce its energy, water, ventilation, biomass and materials demand to a minimum. What remains will be supplied by passive measures; only where such measures do not suffice, active systems will be used. In the meanwhile we generate electricity, clean the water and the air, and recycle biomass and materials to make the structure net positive. By such, MOR will not be less bad, but good for the people and the environment.

To ensure that the totality of the existing structure is addressed during the renovation, the building was split into three major constituents; the core, the floor space, and the facade. All three elements were evaluated for their ability to meet the demands of the new housing function and the accompanying program.
The core of the building currently contains all the vertical communication and building services. Considering the fact that the building was designed to meet the function of an office building which has more intensive circulation, after conversion to a residential one, the total number of elevators can be reduced, and the leftover space can be allocated to new functions such as additional ventilation, producing food which could thrive in such conditions (e.g. white asparagus, sprouts, oyster mushrooms). Additionally, the core space will be used to accommodate certain communal functions such as laundry rooms or storage spaces.

The adaptability of the concept includes the ability to restore the office function as well as to allow future functionality to be easily implemented.

BUILDINGS ARE ONE OF THE LARGEST CONSUMERS OF RESOURCES.

WE THINK THIS SHOULD BE DIFFERENT.

FOR FUTURE GENERATIONS TO FLOURISH, WE ENVISION A FUTURE-PROOF BUILT ENVIRONMENT THAT GIVES BACK TO ITS SURROUNDINGS MORE THAN IT TAKES AWAY FROM IT: MOVING AWAY FROM BEING A CONSUMER TO BEING A CONTRIBUTOR.

NET-POSITIVE STRATEGY

ENERGY+
Photovoltaic panels and electricity generator

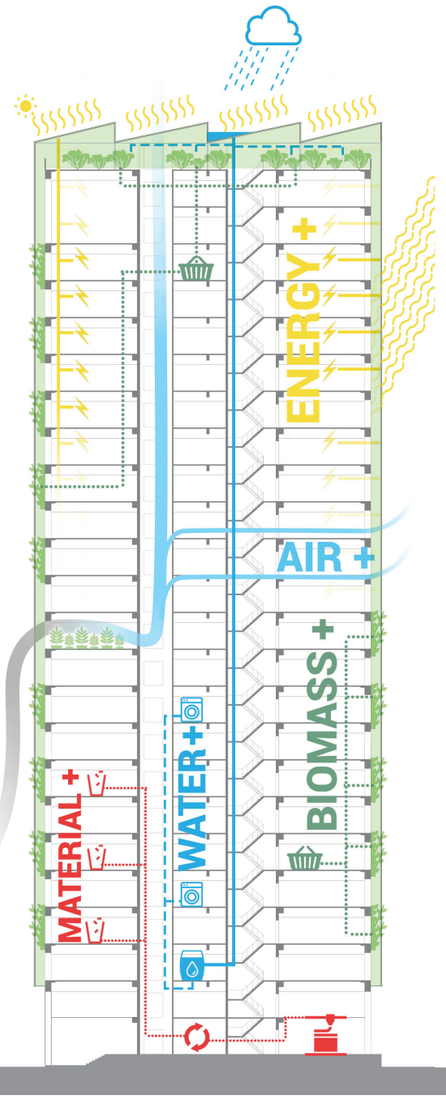
The facade will not only serve as a passive skin to regulate the interior climate, but will also act as the main energy generator of our structure by usage of building integrated PV panels. In total, this allows our entire complex to become an energy supplier to the neighbourhood rather than only for the user.

WATER+
Greywater treatment, biogas from blackwater and rainwater harvesting

The water system is designed to reduce water demand, as well as collect and reuse water in the building and neighbourhood. Use of freshwater is minimised and greywater is treated in a constructed wetland, offering a local supply of water for urban parks and farms. Blackwater is treated to produce biogas and plant fertilizer. Rainwater is collected and used in the rooftop greenhouses and for toilet flushing.

AIR+
Passive ventilation and high air quality

Air-purifying plants are integrated in the building. This purified air is brought in through the second skin to pre-heat in winter. A solar chimney then extracts the air through the central core where energy is recovered. In the summer, cross-ventilation is introduced through the indoor gardens and the open floor plan with shading by the second skin ensuring a comfortable climate.



BIOMASS+
Toilets and greenhouse

Food production in the buildings helps reduce food miles, while the use of organic matter helps restore soil fertility. This proposal aims to integrate the food production unit into Rotterdam's existing urban farm network, contributing to the larger goal of closing the food loop locally. With regard to organic matter treatment, biogas is produced from human faecal matter and kitchen waste, while the resulting sludge is used as fertilizer.

MATERIALS+
Upcycling, material passport and end-of-life planning

Our materials' strategy is to keep biological and technical materials within their respective flows rather than using composites that are less easy to disassemble and recycle. Components are designed to be dismantled allowing individual materials to have a second life instead of being discarded or incinerated. Sources and end-of-life protocols of materials are determined during the design process to ensure material positivity.

MODULAR DESIGN

Our design is modular in the sense that the added structure is built-up out of different prefab modules. All connected they form the whole of a functional building that performs net positive within the framework of the 5 elements.

