



ANALYSIS



PRODUCT



SUPPLY CHAIN MANAGEMENT

PROFIT



DISTRIBUTION



PROCUREMENT



PLAN

IMPROVING SUPPLY CHAIN MANAGEMENT

Procurement &
Supply Chain

(ACEA 7011)



PRIFYSGOL CYMRU
Y Drindod Dewi Sant
UNIVERSITY OF WALES
Trinity Saint David

Shaun Kilbane

1705015

1. Table of Contents

1. Table of Contents.....	1
2. Table of Figures.....	2
3. Introduction	3
4. Part 1 – Critical Evaluation of Supply Chain & Risks	4
4.1 Overview of The Global Supply Chain.....	4
4.2 Political Impact	5
4.3 Environmental Condition	6
4.4 Economic Risks.....	6
5. Part 2 – Making the Supply Chain Resilience.....	7
5.1 Prevention & Preparedness.....	7
5.2 The 4 Key Factors.....	7
5.3 The 7 Factors for Success.....	9
5.4 Outsourcing SCM	11
5.5 The 6 Strategies for a More Resilient Supply Chain.....	13
6. Part 3 – Changes to the Supplier Appraisal Process	15
6.1 Overview of Supply Chain Appraisal Process.....	15
6.2 Factors of The Appraisal Process	15
7. Conclusion.....	18
8. Recommendations	20
9. References.....	22

2. Table of Figures

<i>Figure 1 - Current Supply Chain (Kilbane, 2022)</i>	4
<i>Figure 2 - The 4 Key Factors Model (Millar, 2015)</i>	7
<i>Figure 3 - The 6 Strategies Model (Hippold, 2020)</i>	13
<i>Figure 4 - The 10 Considerations for Appraisal (Kilbane, 2022)</i>	16

3. Introduction

Supply chains are often regarded as complex ecosystems (*Millar, 2015*) (*Steel Times International, 2018*), particularly in today's world of globalisation as they require great consideration and management in order to support the success of an organisation (*Nair & Reed-Tsochas, 2049*). This report will focus on one area, specifically an aerospace organisation based in Wales who has a large and complex supply chain, as aerospace organisation often do (*Barbosa, et al., 2019*). There is one particular product of this organisation that has been impacted due to the COVID-19 global pandemic, this consists mainly of large, machined component known as the seat adaptor. The seat adaptor is purchased from a company in the Shenzhen region of China, an area known for its manufacturing and growth in recent years, being hailed as "the world's factory" (*Harris, 2017*). Effective SCM (Supply Chain Management) will lead to a competitive advantage (*Mentzer, 2007*), and contribute towards becoming a successful and prosperous organisation.

The report will first discuss the difficulties in the specified area, defining the problem statement and current state. This section will consider all foreseeable risks associated with the supply chain in terms of vulnerability, it will delve into the impact due to COVID-19, including other factors. Considerations shall be made to future-proofing the supply chain, and identify the potential political and environmental aspects associated with working with China, in the short, medium and long term (*Paulson, 2015*). The second part of this report will attempt to identify how the supply chain may become more robust and resilient to the factors identified under part one. There are a multitude of case studies and literature surrounding supply chain management, this report will identify the most applicable to the specified scenario and advise on how the may be implemented. The Third and final part of the report will determine the supplier appraisal process, it will discuss techniques and considerations for the given supply chain. This will include more general considerations that are available for implementation as and when the organisation evolves over time, for future consideration if deemed necessary.

4. Part 1 – Critical Evaluation of Supply Chain & Risks

4.1 Overview of The Global Supply Chain

Evaluating the effectiveness of a supply chain is important to enable risk management, it is important to manage the risks to ensure the supply chain is operating effectively, thereby providing a reliable flow of materials through to the consumer in a timely manner. In this instance, the raw material is produced and then purchased by the manufacturer to create the seat adapter assembly. The assembly is then shipped to the UK via sea freight, where it is transported by road to be assembled by the producer, and then transported to the customer. Fortunately, Shenzhen is ranked third in the world for container ports, trailing behind Singapore, with Shanghai being top of the list (*Millar, 2015*). It is worth noting that China holds seven of the top ten ports on the list (*Millar, 2015*). The COVID-19 pandemic exposed significant issues within the supply chain, from manufacture through to delivery, however this may be regarded as somewhat of a unique scenario, for reasons set out below.



