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Engineering Project Technical Report

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1. Introduction

This report will demonstrate and discuss the process of product development, this includes information such as team structure and composition as well as looking at the environmental impact the product will have. Furthermore, contained within this report is information looking at the legislations and laws that may affect the development process. Aswell as legislation there will also be information regarding sustainability and the problem-solving process. Included will also be information regarding the potential risk assessments that may need to be carried out during the development of the product. The final part of this report will look at personal career development and goals as well as how they might be achieved.

The product that has been selected to be developed is a sit-stand desk, This product was selected as it is widely used by businesses globally as well as in educational settings such as call centres and universities. As stated by (The Pinnacle List, 2022) sit-stand desks are proven to reduce body pain and fatigue, thus maximizing work efficiency and being highly beneficial to the long term physical and mental/psychological health of the individual who uses it.

2. Organizational team structure

The team structure that has been selected for this development project is a hierarchical composition. This team structure has been selected due to the advantages it possesses, (BrandonGaille.com, 2018) states one advantage of a hierarchical structure is there being a clear structure of communication, this is an important advantage as it allows for business strategies to be implemented easier. Secondly another advantage of a hierarchical structure is a clear definition of roles and responsibilities within the product development as stated by (nibusinessinfo.co.uk, 2022). Finally, another advantageous attribute the hierarchical structure has is employees are organised by job role and specialization this enables employees working in similar roles to share studies and resources. This is an advantage that is reiterated by (nibusinessinfo.co.uk,2022) one clear disadvantage of using a hierarchical is there is often a disconnect between employees and project organisers which can inhibit communication. During this project team meetings will be scheduled between employees and project organisers on a regular basis to reduce this issue.

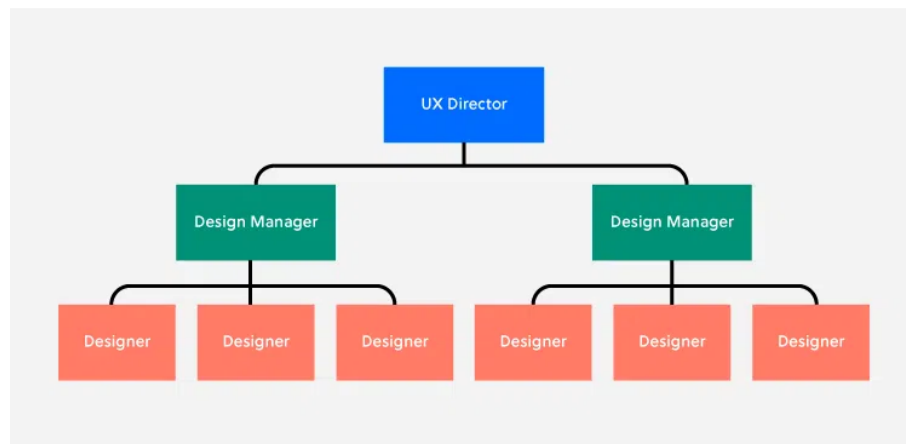


Figure 1: Hierarchical team structure | UXPin, 2022)

Engineers have to adhere to codes of conduct in their work, and therefore these pieces of legislation have to be kept in mind when working and going through the development process, within the code of conduct there are many principles that engineers must agree to uphold which include honesty and integrity which covers aspects such as vowing to report corruption in the workplace in whatever form it might take, as well as being mindful of the affect that one's work and behaviour might impact any individual and their privacy and rights, as stated by (Engineering council, 2022). Another key element within the codes of conduct for engineers is to promote sustainability and the preservation of the environment this includes being conscious of the limited resources available to the world. These principles are also stated by (CIBSE, 2020)

