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Individual Project: Executive Summary

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**Introduction**

The process of digitization involves moving a business’s existing processes and methodologies into digital technologies. This is done so that a business can control their costs, increase their efficiency, and potentially create more avenues of income generation. The owner of Pampered Pets, Cathy, has decided to start the digitalization process considering the Risk Assessment report that was done for her business. In this process, Pampered Pets has decided to acquire an international supply chain and several automated warehouses that stretch across the world allowing Pampered Pets products to be stocked worldwide. However, with this new acquisition of international warehouses and supply chain, it has drawn the attention of two new high-profile clients who share concerns about the effects these changes will have on the well-known quality of Pampered Pets products. Both high-profile clients have requested for Pampered Pets to enumerate the risks that this new step will have on Pampered Pets and for the business to establish a disaster recovery plan for their business that is required to meet certain criteria to ensure the business stays up and running even through a disaster.

**Quantitative Risk Analysis:**

Taking into consideration the digitalization process that Pampered Pets is going through, it is critical for the correct modelling technique to be selected for the quantitative risk analysis (Meyer & Quell, 2020). The selected model for this analysis is the Monte Carlo simulation model.   
The Monte Carlo simulation model is a mathematical technique used to show the probability of various outcomes in a process which cannot be easily seen or predicted due to the potential introduction of random variables which could sway the outcome (Kenton et al., 2023) (Lutkevich, 2023). This model is used to tackle a variety of problems in many different fields. This model was invented by John Neumann and Stanislaw Ulam during the Second World War. Their aim when developing the model was to aid decision making when uncertainty became a factor allowing risks to be calculated allowing a decision to be made.

Considering Pampered Pets has decided to implement an international supply chain and worldwide warehousing, there are many variables that could come into play affecting the outcome of the products of Pampered Pets. Taking this into account, the Monte Carlo simulation suits this quantitative risk assessment allowing the variables to be identified and the probability distributions calculated to each variable.

To begin the risk analysis with the Monte Carlo simulation, one first needs a quantitative model of the business activities, plans and processes that need to be analyzed. In the case of Pampered Pets, the potential risks to the quality and supply chain of the products need to be analyzed.

The next step would be to identify the key variables of the process. These can include:

* The reliability of the supply chain.
* The defect rate of the supply chain.
* The lead time (delivery time) of the supply chain.
* The change in demand for the products created by the supply chain.
* The quality control measures that are in place within the supply chain.

It is to be noted that the reliability of a supply chain can be determined by the other variables highlighted. Therefore, calculations would only be performed on the other variables as they will assist in determining whether the supply chain is reliable or not.

With the key variables now identified, the probability distribution for the key variables can be identified. Variables can be split into different probability distributions including:

* Bernoulli Distributions: This is a type of probability distribution where experiment asks a question that can only be answered with a yes or a no.
* Uniform Distributions: This is a type of probability distribution where all outcomes are more than likely to be equal.
* Binomial Distributions: This is a type of probability distribution where there are more than likely only two possible outcomes. The defect rate variable would fall under this probability distribution.
* Geometric Distributions: This is a type of probability distribution where there will be a few undesirable outcomes before the desired outcome. The quality control measure variable would fall under this probability distribution.
* Poisson Distributions: This is a type of probability distribution where an event affects the volume in a specified time frame. The lead time variable and change in demand variable would fall under this probability distribution.
* Normal Distributions: This is a type of probability distribution used when the data is symmetrical and will always rise around the middle mark.  
    
  (Hayes et al., 2023)  
  (Shruti, 2023)  
  (Kishore, 2023)

Considering the different probability distributions and the variables assigned to them, calculations can now be carried out to understand the amount of risk that each variable carries.

Supply chain defect rates can fluctuate according to the different markets and different supply chain operators as well as factors within the supply chain itself such as lead times, changes in demand and quality control. The expected average defect rate is sitting at 25 PPM (parts per million) or 0.0025% (Clayton, 2016). This means if one receives 1000 products, only 2 should be defective. This PPM rate can increase depending on the conditions the product is produced in and the transit of the product from supply chain to the warehouse.

Unfortunately, due to the lack of freely accessible data with regards to the defect rates of supply chains across the world in the pet food sector, proper calculations cannot be carried out. All calculations carried out is based on the average defect rate supplied for across the markets.

With an average defect rate of 0,0025% PPM, one will see an exponential growth in defective products if one increases the number of products being manufactured.