Figure 1 - Current Supply Chain (Kilbane, 2022)

Every element of the supply chain was impacted by the pandemic, materials were not being produced, the manufacturer was not operating at full capacity, and shipping was delayed significantly due to these reasons. Usually this would be catastrophic to the organisation, due to penalty fines being imposed for late delivery of the end product. However, the integrator (Boeing) was unable to operate due to site closures in the USA, therefore there were no penalties. Whereas the pandemic paralysed this entire supply chain, to the extent in which the customer was not even accepting the product, other organisations were in a different situation and the consumer needed products. There are advantages and disadvantages of a global supply chain, it is worth evaluating these factors carefully and regularly (*CIPS, 2021*), especially as the world is constantly evolving (*Kettering Global, 2018*). Here are some factors:

Advantage	Disadvantages
Ability to Upskill Suppliers	Communication Challenges
Better Transportation Management	Exchange Rate Instability
Good Supply Chain Management	Increased Exposure to Risk
Improved Effectiveness	Increased Lead Times
Improved Risk & Threat Management	Less Control
Innovation Access	Lower Quality Control
Larger Choice of Suppliers	
Overhead Cost Reduction	
Positive Cash Flow	

(Tan, et al., 2015) (Barbosa, et al., 2019) (CIPS, 2021) (Sebastian, et al., 2015) (Grant, et al., 2017) (Min, 2015) (Ross, 2015) (Kim, 2018)

4.2 Political Impact

A consideration is CSR (Corporate Social Responsibility), this relates to the organisations' responsibilities to communities and societies in which they operate (Charantimath, 2017), i.e. political aspects such as human rights, fair trade, working conditions etc. An article on 'Global Supply Chain Law' reports on the impact of immigration policy at the USA and Mexico border, where the governmental directive resulted in significant delays and 'estimated tens of millions of dollars in losses for supply chain partners' (Rathke, 2019). A study by APQC (American Productivity & Quality Centre) reported that 63% of organisations surveyed identify that their suppliers being within parts of the world experiencing political turmoil (Kettering Global, 2018). The report suggests that the political risk is "enormous threat to the success of companies operating in the global supply chain arena" (Kettering Global, 2018), with the largest increases in areas where productivity is likely to expand, being the BRICS countries (Brazil, Russia, India, China & South Africa) (Kettering Global, 2018). Looking at current events, with the relations between the China and the world souring due to the outbreak of COVID-19, and attitudes within China towards the west changing quickly, it is questionable if the current operating procedures are sustainable in the long term (Danner, 2018).

4.3 Environmental Condition

Another topic area that overlaps with the political landscape is that of environmental concerns (*Grant, et al., 2017*), and there is a positive correlation between the economic growth of a country and the carbon emissions due to logistics (*Liu, 2049*). With an increasing focus on environmental impact and carbon emissions, there is a strong argument to be made for the manufacturing of domestic products to reduce the carbon footprint (*Jia & Wang, 2019*). There is a risk of tax increases on shipping, this is reported in a news article by the BBC which discusses the IMO (International Maritime Organisation) targeting cuts to emissions, and this could be achieved through increased taxes globally on shipping (*Josephs, 2021*). Considering it is most likely that logistics organisations will make their fleet of ships more environmentally friendly, there will be an associated cost with this change and therefore it will undoubtedly impact the cost of shipping eventually (*Visvikis & Panayides, 2017*).

Not only does the focus on the environmental impact of transportation need to be considered through carbon footprint and pollution, but the fact that disasters occur, hurricanes, floods. Blizzards, earthquakes and ice storms (*Partner Ship, 2018*) (*Katsaliaki, et al., 2021*).

4.4 Economic Risks

As economies expand and contract, supply chains will be vulnerable due to the potential of cost changes (*Farris & Manuj, 2018*) (*Daehy, et al., 2019*). Contributory factors impact a change in cost may include:

- Labour rates (*Farris & Manuj, 2018*).
- Currency exchange rates (*Farris & Manuj, 2018*).
- Economic development of counties and their developing infrastructure (*Farris & Manuj, 2018*).
- Shipping, road or rail cost (*Farris & Manuj, 2018*).
- Changes in economic order quantity (*Farris & Manuj, 2018*).
- Changes in safety stock levels (*Farris & Manuj, 2018*).

5. Part 2 – Making the Supply Chain Resilience

5.1 Prevention & Preparedness

An argument is to be made regarding prevention vs preparedness:

Prevention – A supply chain may be structured in order to attempt prevent a failure, or at least reduce the risk of an occurrence (*James, 2015*), e.g. clear communication systems that may reduce the risk of something being delivered late.

Preparedness – In this instance, preparedness means building supply chain resilience in order to manage unforeseen disruption, a good example of this is the COVID-19 pandemic, which effected everyone, however some supply chains managed to operate better than others (*James, 2015*).