Table 1:A description of various sub-roles within a product development team

Concept developer	This role within the company is very important as it is a process of generating ideas to solve issues with a product. This can take many forms but some of the more popular responsibilities is ensuring the exact specifications needed for the product are met as stated by (nibusinessinfo.co.uk,2022)
Research and development	The aim with this job is to study information and possibly find ways to improve or create new products. R&D is used in every business as it allows the company to make products that are going to sell. There are multiple ways research can be carried out the most common ways are conducting public surveys, interviews and focus groups this is explained by forrestbrown.com,2021)
Line management	It is vital to have good line manager as without line management employees can lose sense of direction resulting in issues such as miscommunication. A line manager can also be responsible for ensuring all employees on the production line are fit to work as supported by (Line Managers' Role in Supporting the People Profession Factsheets CIPD,2022)
Manufacturing	Manufacturing is the process of creating a product using specifications and mostly raw materials. The most popular manufacturing method used by companies is assembly lines, this process uses employees and machines to progressively construct the product by the time it reaches the end of the line. It is important this process is carried out correctly as a dysfunctional manufacturing process can lead to product recall resulting in loss of profits as stated by (Getreskilled.com,2022)
Marketing Research	The job of a market researcher is to study current market trends and also generate interest in the product the company intends to sell, even with a good product companies can still fail at generating profit if the marketing is not done correctly, Some of the more common responsibilities of a market researcher may include organising online or tv adverts, studying the market for a specific product fluctuation, allowing the company to release a product at the correct time as expressed by (The Hartford, 2022)
Customer service	Finally, this role is usually overlooked by companies but is very important, a company with effective customer services allows customers to express their praise or concerns with a product. The role of a customer service provides communication between the company and the consumer, they are also responsible for documenting any issues with a product that may occur and report it to the company so it can be altered as acknowledged by (Liveagent.com,2022)

The table shown above shows a variety of different sub-roles, it is necessary to include this data as without the roles progression regarding the development of a product would not be able to proceed, also included is a brief overview of what each sub-role within a company are responsible for, it is also worth noting that within each of the sub-roles it would be also common to find many different sub-departments within each role for an example within marketing a department could be formed to focus on the production of a tv advert.

The table below shows a brief list of advantages and disadvantages for alternative organisational structures, some of the more commonly found structures shown in the table is the flat structure, this type of structure usually has a small amount or no local management this can be a positive as employees are all treated equally and can improve department relationships resulting in development and production speed being increased. However, if the flat structure is not orchestrated and maintained correctly it is possible to see miscommunication and lack of promotional opportunities for employees as stated by (nibusinessinfo.co.uk,2022). While referencing the table shown beneath another organisational structure known as a divisional structure can also be found in many companies, This type of structure is formed using the skills and roles of the employees. Workers are grouped together based off of the roles or department they specialize in some advantages of this are the is a smaller chance for miscommunication within the designated department and provides responsibilities and accountability for each department as stated by (Divisional Structure Summary & Examples | (Study.com, 2021) The disadvantages of this structure is departments can become competitive resulting in rushed and poorly finished work as well as it can be costly to employ such large teams for different departments as supported by (AccountingTools, 2022). The information in the table listed above is crucial when starting a company as each structure will have an impact the functionality of the company possibly improving or decreasing the productivity and quality of work produced.

Table 2: Advantages and disadvantages of different organisational structures

Types of organisational structures	Advantages	Disadvantages
Flat	Provides employees with more responsibilities, can allow for clearer understanding, can reduce time delay when implementing new ideas. As explained by (Chron,2019)	Also stated by (Chron,2019) it is Possible to see a reduction in work quality due to no supervision. Difficult to maintain when companies begin to get big.
Functional	Allows for specialization, easily implemented in any size company as stated by (Indeed.com,2021)	Can reduce department communication acknowledged by (<i>A Guide to Functional Structure: Benefits and Disadvantages</i> / Indeed.com UK, no date)
Divisional	Allows for quick adaptations to current market and customer needs. As supported by (Chron,2019)	Can lead to insufficient communication throughout the company as explained by Chron, 2019)
Team-based	Prioritises experience over qualifications, requires small amount of management as stated by (Notesmatic,2022)	Can make it difficult to gain promotions as indicated by (Notesmatic,2022)