MODULARITY

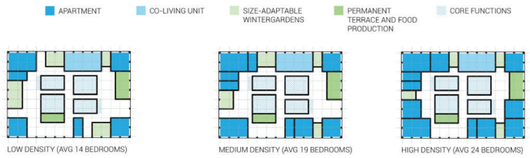
The concept of modularity aids the circular dimension of the project. Use of de- and re-mountable materials to build up the modules promotes extraction, reusing and recycling. We plan to facilitate this by making use of the concept: 'Buildings as material banks.' Where suppliers of materials remain the owner of the product and lease it to the building users. All the applied materials will be compiled in a material passport which will be monitored in a database. This will encourage suppliers to invest in sustainable building components and make money by leasing it out while remaining the owner of it.

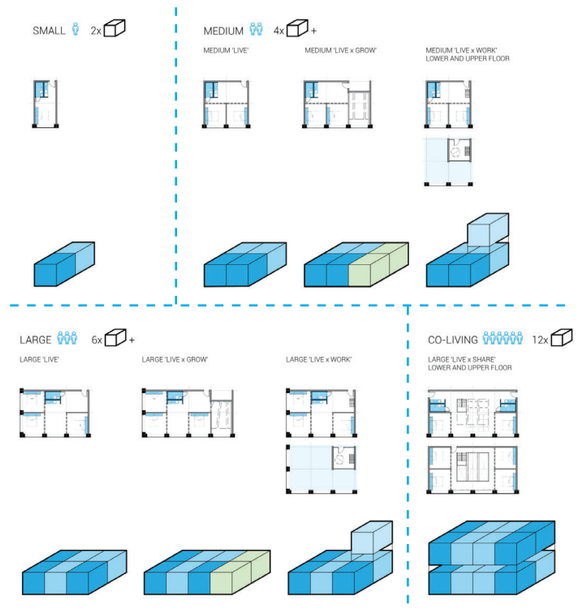
CIRCULARITY

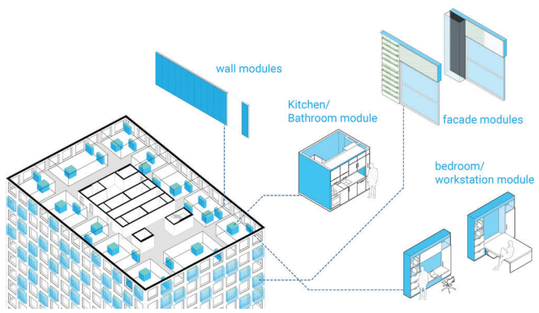
Catering to the growing issues of waste in the construction industry, the MOR team aims to exert the material circularity with this project. All the materials and systems are intricately designed keeping in mind the reuse of the materials post the project life cycle. This will help demonstrate the opportunities and advantages of using these concepts from the initial design stage of the project adding value to the project rather than it being a design constraint. Every component in this project is not only assessed in terms of its performance but also its reusability at the end of the project cycle, thus carefully crafting it to cater to future needs as well.

