

***Assignment 1: Specification Document***

***MT319 Advanced Operational Modelling for Business***

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**Introduction:**

Medtronic is a global leader in the medical technology industry, with the company being registered as Irish American although primarily being based in the United States. The company is looking to implement another medical device factory due to high demand from its consumers with future market trends being another influencing factor. Due to the company already having operations globally, it is wise to consider the best locations available to them before a final decision. The Med-tech industry is constantly evolving with the movement from doing digital to being digital at the forefront of the future of the sector. To gain a competitive advantage over their rivals, Medtronic’s need to expand operations to meet the ever-changing trends in the industry will be vital. As healthcare manages and tries to recover from the pandemic there is a clear need for treatments that give optimal patient outcomes but require less time in hospitals. Medtronic have identified the opportunity to expand its coronary stent portfolio to offer a new stent to meet the needs of the patient and the healthcare providers. There is a need to create a new factory for this portfolio addition which can be distributed to its European Operations Centre in Heerlen, Netherlands. Companies will need to incorporate digitally enabled customer engagement capabilities into their product design to succeed in this new environment. The best course of action is to start a new business operation that is driven by a growth and transformation philosophy (Snyder, 2022). The owners of the company will be aware of these trends and therefore have decided to act with the decision to set up a new factory for producing this specific product. These decisions must involve deep thinking into the viable locations and factors involved in this process that will allow Medtronic to remain at a competitive advantage and continue efficiency. In turn, this has led us to the task of finding the most suitable location for the companies new factory and to investigating and presenting the data concisely to management on a spreadsheet that follows best practices.

**Scope:**

*Objectives of the model*

This spreadsheet model plans to present management with an easy-to-use, reliable, easy-to-understand model that has clear specifications and good design that combines with well-thought-out use approaches which in turn will help with getting more from the model. The question that this model will answer will be ***“Where is the best location for Medtronic’s new factory?”***. To achieve these objectives within our spreadsheet model, the continued use of best practice techniques will be availed of (as seen in Read & Batson - 1999 - Spreadsheet Modelling Best Practice).

The proposed model will make it easy for the company to access key information considered while also allowing the team to consider various options using “what if” scenarios. This feature gives the freedom of changing the data set to reflect a situation you have inputted. The inclusion of this will also give management the ability to determine budgetary requirements for best and worst-case scenarios and to test any assumptions. Including collaborators with experience in each part of the plan is important as they will have more insights to give management. The current research objective allows for the use of the formula to provide measurement.

Although Medtronic currently has facilities globally, it is important to still consider locations they currently already have placed in. Medical device companies have traditionally had their major customers in Europe and North America, and corporations have positioned their manufacturing facilities appropriately. To be near to consumers or meet regulatory criteria, most MedTech businesses continue to manufacture in these areas. Some corporations who shifted manufacturing to emerging countries discovered that the advantages of cheaper labour costs and accessibility to fast-growing markets were overshadowed or undermined over time by quality difficulties and logistics interruptions. Countries from each market will be considered in the model to see where meets the requirements of the company. Initial research into potential locations has narrowed it down to the U.S., Ireland, the U.K, and Puerto Rico.

After all, data factors considered which, I will discuss later, the country selected will have met all the correct criteria indicated from management will be chosen as the location for our factory.

*The appropriate level of complexity*

The proposed spreadsheet model formulas will be used to calculate figures automatically which will improve the accuracy of the model. This method of calculating offers a more stable less prone to error technique of modelling. Narrowing down our sample of countries will make our data more precise and easier to understand for management as a large number of countries can lead to an excess of detail.

As mentioned already, just because one factor such as labour costs could be cheaper in one country this cannot be the only deciding factor when selecting a location. The data must be examined precisely to ensure in the long run other difficulties may not occur within the given country.

*Key assumptions:*

* Tax incentives will be a key deciding factors in selecting of location
* The model will be displayed in a clear and informative manner for management
* Failing to test the model will result in ambiguous results
* Due to many multinational med-tech companies already based in Ireland, it could be a front runner prior to evidence
* Ireland has the workforce and therefore can be profitable
* Brexit to have an impact on the shipping and imports in the UK which could result in not selecting them
* Failure to follow best practices throughout the model will make it unreliable and difficult to use

*Timescales:*

This spreadsheet model will be completed by its given deadline and will be submitted to management to review.

*Data requirements*

Before deciding where to locate a factory, there are a number of qualitative and quantitative factors which must be examined to ensure an efficient and profitable setup in the long run. The data which will be acquired for Medtronic will be done via internet research. The required quantitative data needed for this spreadsheet model is as follows:

***Labour force climate***- A highly trained, well-educated, and expanding workforce is a critical factor to consider when establishing a new business site. The following are some often asked questions: What is the skill level of the labour pool in the region? How much does the average worker earn? State agencies are usually able to provide specific statistics on biotechnology, medical, and other industry-related educational backgrounds (Medical Device & Diagnostic Industry Magazine, 1997). Finding out the level of skilled workers within each country must be calculated in order to find out the answer to our given problem. The level of productivity is key to consider as it is not wise to base everything off a low wage rate when in turn your workers could be producing also at a very low level.

***Labour Cost-*** These costs vary worldwide but can have a large impact on decision-making. The need for research into raw material cost, manufacturing costs, and fixed costs while the factory is being built is extremely important as various countries have different rates for materials and utility costs, etc.

***Transportation costs-*** Due to the med-tech industry being global, it is extremely important for them to locate their factory’s in areas with good transport links such as quality roads, airports so that if large quantities of materials/products must be delivered it can do so in a timely and safe manner. Medical device manufacturers face few transportation constraints due to the small weight of most medical devices. In the medical device sector, proximity to a major international airport is frequently the most significant transportation criterion, allowing devices to be delivered the following day around the world.

