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Prifysgol Cymru

Y Drindod Dewi Sant

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Leadership in Engineering Design and Personal Development

Workshop & Practice (ACHA4011)

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1 Introduction

This report aims to outline the role a lead engineer would have in organizing and managing a team of engineers tasked with designing a new product, overlooking the development of the product and how the structure of the team and communication affects the overall success of the project.

The product chosen for this report is an office chair wheel targeted towards individuals working desk jobs. An overview of industry standards, environmental issues and professional codes of conduct will be included in this report and how they will affect the process of developing this component.

2 Research

2.1 Team Structure

The structure of a team in any setting is one of the most important aspects as it allows everyone to know what they are responsible for and what is expected of them. Without a structure in place, individuals in the group may not fully understand the goal of the project or several members taking on responsibility for the same sector, leaving others incomplete. This can result in the overall project being delayed or an increase in cost. (León, Tech and Farris, 2011)

Good communication is an important component within a team structure to reduce the risk of miscommunication resulting in mistakes or delays in the development and production cycle which in turn can increase the cost of the project. Choosing the correct mode of communication is also an important aspect as it limits the potential for issues such as semantics to cause confusion which can further delay the project. (Martin, Lewis and Fifi, 2014)

The lead engineer will be responsible for planning and organizing the process of development through decision making which can increase effectiveness and efficiency of the project. Trust needs to be created throughout the team so that they know they play a fundamental role in the success of the project and its failure. (Riaz, Tahir and Noor, 2013)

Centralised and Decentralised are the two systems of management that are widely used in all industries depending on the requirements of the whole organisation. There is also a third system that combines concepts of both systems to create a hybrid system.

(Marume and Jubenkanda, 2016) describes the difference between centralised and decentralised systems as follows. Centralisation functions in a top-down hierarchy where the individuals at the top are responsible for making decisions that determine the direction of a company, product, or service. In a centralised system, individuals cannot act of their own accord and must refer to management with any problems or requests. This means that a centralised team structure would function with one individual in control of the project where they would coordinate with team members towards set goals in line with the same policies and procedures. A Decentralised structure would consist of multiple sub-teams with an individual leading those groups who would be responsible for making decisions which can be completely autonomous without requiring permission from the project leader. The project leader will continue to oversee the entire project but will coordinate with the individuals in charge of sub-groups to ensure the overall project remains on task.

Having a centralised system in a large team allows for clearer communication and faster decision making as they are usually coming from the same individual or location, this enables individuals to continue with their work towards the plan or vision set by upper management without having the delays of making decisions. A decentralised system would work well for smaller teams as it would allow individuals with specialist skills the freedom to make decisions in areas where the lead engineer may not have experience.

A hybrid structure combines the advantages of both centralised and decentralised structures whilst minimizing the disadvantages of either. In a hybrid structure each sub-team will be led by an individual that can make decisions for that group without needing permission from the project leader. The project leader retains executive control of the overall project to ensure that resources are not wasted in situations where individuals leading sub-teams may be pursuing designs that are incompatible with other sub teams.

Figure 1 below shows the traditional setup of a Centralised and Decentralised system.