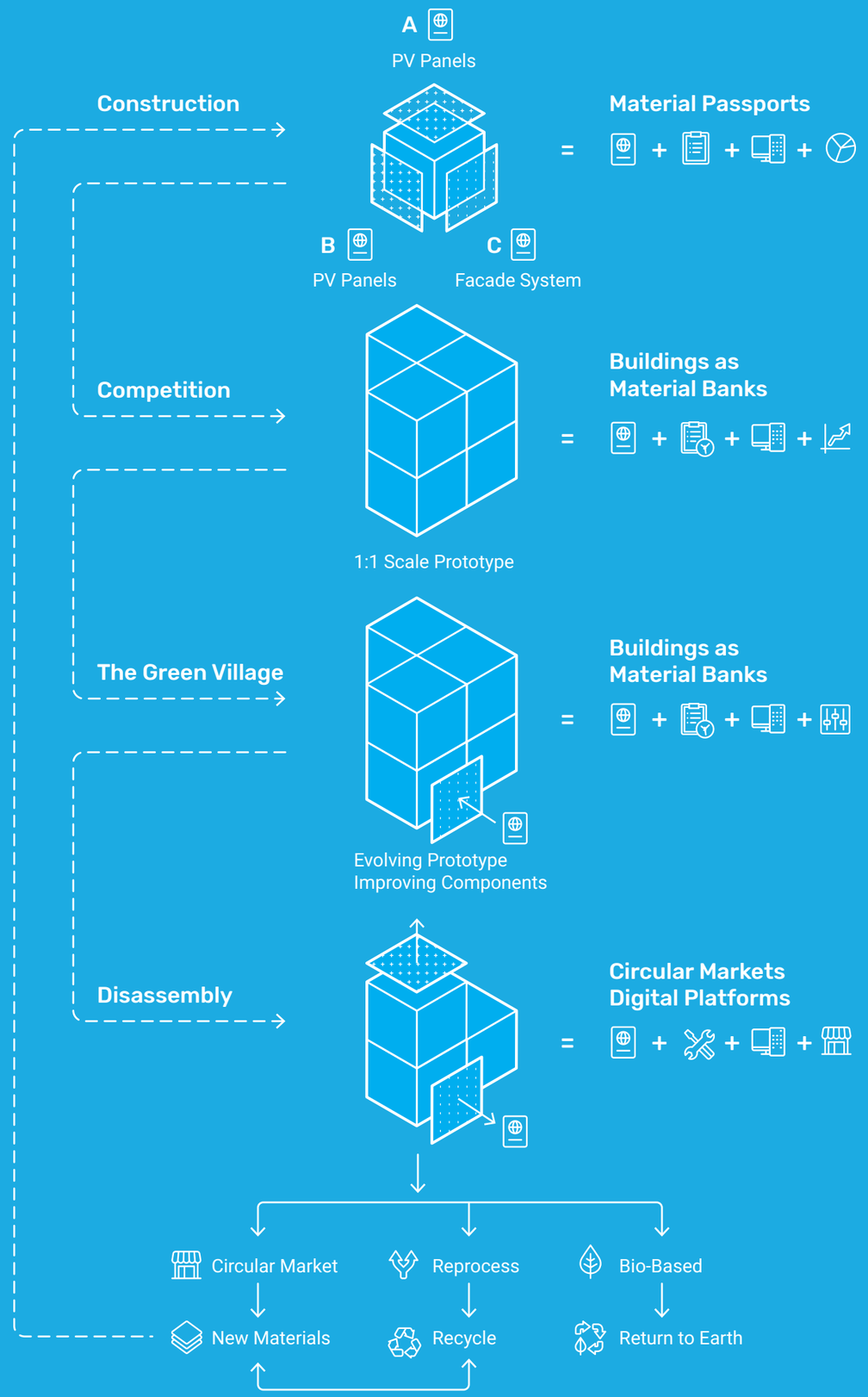
BIM

To achieve a high level of prefabrication and low amount of waste material, an extensive 3D model of the added structure is required. We make use of a Building Information Model in which all different modules are designed and materials are defined. All materials consist of a material passport that is monitored in a database. The performance of the applied materials will be measured during their lifespan and the acquired information will be shared with the material owners. By experimenting with this strategy the material suppliers can gain information about the actual performance of their products and can get insight in the return of investment of their products.







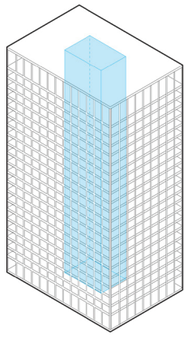


ADAPTABILITY

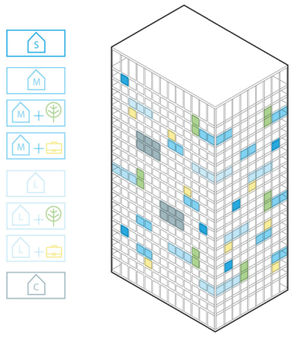
The social context we live in is always changing due to all kinds of societal and technical developments. The current building stock needs to be able to adapt to these developments in order to retain its active function. Within the context of societal developments there can be considered the changing concept of working and living, economic fluctuations but also changing legislations for health, safety or energy performance in buildings. Within the scope of technical developments there can be considered the exponential improvement of smart building installations combined with integrated design solutions. We envision a flexible building that is able to adapt to these changing market conditions and allows for technical improvements which are aligned with the users' needs. Our solution is based on applying modular and demountable units which will provide the building to change it's function on each floor, with a minimal effort and investment.

A new business model can be thought of regarding the principal investment for the refurbishment of buildings. Instead of buying the modular units they can be leased directly from the manufacturers. This way the modules can be seen as services rather than goods. When the modules will reach their technical end-of-life, or the building requires a change of function; the manufacturers will take back its modules in order to find a new application for it or recycle/reuse the materials (principle of circular economy). Within this business model the principal investment for the refurbishment will be less for the building owner since they would share the costs directly with the manufacturers of the modules. Therefore a cost-effective and energy-efficient renovation will be more feasible in our common goal to make the building industry independent from finite resources.