Product development

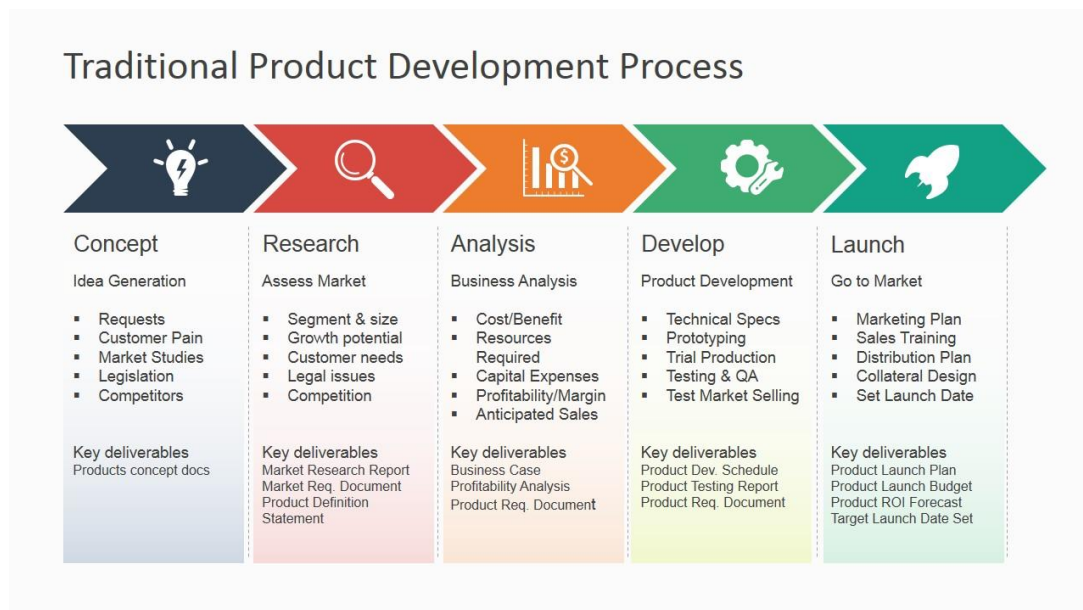


Figure 2: developmental process for a product (SlideModel,2022).

1. Concept.

This is the first phase of the development process, there is a variety of tasks and research needed to progress onto the further phases of the development plan. Some of the research needed at this stage will include market studies, which is the method of assessing the validity of a product by undertaking research carried out directly with potential customers. There are a variety of techniques that are at the disposal of the researcher when it comes to gathering this information, such techniques one might use is surveys which can be conducted in conjunction with product testing or focus groups as expressed by (Investopedia, 2022) The concept phase is also where the rough parameters of a product will emerge, and all later phases of the product will be based about the original concept drawings.

2. Research

During the research phase of the development procedure a vital point that has to be performed is research that looks into the size of the market the product is aimed at. It is important to study the size of the market relevant to the product as this allows for the developer to begin estimating how much profit they may receive from a product once it is in production, this point is indicated by mind tools,2022). With regard to the product being developed in this project (Grandview research, 2022) states that in their research the market size for office furniture was valued at \$14 billion in 2021 and in between the years 2022 and 2030 it is estimated that the compound annual growth rate will be 5.3%. The increasing number of people working from home has resulted in a higher demand for office furniture and supplies, this has allowed the market for office furniture to expand positively in recent times meaning an increase in consumers for the product.

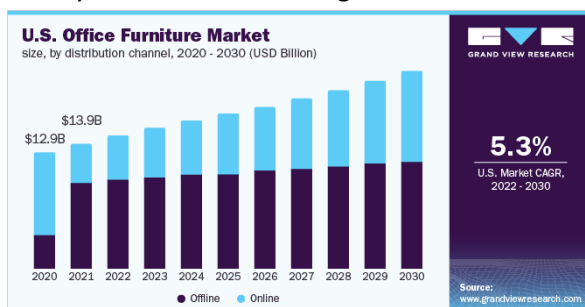


Figure 3: US Office furniture Market Growth(Grandview research, 2022)

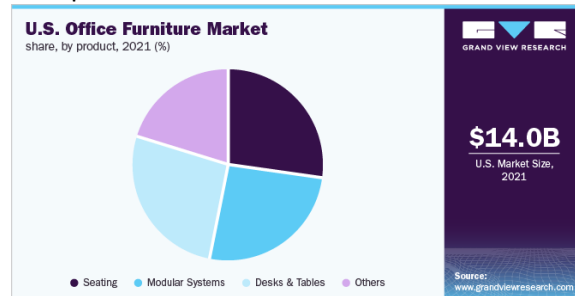


Figure 4: US Office furniture market separated by type(Grandview research,2022)

3. Analysis

This section of the development process is very important as analysing key factors will impact the production and profit of a product. One example of this research is looking at the capital expenses, A company's capital expenses can limit the product quality and production numbers this is due to capital expenses being used for long term investments such as better machinery which allows for better quality and faster production times, Capital expenditure is spent to ensure regular maintenance on machinery as stated by (Kissflow.com, 2020). It is essential a capital expense budget is correctly implemented and managed within a company as failing to do so can result in loss of profits, low ROI (return on investment) and in extreme cases even bankruptcy. There is a variety of ways capital expenses can be used however the two main categories is money needed to maintain current operation levels and money needed for further growth as explained by Investopedia,2022).