***Proximity to market-*** Medtronic’s leading position in the med-tech sector could potentially be at risk if they fail to deliver to the given market at a slower rate than close competitors. Consideration of the number of customers, size of the markets, delivery speed and the location of demand must all be considered.

***Tax Structure-*** Countries are constantly looking for ways to attract med-tech companies to set up on their shores and providing tax incentives can be a beneficial way of luring them. Investigating the countries tax incentive schemes will be a key deciding factor in the selection of location. Tariffs and quotas will be of consideration for management as these can have an effect on company costs in the long run.

*Limits & Boundaries:*

Due to the lack of time and resources, this model will be limited to these factors while the inclusion of various other factors such as geopolitical, social environment and quality of environment/climate factors would all have a respectable impact on the decision of locating the factory.

**Specification:**

Due to the sheer importance of model specification, testing becomes considerably easier and more effective. The specification explains exactly what the model is supposed to achieve (Read & Batson - 1999 - Spreadsheet Modelling Best Practice).

**Sample Input Chart:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Variable Name** | **Data Type** | **Format** | **Example** | **Source** |
| Country | Text | Calibri, 12 | Ireland | Research Team |
| Distance from Market | Numeric | Km | 1300km | Research Team |
| Time | Numeric | Hours | 5 ¾ hours | Research Team |
| Corporation Tax | Numeric | Percentage | 12.5% | Research Team |
| Minimum Wage in Country | Numeric | Currency | €10.50 an hour | Research Team |
| Size of market | Numeric | €000’s | 9000000 | Research Team |
| Cost per km | Numeric | Currency | 44.79c | Research Team |
| Workforce availability | Numeric | 000’s | 50 | Research Team |

**Sample Bubble diagram:**

Diagram, schematic

Description automatically generated

**Sample Calculation table:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Ref No** | **Description** | **Ref No** | **Calculation Rule** | **Units** | **Example** |
| **Inputs**  Inp10  Inp20  Inp30 | Raw Materials  Labour Costs  Manufacturing Overhead |  |  | 000’s  000’s  000’s | €21,760  €34,056  €16,097 |
| **Calcs**  Calc10  Calc20 | Raw Materials  Labour Costs  Manufacturing Overhead  Total Manufacturing Costs | Inp10  Inp20  Inp30  Calc20 | Raw Materials  +  Labour Costs  +  Manufacturing Overhead  =  Total Manufacturing Costs | 000’s  000’s  000’s  000’s | €21,760  +  €34,056  +  €16,097  =  €71,913 |

* *Total manufacturing costs = raw materials + direct labour + manufacturing overhead*
* Prior to finding the total cost of raw materials, beginning inventory + purchases added – Ending inventory would have been calculated
* Manufacturing overhead figure would have included electricity, utilities, sanitation personnel, material handlers, factory supplies for manufacturing processes, etc.
* Labour costs would have included wages, PAYE tax, holiday pay, workers compensation insurance for staff directly involved in manufacturing, etc.

**Design:**

The spreadsheet model must have an easy-to-use and understand model which in turn will reduce the likely effects of errors. If by chance, there are errors they will be easy to spot due to a clear model design. To ensure this happens, adhering to best practice modelling will suffice (Read & Batson - 1999 - Spreadsheet Modelling Best Practice).

The six golden rules of spreadsheet design will be followed throughout the entire design process to ensure consistency.

* Inputs, calculations, and outputs will all be separated more specifically inputs will be highlighted to ensure unambiguity or inputs being overlooked.
* For quicker development and effective testing, the spreadsheet model will use only one formula per row or column to reduce the number of errors once again.
* The model will use multiple worksheets for ease of expansion and to ensure the clarity and flow of the model remains constant throughout.
* To remain consistent throughout the model, each column will be used for the same purpose. For example, Columns A and B will always be seen as labels, while column C will remain as Units throughout.
* Inclusion of a documentation sheet will be provided on the first sheet of our model. It will give management a brief description of the model’s purpose, who built the model, how to contact the model owner, the model version number and when it was written.

**Test:**

Focus can be placed heavily on the testing stage as it is important to fully test your model before presenting to management. The main objective of testing is to ensure the outputs you obtained are reliable and free from error (Read & Batson - 1999 - Spreadsheet Modelling Best Practice). Different tests can be used to ensure the quality of your spreadsheet model delivers an industry-standard data set.

* The proposed spreadsheet model will make use of specification tests, numeric tests, formulae tests, and macro tests. Completing all these tests will ensure that you can hand over your model to management with confidence in your findings.
* Data validation will be used to ensure that the data that is required to be in the cell is there. This ensures the minimisation of errors and improves the data quality within your model. The use of this technique enables the model owner to save time on the rechecking of their model at the end.
* The model will be tested when it is fully complete, or to a point where we feel no more changes need to be made within the logic of the model.
* The model will also be retested in a case where we had to make changes to a significant amount which resulted in the action of a full retesting

**References:**

Snyder, G., 2022. MedTech Industry Trends. [online] Deloitte United States. Available at: <https://www2.deloitte.com/us/en/pages/life-sciences-and-health-care/articles/medtech-industry-trends.html> [Accessed 6 February 2022].

Medical Device & Diagnostic Industry Magazine, 1997. Site Selection Criteria for the Medical Device Industry. [online] mddionline.com. Available at: <https://www.mddionline.com/news/site-selection-criteria-medical-device-industry> [Accessed 8 February 2022].