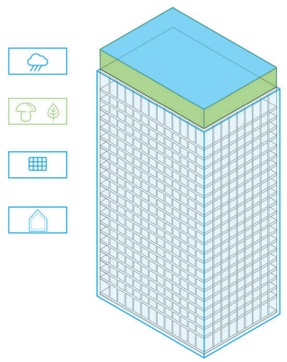
REUSE OF THE EXISTING STRUCTURE

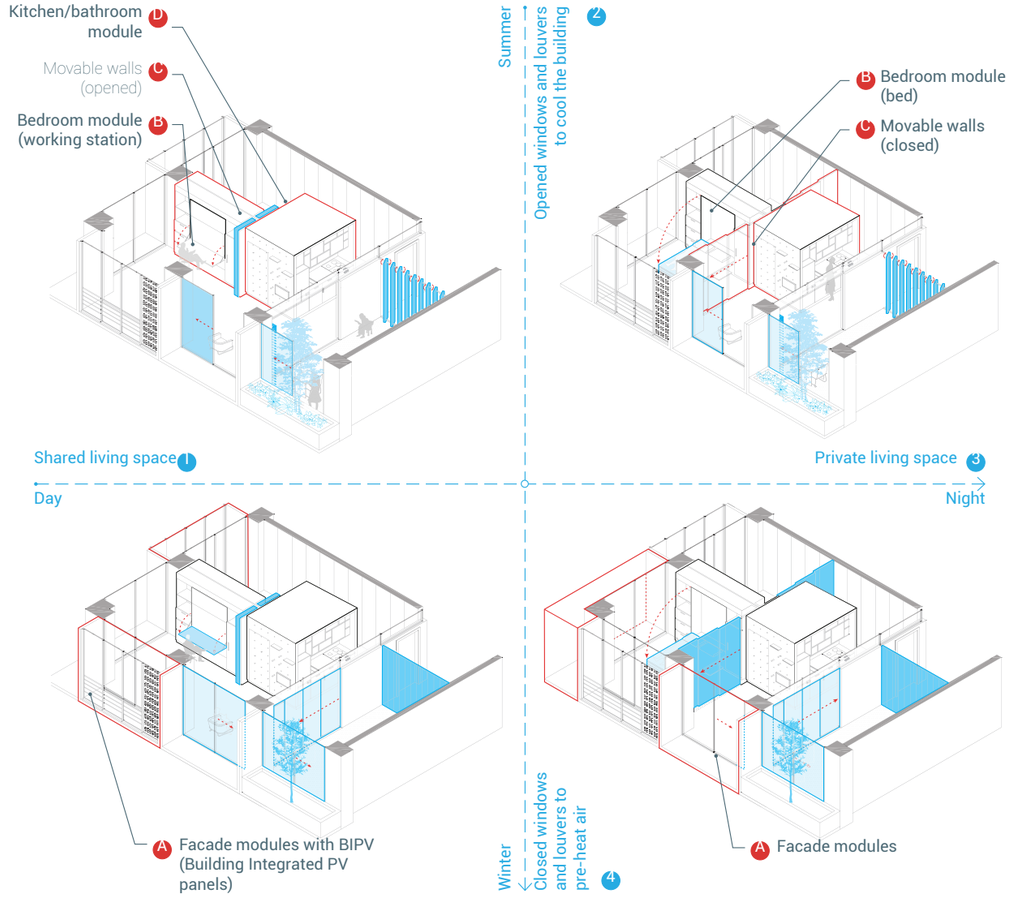


IMPLEMENTATION OF A NEW HOUSING TYPOLOGY



NET POSITIVE STRATEGY





DAILY AND SEASONAL ADAPTATION

With the conversion of the building we are aiming to achieve net positivity for 5 goals of sustainability. Active and passive systems will be implemented on the apartment scale. On a daily basis, walls can slide in and out to create a shared (1) or private (3) space. The flexible façade modules will allow the users to open both the vertical louvers and exterior windows (2) to increase the ventilation rate which is a passive measure to cool down the building in summer. During the colder months, this air circulation inlet and outlet will be closed (4), to pre-heat the incoming air.

FLEXIBLE MODULES

The introduction of pre-fabricated and demountable modules to create the different functions in the building is a key element of the concept. Firstly, the different façade modules (A) produce energy and will take care for a high performance of thermal comfort. The bedroom module (B) gives the opportunity for the users to use their personal space as a working station, bedroom or common space. The moveable walls (C) can create rooms, or even extend the apartment. The kitchen/bathroom module (D) takes care of the basic domestic needs within the apartment units.

DEMOUNTABLE MODULES

The heavy renovation works in the building will be limited to the first year of the renovation, with the installation of central systems and of the façade modules. During the following years, it will be possible for the users to demount and move the modules by using the existing elevators, and to assemble them with light tools. Designed as an assembly of demountable elements, it will be possible for the users to assemble the interior modules from a kit of components. This concept will allow for the replacement of critical parts, that will be repaired or recycled.

DISSEMINATION & IMPACT

PROTOTYPE REVEAL

Date: June 3rd, 2019
Location: The Green Village, TU Deflt

Target audience: Partners, sponsors, government officials, student community and sustainability enthusiasts from the local community

Description: After over 6 weeks of building the prototype on our university campus, out team was finally ready to show their hard work in its full glory at an event held at the Green Village where the prototype was being built! The event comprised of two separate parts:
- the first one focused on showcasing the prototype to our sponsors and partners who have been involved from close or far with the design and construction;
- the second part was aimed at the general public as well as the team's friends and families. The mayor of Delft was also present to visit the prototype along with the public event.

FUTURE LIVING PANEL

Date: March 27th, 2019
Location: TU Delft Aula (Main University Hall), Delft, Netherlands

Target audience: Student community and sustainability enthusiasts from the local community

Description: To sensitise the student and local communities, MOR is organising an interactive panel moderated by a TU Delft professor. The topic that will be covered focusses on exploring the new ways of living that will emerge in by 2030. By looking at what trends will be more determinant, what should we expect, what to watch out for.

Topics to be discussed:
- Role of technology
- New constructions vs Existing building stock
- Minimalism and lifestyle changes
- Sharing economy and home life

INTEREST DRINKS: MOR AT BOUWPUB

Date: March 7th, 2019
Location: Bouwpub, Architecture Faculty TUDelft, Delft, Netherlands

Target audience: Student community, university representatives, and sustainability enthusiasts from the local community

Description: As a DreamTeam at the TUDelft, MOR has to ensure continuity in the team to participate in future Solar Decathlon competitions and follow suit with the current design. MOR members served beer at the student pub and members of the team could chat with student interested in joining the team and in the project in an informal setting. This gives the team visibility in its immediate community especially as the construction of the prototype in Delft approaches.