With the basic calculation, it would seem by ordering in lower quantities from the supply chain, there is less of a risk of receiving defective products. However, the percentage of defective products remains the same even though statistically it does not look that way.

This number could increase however during transit from the manufacturing plant to the warehouse, however, with an initial risk of 0,0025% and industry standard of acceptable risk being <1%, the business will be safe if the defective product increases ever so slightly through transit.

To avoid any lack of stock or excess defective products, Pampered Pets is recommended to monitor their stock well and to order on time to avoid any loss of customer satisfaction.

With the use of international warehousing from which the products will be shipped, it is important that the business stays within the GDPR standard of the EU. This can be done by ensuring that across the supply chain and warehousing systems, that customer data is processed legally and is minimal to avoid any data breach of client data. (Burgess, 2020)

**Disaster Recovery Plan:**

Pampered Pets has also been asked to implement a disaster recovery strategy if the business is to continue the digitalization process. A disaster recovery strategy, also know as a DRP (disaster recovery plan), is a structured methodology for a business to use when faced with an unforeseen incident that could cause a business to stop working. (Brush & Crocetti, 2022). The disaster recovery strategy assists with ensuring a business faces minimal downtime as well and can resume its work as quickly as possible while ensuring there is little to no loss of data or system functionality. It is important to note that even though a disaster recovery plan was requested, this can be confused with a business continuity plan. The key difference between the two concepts is that the DRP is for when the business faces a disaster while a business continuity plan is for the business to continue through the disaster.

In a disaster recovery plan, there are two key factors that a business must consider when formulating their plan. The recovery time objective (RTO) and the recovery point objective (RPO). The recovery time objective is the maximum set amount of time that the business should take to resume its normal operations (Marget, 2021). The recovery point objective is the maximum amount of data an organization can afford to lose (Marget, 2021).

With this Disaster Recovery Plan, Pampered Pets has been given a prerequisite that the online store to be implemented needs to be online 24 hours a day, 7 days a week and 365 days a year. If the DR strategy is invoked, there should be less than a one-minute change over time for the business so that the loss of data is minimal. Considering that the business Pampered Pets can only have a maximum of a one-minute RPO, the business would be considered to have a highly critical system. This means that the business would need to consider an active-active clustering solution for the business.

An active-active cluster, which could be also known as dual-active cluster, is the operation of two or more nodes that operate simultaneously distributing tasks across all the nodes to in the end store data in an accessible, protected, and safe area. Spreading the workload across all the nodes happens using a load balancer which ensures that no nodes remain inactive after completing their tasks. All the nodes share a copy of the same storage locations, databases, webservers, and app servers ensuring if one node goes offline, all the other nodes can still function until the offline node can come back online. (Villanueva, 2023)  
  
The advantages of having a an active-active cluster includes:

* Has longer uptimes than usual.
* Allows load to be balanced across multiple nodes.
* Allows for additional nodes to be added as traffic increases.
* There isn’t a single point of failure ensuring as much uptime as possible.
* This solution provides zero RPO and RTO meaning that there should not be any loss of data or uptime. (Amber, 2022)

The disadvantages of having a an active-active cluster includes:

* The solution requires 24/7 maintenance to ensure that there are no offline nodes and all hardware in the system are functional to ensure the zero RPO and RTO on the system.
* An active-to-active cluster can be quite costly.
* It requires load balancing to function efficiently. (Amber, 2022)

Amazon Web Services can provide this system through the means of their cluster system known as AWS Aurora. Aurora focuses on having a singular primary instance that is responsible for reading and writing to all the storage devices for all the instances in the cluster, while the other instances are responsible for reading from their copy of the stored data. When the main instance goes offline, one of the other instances will become responsible for writing data to the server and ensuring all instances have an exact copy until the primary instance comes back online. (Schitzer, 2017)

There is a concern with these kinds of solutions that one becomes locked into the vendor that you use for the solution. For example, if you use Amazon Aurora, you will be locked into Amazon Aurora. Unfortunately, migrating between any vendors would incur downtime for the business as competing vendors will ensure that their products are just different enough so that vendors cannot have a one click solution for migration.

**Conclusion:**

Considering the above, Pampered Pets risk in acquiring an international supply chain and warehousing is minimal and will not affect their business drastically. In addition, adding a disaster recovery plan into the business structure will ensure that the business remains operational even during times of disaster.

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