An organisation should consider if to best to invest in preparing for an incident that may effect the operations of a supply chain, or if it should find the potential risk and seek to control it. There is not simply answer, and it is possible to apply both approaches depending on the given scenario.

5.2 The 4 Key Factors

Resilience may be described as having the ability to recover following misfortune or change, and return to the original state quickly, therefore a resilient supply chain is better equipped to manage the risk within the ecosystem (*Millar, 2015*). There are four main categories that may be attributed to the term 'resilience' when referring to supply chains, these are as follows:



Figure 2 - The 4 Key Factors Model (Millar, 2015)

Visibility – Problems must be identifiable, in order to achieve that, they obviously need to be visible, technological advances offer great means of achieving visibility of every aspect of the supply chain (Millar, 2015).

Flexibility – This involves adapting quickly to change, potentially having the ability to draw on additional or alternative resources at short notice in order to protect the supply chain. Flexibility is often a KPI (Key Performance Indicator) measure for supply chain, adopted by the Supply Chain Council (Millar, 2015) (Hudson, 2004).

Collaboration – Consisting of many different elements, the sharing of information is important, therefore the protection of IP (Intellectual Property) in order to share information is important, therefore NDAs (Non-Disclosure Agreements) will almost certainly be required (Min, 2015). Sharing of information is not only in relation to the actual product itself, but it may also include volume trends and orders, this will enable the supplier to forecast accurately and be prepared for fluctuations in demand (Min, 2015).

Speed – This occurs naturally when the other factors are implemented effectively, because speed is a natural byproduct of visibility, flexibility and collaboration (Millar, 2015). The faster the supply chain can react and provide a product is essential, it satisfies the needs of all aspects of the supply chain through to consumer.

5.3 The 7 Factors for Success

A white paper by Kinaxis highlights seven success factors for today's SCM projects, these are based in the 10 success factors for IT projects (*Kinaxis, 2017*) (*Standish International, 1999*), and are as follows:

1. Set realistic goals – “Begin with the end in mind” (*Kinaxis, 2017*), keeping it simple by working from right to left. Set metrics or agreed KPIs (Key Performance Indicators) to promote alignment between everyone within the supply chain.
2. Make an effective plan – It is said that for every one minute spent planning will save ten minutes in execution (*Tracy, 2013*). It is important to cover the basics, software, hardware, data and security (*Kinaxis, 2017*).
3. Find a strong executive sponsor – In order to maximise the probability of success, the support of the business is necessary, therefore it is important to gain the backing of senior or executive members of the business (*Kinaxis, 2017*) to align with the business strategy (*Slack & Lewis, 2017*). The executive sponsor may provide better assistance if a difficult situation arises that requires escalation.
4. Assemble good resources – Where possible, an experienced multi-disciplinary team should be assembled in order to manage all areas of the project (*Kinaxis, 2017*), however it is important to train individuals by bringing them onboard for future sustainability of the organisation (*Meehan, 2017*) (*Fulmer & Ployhart, 2013*) (*McEwan, et al., 2017*).
5. Stay flexible – The paper claims that supply chains that remain flexible may result in better solutions than originally intended (*Kinaxis, 2017*). Flexibility provides options and the ability to adapt to different situations and resolve problems and risks.
6. Allow for testing – Over testing may be better than under testing, ensuring the system is established and free from bugs or errors will aid with a smooth deployment of the process. Testing consists of three main sub-categories: (i) Consider the design of the product to be

compatible with the available supply chain; (ii) Test cases are important, these may be simulations for known or likely scenarios that could occur, designed by developers with input provided by users & supply chain members, and; (iii) Devote time for face to face testing, using the lean practice of walking the process is not to be underestimated (*Kinaxis, 2017*).

7. Promote user buy-in – This ties all aspects together, consolidating the setting out of all the above (*Kinaxis, 2017*) whilst considering SMART (Specific, Measurable, Achievable, Relevant & Timely) objectives (*Bogue, 2005*), this is one method of gaining buy-in from all within the supply chain.

These are somewhat more abstract than the four factors described in section 7.2, however they are not mutually exclusive, they should be used to complement each other.

5.4 Outsourcing SCM

3PL (Third Party Logistics)

Outsourcing of the supply chain may be a plausible option in some instances, but it depends on the reason for wanting to do so. One method is known as the 3PL (Third Party Logistics), this is a technique in which parts or all of the supply chain is outsourced, the benefit of this is that it frees the organisation up to focus on other parts of the business (*Pilkington, 2020*). This approach may benefit the organisation through cost reduction, mitigate risk, gain expert knowledge in the field and improve international logistics (*Pilkington, 2020*). Even though the supply chain in part, if not completely is outsourced, the organisation is still in control of the supply chain.