MOR SHORTS

Date: March, 2019
Location: TU Delft Orange Hall (Main Architecture Hall), Delft, Netherlands

Target audience: Starters, general public, sustainability enthusiasts

Description: Short video series, released bi-weekly, covering various topics and challenges addressed by our project and its vision, as well as providing brief updates from our progress on the construction of our prototype in Delft.

SPONSORSHIP EVENT

Date: January 15th, 2019
Location: TU Delft Orange Hall (Main Architecture Hall), Delft, Netherlands

Target audience: Sponsors and Industry partners

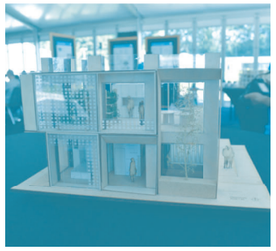
Description: After working hard on finalizing the design at the end of 2018, MOR gathered its sponsors, industry partners, government officials and potential partners for a presentation showcasing the latest progress on the project and design, as well as a timeline of what's to come. The presentation was follwed by a networking cocktail around an exhibition space featuring the prototype model and some informative posters.

MEET THE MOR TEAM

Date: June 5th, 2018
Location: Delft, Netherlands

Target audience: Student community and sustainability enthusiasts from the local community

Description: the MOR Team proudly presented its first public event in the inspiring setting of The Green Village, located on the campus of the TU Delft. The first edition of Meet the MOR Team gave us the opportunity to bring together existing and potential partners alongside professors and fellow curious students. Being the only Dream Team working in the field of the built environment on the campus, our common goal was to inspire the people visiting the event, getting enthusiastic members on board and getting valuable feedback from external point of views.

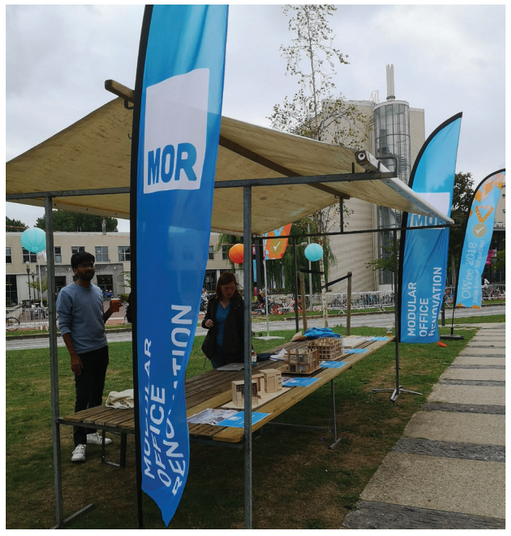


INNOVATIONQUARTER

The MOR team went to the InnovationQuarter event on the 11th of June 2018 where we displayed our project as part of the innovation market. It was an inspiring day full of interesting presentations and introducing new people to our project. "The InnovationQuarter's mission is to strengthen the regional economy in West Holland by supporting and stimulating the innovation potential of this unique delta region." They work closely with the TU Delft and they support technological developments with a social impact, encourages entrepreneurship and invests in fast-growing companies.

SUSTAINABLE THURSDAY MARKET AT OWEE

During the OWee (introduction week of new students at TU Delft) MOR had a stand during the Sustainable Thursday market where we showed our project to the new students. We explained our project through models and posters. It was a huge success and we ended up winning the first prize as the best new sustainable initiative, sponsored by Rabobank.



TENANTS FESTIVAL TOGETHER WITH PRÊT-À-LOGER

On the 29th of September 2018 MOR went to the tenants festival together with Prêt-à-Loger, the previous TU Delft team that competed in the Solar Decathlon Europe 2014. There were more than 600 people that learned about the importance of both projects. Hopefully, we inspired tenants to make their own houses more sustainable.

PRESENTATIONS AT DIFFERENT LECTURES

At the start of the academic year, MOR gave presentations in a couple of different lectures around the TU Delft. We spoke to students from the third year bachelor Architecture and the Built Environment as well as first-year Building Technology, Architecture and Urbanism master students. Also, a presentation was given to first-year master students of Sustainable Energy Technology. The two main purposes of those presentations were to educate students about our project and recruit new team members. This was very successful since 17 new students joined our team.

DREAMTEAM

The collaboration with the other dreamteams of the TU Delft kickstarted in September 2018. We are joining the meetings with all the other team managers and PR managers and a few team members joined the course Toptrack provide by D:Dream. MOR is becoming a part of this awesome community, that focuses on innovation.

D:DREAM

SPONSORS

COLLABORATING INSTITUTIONS & SPONSORING COMPANIES

To live up to our vision, which is to realise a built environment that gives back to its surroundings more than it takes away from it. We have developed a business strategy that focuses on realizing a consortium of supporting institutions and companies including the most important stakeholders from the built environment. This creates valuable input from all supporting partners for the development of our concept and at the same time brings all parties together that could actually introduce the concept into the market. In general, the following table shows the nature of the supporting partners.