4. development

The penultimate step of the project is the development phase, this includes work such as prototyping. A prototype of a product is usually the first concept of the product made and can be helpful in many ways such as allowing early discoveries of design issues on the product as stated by (infinitiare,2021). By prototyping companies are also able to see the upfront cost of producing a single unit this allows adjustments to be made by the developer before the product reaches the consumer. In some cases, multiple prototypes can be tested by the public in phases such as alpha and beta testing, companies will then use the customer's feedback to make any necessary changes to the product before the final production.

5. Launch

After all the previous work has been completed it is time for the launch phase of the product to begin, this phase is compiled of many different tasks such as advertising a product that must be done correctly and aimed at the right audience, There are many ways to advertise a product but some of the more successful options are taking advantage of online advertisement and tv commercials as stated by (Business Queensland, 2022). Finalising a Distribution requirements plan (DRP) before the release of a product is essential as this allows the company and the suppliers to accommodate for the product demand once released and allows for a successful launch of a product as stated by (WhatIs.com,2022) . Without a well-established distribution requirement plan it is likely the company will not have enough resources available to maintain the customer demand for a product. This has been seen throughout many companies the most recent being the pc graphics processing unit (GPU) shortage due to the overwhelming number for customers deciding to build a pc through and the slow production of resources from external companies due to covid-19 as stated by (Inside Telecom,2022)

3. issues, Legislation, standards

Whilst developing a product a company must also consider the wellbeing of their employees and therefore must adhere to certain laws and regulations that have been implemented by the government. One of the most popular acts employers and employees have to abide by is the Health and Safety at work act 1974. There are many laws within this act that must be followed for instance employers must take legal responsibility for the health and safety of each and every employee as stated by (Health and Safety executive,2022). This means employers must ensure working condition are up to regulation such as not being too noisy for the employees under the control of noise at work act 2005. Whilst producing a product there are many other laws and legislations that must be followed such as the control of hazardous to health regulations act 2002. This means that companies much carry out assessments on the work place the most popular being (COSHH) Control Of Substances Hazardous To Health. Companies are able to use methods and software to evaluate the safety of current conditions the most commonly used system is know as the risk matrix system shown below. This allows the employer to evaluate the likelihood of an accident and the severity of it. If an accident is more likely to happen, then it is the responsibility of the employer to ensure all actions are taken to reduce the risk of an accident. In an event of a minor accident employees are requested to report the accident into a accident log book and must seek medical advice if necessary as explained by (Truth legal.com, 2017)

Table 3:Shows a risk matrix looking at the likelihood and impact of an accident

		Impact →				
		Negligible	Minor	Moderate	Significant	Severe
Likelihood ↑	Very Likely	Low Med	Medium	Med Hi	High	High
	Likely	Low	Low Med	Medium	Med Hi	High
	Possible	Low	Low Med	Medium	Med Hi	Med Hi
	Unlikely	Low	Low Med	Low Med	Medium	Med Hi
	Very Unlikely	Low	Low	Low Med	Medium	Medium

The company must also look at the sustainability of the product they produce, due to the increasing pressure to reduce greenhouse gases implemented by the government companies should now look to use more renewable materials such as wood and wool. Companies are also encouraged to introduced renewable energy sources such as solar, hydro and geothermal as stated by (Circular Economy Guide,2022). The global electricity generated by renewable resources in 2020 was at an all-time high of 29%, this figure is expected to rise more than 8% in 2021 an explained by (Global Energy Review, 2021). When choosing a renewable energy source company owners must also be aware of the upfront cost and maintenance of the technology they use. The most common renewable energy technology used is solar panels, this is due to the low maintenance cost as well as being the simplest to install withing a company's structure. Currently companies such as ecotricity and octopus are able to provide businesses and residential homes with 100% renewable energy reducing the greenhouse gases produced by factories as stated by (Conscious Creatives,2022)