4PL (Fourth Party Logistics)

Implementing the 4PL is to outsource even further, the 4PL is regarded as the single point of contact between the organisation and the supply chain. A benefit of this may be that the 4PL may provide access to an expanded network, which may have significant efficiencies, thereby allowing the organisation to step away from the complex supply chain to focus on other activities even further (*Millar, 2015*) (*Pilkington, 2020*). As with everything, there are disadvantages as the organisation may not have a great deal of control over the supply chain, and the cost of the setup may be significant (*Pilkington, 2020*). For this reason, the organisation should consider its primary target, if it is to streamline the business to a more lean way of working, then this method may be a good option. Similarly, if the organisation is looking at another target, with that being to optimise cost, then the additional cost associated with this method may be unattractive and potentially the best route would be not to implement the 4PL system.

VMI (Vendor Managed Inventory)

Another method of outsourcing is VMI (Vendor Managed Inventory), this is when the holding of inventory or parts may be outsourced to a third party to hold as stock (*James, 2015*). This system is said to be a dynamic replenishment process (*James, 2015*), and adheres to the JIT (Just In Time), although JIT in itself has inherit risks for a complex supply chain (*Fulmer, 2021*). Factors to review when considering VMI include:

Flow of information – Accurate forecasting to optimise stock levels (Müller, 2011), achieved by sharing data via an information management system (Meehan, 2017). The flow of information aids also with providing visibility of the supply chain, and in doing may aid with identifying weaknesses and risks (Christopher, 2000).

Flow of Material– Process efficiency controls may reduce lead times of parts (Müller, 2011)

Strong partnership – Transparency and openness in sharing inventory usage data with the supplier is important as it may promote an accurate means of planning (Lynch, 2009). The responsibility lies with the supplier in terms of providing the correct stock levels to enable a JIT delivery of inventory (Ptak & Smith, 2016) (Lu, 2011). It is important when using VMI to have a robust contractual agreement with the vendor, this is to protect the organisation's interests and to agree on the delivery time expectations (Millar, 2015).

5.5 The 6 Strategies for a More Resilient Supply Chain

It may be difficult to balance of efficiency and resilience, lean methodology being the efficiency, whilst also being agile in order to adapt and react to change. The six strategy model for supply chain resilience seeks to achieve a trade-off between the two. A survey of organisations reported that only 21% were good in terms of resilience, this is in light of the COVID-19 pandemic, with another ~30% expecting to b resilient within the next two to three years (Hippold, 2020).



Figure 3 - The 6 Strategies Model (Hippold, 2020)

1. Inventory & Capacity Buffers – Said to be one of the simplest way to improve resilience (*Hippold, 2020*), this should be built upon forecasting and possibly a good option for volatile or unpredictable demand. The cost of holding stock is also a consideration, as is obsolescence due to design changes.
2. Manufacturing Network Diversification – Due to the trade war between the USA and China, many USA organisations are moving away from China as a manufacturer (*Hippold, 2020*). The impact of this, if any, is not currently known on the rest of the world economies, and diversifying the network is not necessarily a bad idea.
3. Multisourcing – This is a technique where multiple suppliers are selected for the same product, the benefit of this is that it provides a level of protection in the event of one supplier failing (*Hippold, 2020*). Failing in this aspect may not be failing to supply on time, but in the event of unforeseen natural disasters such as tsunami, earthquake, or in recent years, severe flooding.
4. Nearshoring – There are undoubtedly benefits of a wide spreading global supply chain, however, the greater the scale of the supply chain, the greater the probability of an issue occurring. Therefore it is a consideration to strategically position suppliers within the supply chain nearer to the organisation (*Hippold, 2020*).
5. Platform, Product or Plant Harmonisation – This is where the design of the end product may aid with the supply chain, limiting the number of variations of the product, simplifying the design to achieve compatibility of parts for one assembly to another (*Hippold, 2020*). This will help cut cost and will enable the organisation to use more suppliers potentially.
6. Ecosystem Partnership – This overlaps with the 3PL element discussed in section 7.4, working collaboratively with partners to thrive towards a successful future. This should also consider the logistics of the product also, tying in the entire supply chain ecosystem (*Millar, 2015*).