ACADEMIC INSTITUTION

DELFT UNIVERSITY OF TECHNOLOGY

Provides resources for the team in various areas

1. SUSTAINABLE LEADER

ABN AMRO

In general, the following table shows the nature of the supporting partners.

DE GROOT & VISSER

Inkind sponsoring focussed on development of the facade system

JP VAN EESTEREN | TBI

Main Contractor

CROONWOLTER&DROS | TBI

Main installer

MINISTRY OF ECONOMIC AFFAIRS AND CLIMATE

Funding for the further development of the concept

MINISTRY OF INTERNAL AFFAIRS AND KINGDOM RELATIONS

Funding for the further development of the concept

2. INNOVATOR

METALGLAS

Material supplier

RIJKSVASTGOEDBEDRIJF

Funding of further development of the concept

STEINFORT

Glass supplier

SCHÜCO

Facade profiles supplier

VPT VERSTEEG

Hanging structure facade panels supplier

3. TEAM MEMBER

KAMELEON SOLAR

Colored PV façade panel supplier

M4H ROTTERDAM

Program makers of the urban area of MOR's casestudy

THE NEW MAKERS

Kitchen/bathroom box and bed/ workstation box supplier

WACO

Supplier of prefab concrete structure

4. PROMOTER

BBC

Reinforcement steel foundation

BRINK

Consulting on MOR's circular business model and feasibility

DGMR

Consulting on building physics and building regulations

DIBLO

Reinforcement steel foundation

MAMMOET

Transport and placement of prefab concretes structure

RIETLAND

Supplier of Helophyte System

ROTTERDAM SCIENCE TOWER

Building user of MOR's case study

SNIJDERS

Support of construction drawings and calculations

BIOCOMPACT

Supplier of vacuum toilet, pump system

ABB

Electrical fixtures

SIEMENS

Supplier of appliances

SMITS

Exterior shading systems

STIHO

Circulair building materials supplier

POLYPANE

Insulated glazing

DYCKERHOFF BASAL

Concrete foundation

EVERUSE

Sustainable sound insulation

GUARDIAN GLASS

Insulated glazing

INTECO

Climate ceilings

KINGSPAN

Roof insulation

TIMMERSELEKT DOORNENBAL B.V.

Accoya doorframes

MVB

Construction machinery

PRIVA

Building management systems

REXEL

Electrical and BMS

SEMPERGREEN

Green wall and roof

SOLAR NRG

PV panels

VANDEPUTTE

Safety gear (PPE) supplier

VINK

Preparing the construction site

WTH

Supplier of floorheating and cooling system

5. SUPPORTER

2blueconomy

Supplier of Nebia shower system

ABT

Engineering consulting

BUROHAPPOLD

Checking construction calculations

COPPER8

Support of construction drawings and calculations

EDUBOOKERS

BHV and VCA training

NOTARISKANTOOR ZUIJDGEEST

Notary of foundation

STUDIO RENDIER

Collaboration for rendering

TECHNEA

Supplier of heat recovery system shower gutter

TIMMERFABRIEK FRANK VAN ROIJ

Timber-frame structures

TEDSEN

BMS wireless control

CATEC

Weather station for BMS

FABEREXPOSIZE

Supplier public tour visuals

GROHE

Bathroom accessories

HÄFELE

Connections interior modules

HOLLAND FLOOR

LUXAFLEX

Interior shading systems

SOPREMA

Pavatex isolair flooring

ZZED

Leasing handicap elevator

APKO

Electrical distributor board

BAARS & BLOEMHOFF

Sustainable plywood

HAGER

Electrical supplier

IBOMA

Safety inspections

ISERO

Building tools

CORE IDENTITY

Communication support

VT VERWAAL TRANSPORT

Transportation

RENSA

Mechanical installations

RIVERFOOD

Aquaponics system

VICTRON ENERGY

Electrical energy

VLOER TECHNIEK

Pouring of concrete foundation

WAVIN

Waterpiping

SPONSORSHIP LEVELS

As the project touches on varied fields of expertise from design to construction and transport to Hungary and back. Here are some key areas we would need to gather support for:

- Support for construction
- Products and materials
- Land for the prototype at TGV
- Transportation of the prototype to Hungary and back
- Travel sponsorship of team members
- Events, promotion, appearal and publication

	Sustainable leader 60K +	Innovators 30K +	Team members 15K +	Promotor 5K +	Supportor 1K +
Full acces to all research results including market analysis, performance test and simulation results, construction and design drawings	O				
Possibility to organise 3 company events in the prototype after the competition	O				
Primary exposure on the construction site, sponsor board in the prototype and on the back of the MOR T-shirts (100%)	O				
Exposure on the back of the MOR T-shirts (50%)	O	O			
Possibility to organise 2 company events in the prototype after the competition	O	O			
Prominent exposure on the construction site and sponsor board in the prototype (75%)	O	O			
Possibility to organise 1 company event in the prototype after the competition	O	O	O		
Exposure on the construction site and sponsor board in the prototype (50%)	O	O	O		
Low Exposure on the construction site and sponsor board in the prototype (25%)	O	O	O	O	
Listing on partnerships page on team website	O	O	O	O	O
Invitation to all MOR events	O	O	O	O	O
Presented on all MOR social media platforms	O	O	O	O	O

CONTACT

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MOR

PRESS RELEASE: MODULAR OFFICE RENOVATION

In order to future-proof tomorrow's built environment, MOR's proposal seeks to develop a renovation strategy for underperforming office buildings that turns them into net-positive and multi-purpose buildings. Providing affordable rental housing for starters is one of the aims of the project. This is possible by implementing a highly adaptable design at all scales, the integration of sharing economy and community-building principles, as well as five net-positive aspects.