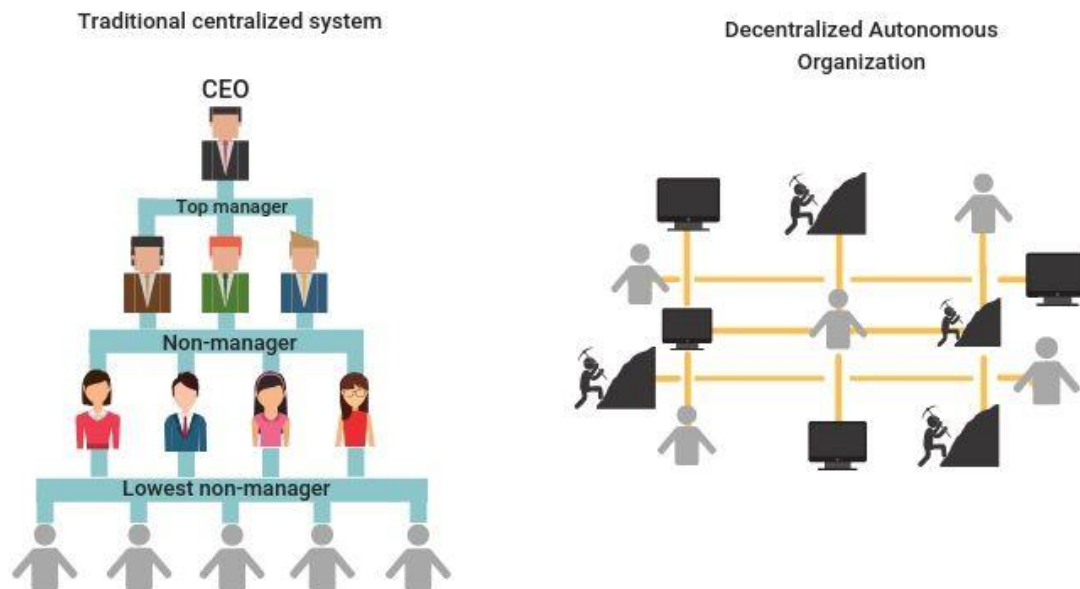


Figure 1 - Centralized vs Decentralized System (image from <https://nirolution.com/decentralized-autonomous-organization/>)

For the development of the office chair wheel, a decentralised system would be the best compromise as it would allow individuals the freedom to innovate and allow the specialist autonomy of their area of expertise such as marketing, Research and Design (R&D) etc. The small team required to produce this product means that the risk of miscommunication would remain low as every team member would be communicating with each other allowing everyone to adapt and work towards a common goal.

The team would be split in two teams overlooked by the lead engineer. There would be an engineering team responsible for the R&D of the product and a marketing team responsible for advertising the product to the target audience. Each team would be free to explore options within their areas although it will be essential that both teams communicate with each other and the project leader so that the direction outlined is followed effectively. The lead engineer will be responsible for the overall path to be followed as well as any issues that may arise from health & safety to code of conduct, making sure that everyone involved in the project adheres to Engineering codes of conduct.

2.2 Engineering Code of Conduct

The Engineering code of conduct are regulations in place to ensure that any engineering field responsible for products or services that may affect other individuals, infrastructure or society are produced and maintained to a high standard of quality and are within the requirements of the law for their intended purpose. It is important that there is a high level of trust between engineers and that they all work towards the same standards to avoid any discrepancies within their work which can lead to a danger to the public or harm the environment.

Engineers in the United Kingdom (UK) are overseen by the Engineering Council that operate within the royal charter, with the aim of being recognised globally for professional compliance. The Engineering council are the overall authority responsible for the United Kingdom Standard for Professional Engineering Compliance (UK-SPEC) (Engineering Council, 2020)

The UK-spec 2021 revise requires individuals to demonstrate competence and commitment in five main areas as follows:

- Knowledge and understanding of engineering principles
- Design & Development of processes, systems, and services
- Communication and Interpersonal skills
- Professional Commitment to codes of conduct, safe work environments and sustainable development
- Management, responsibility, and leadership within engineering

It is vitally important that members involved in the project meet these standards laid out above and it will be required that everyone obtains an Institute of Mechanical Engineers (IMechE) registration.

3 Product Development

When designing a product, it is important to first conduct research into whether a similar product already exists and if there is a market available. Researching past reviews of similar products and understanding the overall needs of your target audience will allow you to produce a more effective product. Surveys are another possible approach that can be taken to gather data regarding opinions of potential users of the product. The statistics gathered from these surveys will allow for a more in depth understanding of what the product will need to succeed.(AlNasseri, 2015)

Considering the product is an office chair wheel, research into the potential materials being used and their properties, strengths and weaknesses will need to be considered and the potential life span of the component. Further research would need to be conducted into where these materials and components would be sourced from and potential effects it could have on the environment through production and recycling/disposal.

Regular meetings during the development and production phase will be essential as it will allow team members time to communicate with the whole project team to update them on progress, ideas and possible issues that may arise. As well as regular meetings, having tools in use such as a Gantt chart will allow everyone to track deadlines of tasks pertaining to the project as well as any overlaps of tasks required by several groups before further work can be completed.