6. Part 3 – Changes to the Supplier Appraisal Process

6.1 Overview of Supply Chain Appraisal Process

The appraisal process is incredibly important in order to build a pool of approved suppliers (*O'Byrne, 2019*), considering many factors from cost and reliability to their environmental policies (*Andriansyah, et al., 2019*). The failure to conduct a sufficient supplier appraisal process may conclude in catastrophic results that could in turn effect the operational ability of the organisation as a whole, if the supply chain fails, then the organisation may halt. The frequency of the appraisal process needs to be determined, because situations change over time, it is suggested that this be conducted twice per year on average (*O'Byrne, 2019*). It is important that the appraisal process considers current factors in order to mitigate risks. The appraisal process intent may be summarised as ensuring that the supplier is fit for purpose and is not a risk to the organisation but indeed compliments the operations of the business.

6.2 Factors of The Appraisal Process

The organisation must consider what is important to itself, to protect its operations, to enhance profitability and speed, therefore some key factors to consider may include:

Quality – Consideration should be made to establish if the supplier is reliable in terms of quality, do that have a robust quality control or quality Assurance policy in place to ensure repeatability of a good quality standard (*CIPS, 2021*) (*James, 2015*).

Politics – As discussed, politics may impact the supply chain, therefore it is worth evaluating the stability of the political landscape of the country in order to protect the interest of the organisation (*Mentzer, 2007*).

Ethics – This forms two parts: (i) Does the supplier adhere to the expected international standards of human rights; (ii) Does the country in which is located adhere to international expectations? (*Grant, et al., 2017*)

In 1995, Ray Carter created the 7Cs for the supplier appraisal process (Carter, 1999), this was first published in an article named 'Purchasing and Supply Management', since then the model has been expanded by several contributory sources to complete the current 10Cs (Jackson, et al., 2016) (Luo, 2018).