" TOGETHER WE CAN DO MOR "

The strategy allows MOR to tackle two major challenges within the Netherlands. Namely, all offices with an energy label lower then C are prohibited from 2023, this leads to a huge renovation task to upgrade the existing building stock. The second challenge is the lack of affordable housing, which translates to a need for 1 million new homes by 2030.

The design for the office tower is **adaptable** at all scales and builds on today's sharing economy and **community-building** principles. The concept is flexible in program and the interior is fully modular which allows for change over time. Public and communal spaces, like shared spaces for working, food production and entertainment among the living areas, are included in the tower, which allow for a highly social environment while promoting sustainable behaviour. The **five net-positive aspects** (biomass, water, air, materials and energy) of the building improve the impact on its surroundings and its resilience for decades to come. By reducing the building's demand on all five fronts and using passive strategies to almost eliminate the need for active systems, MOR's office renovation represents the evolution of the conventional environmentally taxing office building into one that gives back more to its surroundings than what it takes away from it.

To give MOR's proposal shape, a **case study** has been selected: the Marconi Towers in Rotterdam. The towers are a typical office typology from the 70's that exists all over the world. The towers are located in the M4H, city harbour in Rotterdam; an area currently being transformed into a new makers district.

MOR's competition pavilion resembles a cut-out from the Marconi Towers showcasing a 50 m2 apartment with a 25 m2 indoor garden. In the pavilion the modules, community-buildings and 5net+ aspects are represented. The interior of the pavilion is built out of 3 modules, creating an adaptable living area that feels bigger in size due to the flexibility and functionality of the modules. Community-building is represented on the deck around the prototype where you find common functions like a lounge area, food production and common bikes.

To achieve **biomass** positivity, an aquaponics system is installed on the deck to produce food for the residence. Wastewater is treated and purified to be reused for toilet flushing and irrigation by using a helophyte filter. Together with the use of rainwater in the building **water** positivity is achieved. A green wall with purifying plants is installed in the indoor garden to filter and preheat or cool the air for a much healthier and **air** positive indoor climate. **Materials** positivity is achieved by using methods of 'design for disassembly' and choosing environmentally-friendly materials with high recycle and up-cycle values. The building becomes a material bank with each material and its specificities recorded in a material passport. The façade tiles are coloured solar panels and are designed for easy assembly and disassembly. As such they serve both a practical and aesthetic function. Together with the solar panels on the roof the pavilion is **energy** positive.

Delft, 11th of June 2019

THE TEAM

MOR is a student team from the TU Delft in the Netherlands participating in the Solar Decathlon Europe 2019 international competition. The MOR team consists of 46 students from the TU Delft with more than 20 different nationalities and 8 different disciplines. The team has an enormous passion to innovate and develop a strategy that prepares the built environment for 2050, when the built environment must be completely CO2 neutral and circular.

CONTACT

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TU Delft

solar decathlon europe
SZENTENDRE HUNGARY 19
The art of smart building.