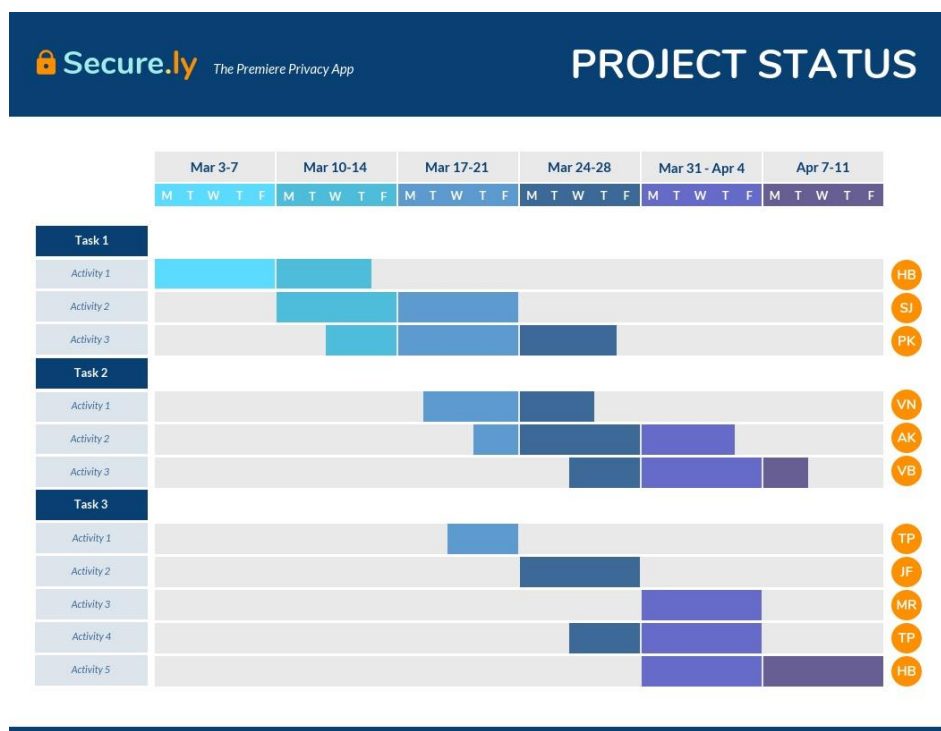


Figure 2 - Gantt Chart (<https://venngage.com/blog/gantt-chart-example/>)

Figure 2 above is an example of a Gantt Chart.

4 Issues, Legislation & Standards

In 2005 the Royal Academy of Engineering and the Engineering Council jointly created a statement regarding ethical principles guiding engineering practice and behaviour which was revised to its latest edition in 2017. The joint statement covers broader categories and overlaps with some already covered in the UK-Spec.

- Honesty and Integrity from professional engineers as they have a duty to uphold the highest standards of professionalism and should act in a reliable and trustworthy manner.
- Respect life, law, the environment and public good, having a duty to obey all applicable laws and hold health and safety to the upmost importance and ensure their work is lawful and justified.
- Accurate and Rigorous in performance that they are currently competent to complete and to keep their engineering knowledge up to date.
- Leadership and Communication, promoting equality, diversity, and inclusion and to promote public awareness and understanding of the impact and benefits of engineering achievements

The potential issues that may arise in producing this product are the health and safety implications if the product were to fail under use and the hazards towards human health and potentially infrastructure. The production cycle must also be considered and whether the product is produced from recycled materials or if the product can be recycled at the end of its lifespan.

When engineering any product, it is important that all aspects are considered especially when they are to be used by other individuals and potentially industry. Conforming to the legislation stated above is a vital aspect of being an Engineer where regulations are expected to be maintained across all industries and applications.

5 Personal Development Plan

Once I have qualified as an Engineer, I intend on working in a Motorsport or Automotive field where I may work on projects regarding the sustainability of motor vehicles and racing applications for enjoyment and pursuit of technological advancement. This would require me to continue my professional development in keeping up to date with changes in legislation and engineering principles that continue to change.

6 Conclusion

In conclusion, the topics discussed in this report outline the importance of team structure in any project by applying the correct management structure depending on the needs of the overall project. This was done by looking at centralised, decentralised and hybrid systems and deciding which would best fit the requirements of this project. The importance of good communication between engineers was also included in this report to avoid potential mistakes and issues. It also included important aspects of the design cycle by outlining the code of conduct and legislation required to be followed by Engineers when creating a product and the impacts it can have on the individuals using them and the environment during production, usage, and recycling.

7 References

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