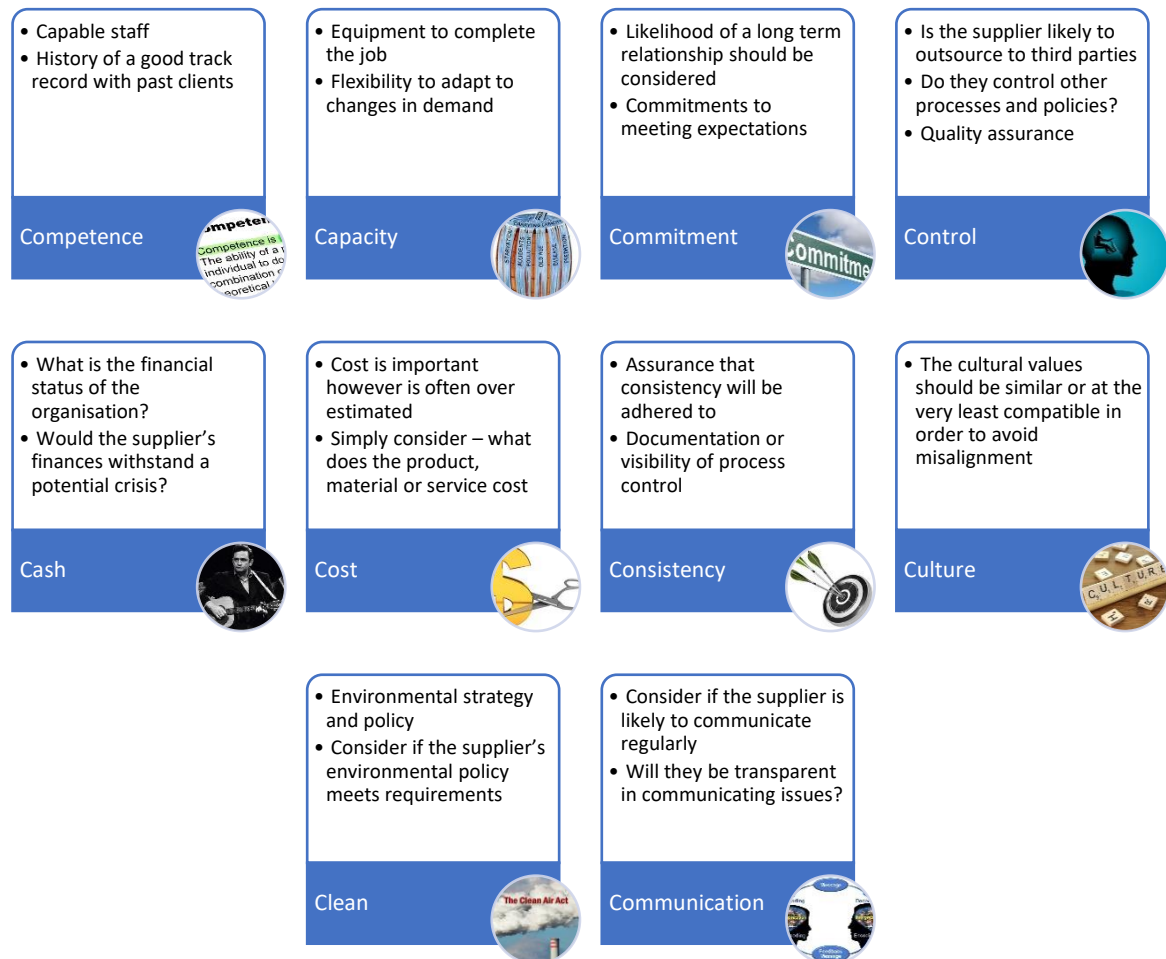


Figure 4 - The 10 Considerations for Appraisal (Kilbane, 2022)

These do provide a good foundation for the supplier appraisal process, and are a good means of covering most aspects in order to prevent the likelihood of an error occurring. Most of the above factors will result in a delay in delivery to the customer if they are not met. (Daehy, et al., 2019) carefully review on the cost implications associated with delay in delivery, and conclude that there should be an efficiency rating established, and set out as follows:

Initial reliability rate – This is a value calculated by measuring the response time from the supplier in days or hours compared with when the delivery was agreed (Daehy, et al., 2019).

Target reliability rate – This is the expected rate of reliability in terms of when achieving the agreed delivery date (Daehy, et al., 2019).

Following establishing this data, the organisation may then proceed to work with the supplier to understand what support may be required to improve the condition. The methodology used for this may be 6s or other lean approaches, such as the 9 wastes (Voehl, et al., 2014).

1. Overproduction
2. Overprocessing
3. Motion
4. Transportation
5. Inventory
6. Waiting
7. Underutilized employees
8. Defects
9. Behaviour

(Voehl, et al., 2014)

Whereas some of these may not be necessarily applicable for this given scenario, 'Over Processing', 'Motion', 'Transportation', 'Waiting' and 'defects' may certainly be areas for investigation. It is common for organisations to request an 8D analysis of their current process, this may be on a recurring late delivery, then from this the process may be improved, leading to the future state:

Obtained reliability rate – This is the new rate of delivery, achieved through changes in the process as a result of the lean activities (Daehy, et al., 2019).

Total cost – The cost is an associated cost of the changes which have occurred (Daehy, et al., 2019), as change is not always without cost, but is intended to improve the overall efficiency, which will in turn recuperate the cost of the change itself.

7. Conclusion

It is recognised that not all supply chains are the same, therefore the approach implemented by one in order to manage risk may not necessarily work for the other (*Millar, 2015*), however there are several commonalities that may be drawn between them. For this particular supply chain being evaluated, the cost benefit of sourcing the products from China is significantly cheaper compared with sourcing the products locally within the UK or even within the EU. It is recognised that the use of global suppliers benefit the organisation not only in terms of cost, but in terms of expertise and experience also. There would need to be a major development in either the cost of manufacturing within the UK to be an alternative solution to China, or something of a political factor to prevent sourcing from China. However, given the current condition with the focus on human rights, and the environmental impact of shipping pollution, it is more so likely today than in recent years to change the supply chain landscape. The logistics and freight turmoil brought about by Brexit and its uncertainty has undoubtedly complicated the situation, but also it in turn places more pressure on the UK government to act to build a prosperous UK that may not necessarily need rely on foreign manufacturing as much as we have done in the past. Considerations should be made to the corporate structure of an organisation as well the market factors (*Millar, 2015*) such as volatility due to political aspects and international law. It is important to consider SCM not as a final plan, but an ever evolving journey that needs to be monitored and able to adapt to the global condition at any given time (*Kinaxis, 2017*).

Selecting the correct supplier is key to success, as discussed there are a number of considerations to be made when selecting a supplier that meets the needs of the organisation. Furthermore, when the successful supplier has been selected, it is important to monitor regularly through agreed KPIs to ensure the performance is being kept on track. The supplier appraisal process is a tool that should be utilised effectively to ensure that all risks are uncovered so that they may be addressed accordingly. Multiple sourcing and single sourcing methodology is to be considered, however multiple sourcing has associated additional cost due to its complexity and the level of management required to enable it to work effectively

(*Costantino & Pellegrino, 2010*). In order to succeed at SCM, a central factor is obtaining the commitment of knowledgeable people devoting their time to it (*Kinaxis, 2017*), this is why the appraisal process is important.