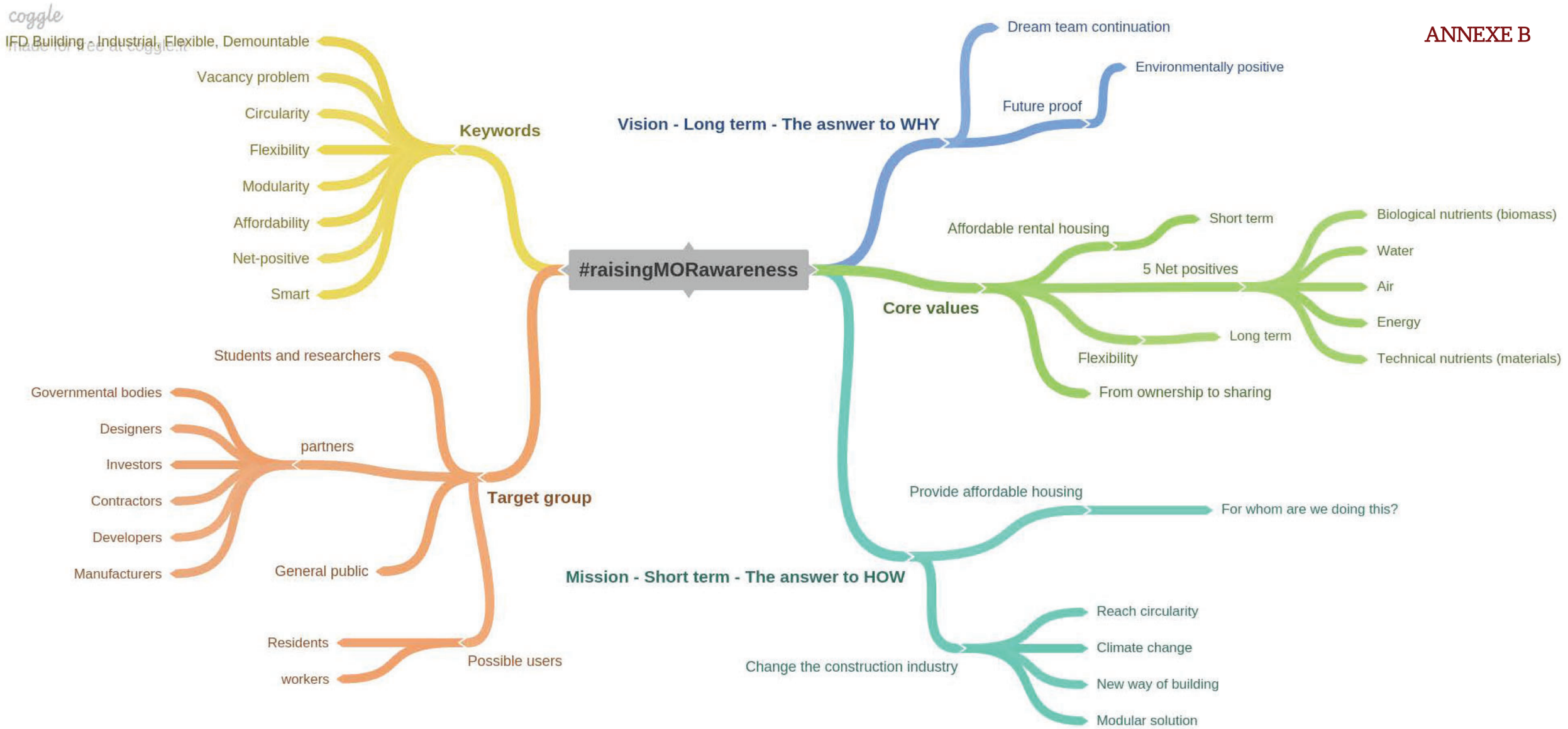
energy endeavour FOUNDATION

ÉMI

Szentendre

MŰEGYETEM 1782

ANNEXE B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IFD Building - Industrial, Flexible, Demountable
Keywords
Vacancy problem
Circularity
Flexibility
Modularity
Affordability
Net-positive
Smart
#raisingMORawareness
Vision - Long term - The asnwer to WHY
Dream team continuation
Future proof
Environmentally positive
Core values
Affordable rental housing
Short term
5 Net positives
Biological nutrients (biomass)
Water
Air
Energy
Technical nutrients (materials)
Flexibility
Long term
From ownership to sharing
Target group
Students and researchers
Governmental bodies
Designers
Investors
Contractors
Developers
Manufacturers
partners
General public
Residents
workers
Possible users
Mission - Short term - The answer to HOW
Provide affordable housing
For whom are we doing this?
Change the construction industry
Reach circularity
Climate change
New way of building
Modular solution

Annexe C

MOR Team Daily Board

Meeting Agenda

12.03.2019 17:30-18:30 @ Science center

Attendance

Students team leaders

Okan	Project Engineer
Ivan	Contest Captain
Francesco	Team Manager
Siem	Partnership Manager
Nienke	Communication Manager
Anna	Project Architect

Faculty advisors

Andy	Main faculty advisor
Peter	Main faculty advisor

Aim: Decision-making, problem-solving, team-steering.

Legend:

Section A: Forward thinking/ Introduction Items relevant to the development of the team, to the medium/long-term perspective, or to introduce relevant topics to be discussed during the meeting.

Section B: Opportunities, Challenges, Updates Items relevant to the short-term, opportunities and possible developments for the team to grab and schedule, difficulties to solve, and general updates from the committees.

Section C: Necessary Items Quick decision, scheduling, organization, and administrative items

Priority Level: 1 High-priority (Must be discussed) **2** Medium-priority (Important to discuss) **3** Low-priority (Good to discuss)

MOR

Meeting agenda and report

Priority 1

B Architecture Update
Waiting to arrange a meeting with timber walls, and stiho, waiting to move on, Interior furniture is not a problem yet. PR will take care of furniture design (?).
Working on samples, suggested to make a mood board with them.
Create a visual representation of all the materials and elements that are already chosen (colour and materials state) with Communications

B Engineering Update
Ordering is slow, limited people on building services. No one is taking care of plumbing. Facebook call for working people (revit)

B Construction and H&S Update
Digging machine at TGV we can already use it (set it up tomorrow)

B Comms Update
Comms ok, flying colors. Needs to think about visibility of partners on the prototype/construction site, , fencing

B P&F Update
Enough to build the prototype here. Another call for money from university stuff (andy will ask around)
Things are rolling.

C MoU do we sign or not? Yes
Nienke and Okan wants to delay.
Siem to proceed
Andy and Peter suggests to go ahead and pull back if necessary.

Others:

Priority 2

C Declaration from Faculty Advisor that we comply with the SDE Building Code
Make the letter

A We now have 39 people available for construction in Hungary: Extra accommodation, higher costs, less work, 3 shifts.

Others:
Priority 3
A Integrated Creative Problem Solving (ICPS) at the faculty of IDE Public tour
Others:

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