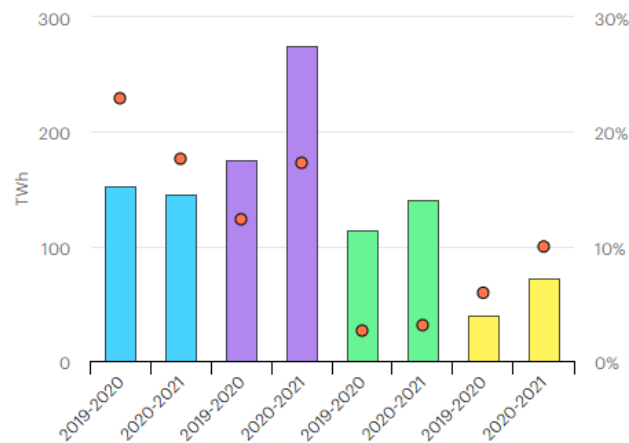


Figure 6: Renewable electricity generation by technology 2019-2021 (Global Energy Review, 2021)

The graph shown above highlights the usage and different types of renewable energy resources used from 2019-2021. Unfortunately, the different types of technology used is unlisted within the graph however the four most common ways of gathering renewable energy is by using the following methods firstly solar being the data shown in blue, secondly wind generated energy represented by purple, last but one being hydro energy indicated by the colour green and finally geothermal energy highlighted by the yellow data.

5. Personal development

I will begin by discussing my career aspirations and how I may achieve this through my own personal plan. In an ideal world I would love to be an aerodynamicist for Mercedes-AMG Petronas f1 team, in order to achieve this goal I would have to achieve a minimum of a 2:1 degree for UWTSD which would allow me to apply for Mercedes graduation scheme. To achieve this opportunity, I would be happy to sacrifice a lot on the years leading up to coming to UWTSD I decided to work every spare bit of my time in garages in my local area acquiring knowledge of vehicles just in the hope I may stand out from the crowd enabling me the chance to get on to the graduation scheme. I would definitely be willing to move wherever it may be even if it is outside of the UK. I believe currently I am on the correct path to achieve my goal by attending UWTSD as I have begun to learn the roles and responsibilities that I may be responsible for in the future and I am confident with the teaching standards at UWTSD I will be able to embrace those responsibilities with open arms. To conclude my personal development, I have also contacted Tim Tudor from UWTSD in the hope I may receive advice on how to achieve my goal as he is an aerodynamicist himself.

6. Conclusion

By gathering research and producing this report I have had a large insight into how a leader of a project must orchestrate themselves as many others rely on them. I have also gathered great knowledge based around how a product company functions from the beginning of the process such as the concept of a product to understanding the health and safety requirements needed to comply with the law. Although a standard hierarchical organisational structure was chosen for this project, I would personally like to see how the process would turn out if a different structure was implemented such as a flat organisational structure.

7. References

- 6 Reasons Why A Modern Office Desk Can Make You Happy – The Pinnacle List* (no date). Available at: <https://www.thepinnaclelist.com/articles/6-reasons-why-modern-office-desk-can-make-you-happy/> (Accessed: 20 November 2022).
- 10 Important Customer Service Duties and Responsibilities* (no date). Available at: <https://www.liveagent.com/academy/customer-service-duties/> (Accessed: 1 December 2022).
- 12 Things You Must Do When You Have Had An Accident at Work* (no date). Available at: <https://www.truthlegal.com/12-things-you-must-do-when-you-have-had-an-accident-at-work/> (Accessed: 30 November 2022).
- 15 Hierarchical Organizational Structure Advantages and Disadvantages - BrandonGaille.com* (no date). Available at: <https://brandongaille.com/15-hierarchical-organizational-structure-advantages-and-disadvantages/> (Accessed: 20 November 2022).
- A Guide to Functional Structure: Benefits and Disadvantages | Indeed.com UK* (no date). Available at: <https://uk.indeed.com/career-advice/career-development/functional-structure-benefits-and-disadvantages> (Accessed: 1 December 2022).
- Advantages & Disadvantages of Divisional Organizational Structure* (no date). Available at: <https://smallbusiness.chron.com/advantages-disadvantages-divisional-organizational-structure-611.html> (Accessed: 1 December 2022).
- CapEx: Capital Expenditure | Definition, Overview & Types* (no date). Available at: <https://kissflow.com/finance/capex-management/capital-expenditure-definition/> (Accessed: 22 November 2022).
- Capital Expenditures - Definition, Overview and Examples* (no date). Available at: <https://corporatefinanceinstitute.com/resources/accounting/capital-expenditures/> (Accessed: 22 November 2022).
- CIBSE - Code of Conduct* (no date). Available at: <https://www.cibse.org/membership-registration/membership-information/cibse-code-of-conduct> (Accessed: 21 November 2022).
- Hierarchical organisational structure | nibusinessinfo.co.uk* (no date). Available at: <https://www.nibusinessinfo.co.uk/content/hierarchical-organisational-structure> (Accessed: 20 November 2022).
- How To Build A Strong Design Team Structure | UXPin* (no date). Available at: <https://www.uxpin.com/studio/blog/design-team-structure/> (Accessed: 20 November 2022).
- Is the GPU Shortage Over in 2022? – Inside Telecom - Inside Telecom* (no date). Available at: <https://insidetelecom.com/is-the-gpu-shortage-over/> (Accessed: 30 November 2022).
- Legal requirements – Work related violence - licensed, retail* (no date). Available at: <https://www.hse.gov.uk/violence/toolkit/legislation.htm> (Accessed: 28 November 2022).
- Line Managers' Role in Supporting the People Profession | Factsheets | CIPD* (no date). Available at: <https://www.cipd.co.uk/knowledge/fundamentals/people/hr/line-managers-factsheet#gref> (Accessed: 1 December 2022).
- Market Sizing - Estimating Product Potential* (no date). Available at: <https://www.mindtools.com/a6ch5h2/market-sizing> (Accessed: 21 November 2022).
- Pros & Cons of a Flat Organizational Structure* (no date). Available at: <https://smallbusiness.chron.com/pros-cons-flat-organizational-structure-3798.html> (Accessed: 1 December 2022).