8. Recommendations

It is recommended that the organisation reviews the findings of this report, and considers the following immediate actions:

1. Conduct a full cost analysis of the current set up, the cost of the finished article is determined, but there are other factors to consider:
 - 1.1. Cost of potential rework due to potential quality issues. It is not practical to send the product back to China for rework, therefore the product may need to be corrected in the UK with the rework cost sent back to China. This is not directly financially detrimental to the organisation simply because the cost will be transferred, however the cost in time and resource disruption to conduct the rework is unwanted and unscheduled.
 - 1.2. If an order is required for an in-service issue there is little lead time usually, therefore there may be an additional cost to expedite the parts from China to enable a fast turn around and supply of the parts to the customer. If the products is required quickly, the cost escalates often dramatically.
 - 1.3. If it is not possible to expedite the product quickly, then it may result in either an unhappy customer or a loss of sale. Either scenario may be damaging to the reputation of the organisation.
2. Consider the potential risks associated with the current climate.
 - 2.1. Will the deteriorating political situation result in difficulties for the organisation in terms of trade, this could impact cost/tariffs also.
 - 2.2. With an increasingly difficult situation arising over climate change, the cost of shipping is likely to increase, therefore manufacturing within the UK may be a financially more viable option.
 - 2.3. The reputation of the organisation over its carbon footprint is questionable, if the product can be manufactured in the UK, it will undoubtedly improve the organisation's image within the home country.

3. Making the process lean and agile.

- 3.1. Conduct a full value stream map of the current supply chain, identify the waste consider if profitability may be improved.
- 3.2. Consider making the supply chain lean, with the intent of improving on delivery time and quality standard.
- 3.3. Consider making the supply chain more agile, this will aid with amendments that may be made in future to products being supplied. It may also help with a change in strategy, a supply chain that is too rigid and established may not be able to react effectively to the potentiality of disruption through disastrous uncontrollable events.

4. Supplier appraisal process.

- 4.1. Establish the criteria for the supplier appraisal process.
- 4.2. Conduct the appraisal process regularly, and effectively in order to manage potential changes to the condition over time.

Finally, it is highly important to view the supply chain not as a system that may be established and left alone, but as a process that needs to keep evolving to adapt to an ever changing environment that is our world economy.

9. References

Andriansyah, A., Taufiqurokhman, T. & Wekke, I. S., 2019. *Critical Evaluation of Policies in Supply Chain Performance: Quality Assurance, Continuous Process Improvement and Environmental Regulation and Policies*. *Uncertain Supply Chain Management*, 7(1), pp. 793-804.

Barbosa, C. et al., 2019. *Towards an Integrated Framework for Aerospace Supply Chain Sustainability*, Cham: Springer.

Bogue, R. L., 2005. Use S.M.A.R.T. Goals to Launch Management by Objectives Plan. [Online] Available at: <https://www.techrepublic.com/article/use-smart-goals-to-launch-management-by-objectives-plan/> [Accessed 6 February 2022].

Carter, R., 1999. Ray Carter. [Online] Available at: <https://www.raycarter.co.uk/models.php> [Accessed 5 February 2022].

Charantimath, P. M., 2017. *Total Quality Management*. 3rd ed. Uttar Pradesh: Pearsons.

Christopher, M., 2000. *The Agile Supply Chain: Competing in Volatile Markets*. *Industrial Marketing Management*, 8(1), pp. 22-33..

CIPS, 2021. Supplier Evaluation and Appraisal. [Online] Available at: <https://www.cips.org/knowledge/procurement-topics-and-skills/supplier---bid---tender-evaluation/supplier-evaluation-and-appraisal1/> [Accessed 18 January 2022].

Costantino, N. & Pellegrino, R., 2010. *Choosing Between Single and Multiple Sourcing Based on Supplier Default Risk: A Real Options Approach*. *Journal of Purchasing and Supply Management*, 16(1), pp. 27-40.

Daehy, Y. H., Krishnan, K. K., Aslaadi, A. K. & Algamdi, Y., 2019. *Effective Cost Minimization Strategy and an Optimization Model of a Reliable Global Supply Chain System*. *Uncertain Supply Chain Management*, 7(1), pp. 381-398.

Danner, L. K., 2018. *China's Grand Strategy: Contradictory Foreign Policy*. 1st ed. Cham: Springer.

Farris, T. & Manuj, I., 2018. *A Total Cost Approach to Understanding Supply Chain Risk*, Lombard Illinois: Council of Supply Chain Management Professionals: Academic Case Studies Series.