Prototyping: Benefits, phases and techniques (no date). Available at:

<https://www.infinitiaresearch.com/en/news/prototyping-benefits-phases-and-techniques/> (Accessed: 22 November 2022).

Renewable resources - Circular Economy Guide (no date). Available at: <https://www.ceguide.org/Strategies-and-examples/Buy/Renewable-resources> (Accessed: 30 November 2022).

Renewables – Global Energy Review 2021 – Analysis - IEA (no date). Available at:

<https://www.iea.org/reports/global-energy-review-2021/renewables> (Accessed: 30 November 2022).

Researching the Market: How to Conduct Market Research, Types, and Example (no date). Available at:

<https://www.investopedia.com/terms/m/market-research.asp> (Accessed: 30 November 2022).

'STATEMENT OF ETHICAL PRINCIPLES for the engineering profession' (no date). Available at:

www.engc.org.uk/professional-ethics (Accessed: 21 November 2022).

Team based organizational structure and its benefits - Notesmatic (no date). Available at:

<https://www.notesmatic.com/team-based-organizational-structure-and-its-benefits/> (Accessed: 1 December 2022).

The Role of a Marketing Department in a Business | The Hartford (no date). Available at:

<https://www.thehartford.com/business-insurance/strategy/creating-marketing-department/role> (Accessed: 1 December 2022).

Top 5 Renewable Energy Companies In The UK - Conscious Creatives (no date). Available at:

<https://www.consciouscreatives.co.uk/environment/top-5-renewable-energy-companies-in-the-uk/> (Accessed: 30 November 2022).

Traditional Product Development Process - SlideModel (no date). Available at:

<https://slidemodel.com/templates/traditional-product-development-process-for-powerpoint/6855-01-traditional-product-development-process-powerpoint-2/> (Accessed: 21 November 2022).

U.S. Office Furniture Market Size Report, 2022-2030 (no date). Available at:

<https://www.grandviewresearch.com/industry-analysis/us-office-furniture-market> (Accessed: 21 November 2022).

Ways to advertise your business | Business Queensland (no date). Available at:

<https://www.business.qld.gov.au/running-business/marketing-sales/marketing/activities/advertising> (Accessed: 22 November 2022).

What is a Manufacturing Engineer and What Do They Do? (no date). Available at:

<https://www.getreskilled.com/what-is-a-manufacturing-engineer/> (Accessed: 1 December 2022).

What is distribution requirements planning (DRP)? - Definition from WhatIs.com (no date). Available at:

<https://www.techtarget.com/searcherp/definition/distribution-requirements-planning-DRP> (Accessed: 22 November 2022).

What Is R&D? Research And Development In Business (no date). Available at: <https://forrestbrown.co.uk/news/what-is-r-and-d/> (Accessed: 1 December 2022).