Fulmer, I. S. & Ployhart, R. E., 2013. "Our Most Important Asset": A Multidisciplinary/Multilevel Review of Human Capital Valuation for Research and Practice. *Journal of Management*, 40(1), pp. 161-192.

Fulmer, J., 2021. *The End of the Just in Time Supply Chain Method*, Nashville: Baseline.

Grant, D. B., Trautrim, A. & Wong, C. Y., 2017. *Sustainable Logistics and Supply Chain Management: Principles and Practices for Sustainable Operations and Management*. 2nd ed. London: Kogan Page.

Harris, B., 2017. World Economic Forum: The astonishing rise of Shenzhen, China's gadget capital. [Online] Available at: <https://www.weforum.org/agenda/2017/11/inside-shenzhen-china-s-gadget-capital/#:~:text=Shenzhen%20is%20known%20as%20%E2%80%9Cthe,units%2C%20mobile%20phones%20and%20drones.>

[Accessed 31 January 2022].

Hippold, S., 2020. 6 Strategies for a More Resilient Supply Chain. [Online]

Available at: <https://www.qartner.com/smarterwithqartner/6-strategies-for-a-more-resilient-supply-chain>

[Accessed 6 February 2022].

Hudson, S., 2004. The SCOR Model For Supply Chain Strategic Decisions,, Poole: Poole College of Management/SCRC.

Jackson, P., Crocker, B. & Carter, R., 2016. 101 Models of Procurement and Supply Chain Management. 1st ed. Cambridge: Cambridge Academic.

James, R., 2015. The Essentials of Supply Chain Management. 1st ed. Bowling Green: Pearsons.

Jia, X. & Wang, M., 2019. The Impact of Green Supply Chain Management Practices on Competitive Advantages and Firm Performance. Journal of Environmental Sustainability in Asian Logistics and Supply Chains , 5(19), pp. 121-134.

Josephs, J., 2021. Climate Change: Shipping Industry Calls for New Global Carbon Tax. [Online]

Available at: <https://www.bbc.co.uk/news/business-56835352>

[Accessed 5 February 2022].

Katsaliaki, K., Galetsi, P. & Kumar, S., 2021. Supply Chain Disruptions and Resilience: A Major Review and Future Research Agenda. Design and Management of Humanitarian Supply Chains, 8 January, pp. 50-62.

Kettering Global, 2018. The Impact of Political Instability on Global Sourcing. [Online]

Available at: <https://online.kettering.edu/news/2016/06/14/impact-political-instability-global-sourcing>

[Accessed 5 February 2022].

Kim, Y. H., 2018. The Effects of Supply Chain Integration on the Cost Efficiency of Contract Manufacturing. Journal of Supply Chain Management, 54(3), pp. 42-64.

Kinaxis, 2017. 7 Success Factors for Today's Supply Chain Management Projects, Ottawa: Kinaxis Inc..

Liu, X., 2019. Environmental Sustainability in Asian Logistics and Supply Chains. 1st ed. Gateway East Singapore: Springer Nature.

Lu, D., 2011. Fundamentals of Supply Chain Management. 1st ed. London: Ventus Publishing.

Luo, S., 2018. 10 Cs of Supplier Sourcing or Evaluation For Potential Suppliers. [Online]

Available at: <https://insightsolutionsglobal.com/10-cs-of-supplier-sourcing-or-evaluation-for-potential-suppliers/>

[Accessed 5 February 2022].

Lynch, G. S., 2009. *Single Point of Failure: The Ten Essential Laws of Supply Chain Risk Management*. 1st ed. Hoboken: Wiley.

McEwan, D., Ruissen, G. R. & Zumbo, B. D., 2017. *The Effectiveness of Teamwork Training on Teamwork Behaviors and Team Performance: A systematic Review and Meta-Analysis of Controlled Interventions, 'A Meta-Analysis of Teamwork Training'*. *A Meta-Analysis of Teamwork Training*, 12(1), pp. 1-23.

Meehan, L., 2017. *How to Effectively Measure Your Outsourcing Success*. 1st ed. London: Cpl Life Sciences.

Mentzer, J., 2007. *Achieving Competitive Advantage Through Supply Chain Management*, Tennessee: University of Tennessee.

Millar, M., 2015. *Global Supply Chain Ecosystems: Strategies for Competitive Advantage*. London: Kogan Page.

Min, H., 2015. *The Essentials of Supply Chain Management: New Business Concepts and Applications*. 1st ed. New York: Pearsons.

Müller, M., 2011. *Essentials of Inventory Management*. 2nd ed. New York: Amacom.

Nair, A. & Reed-Tsochas, F., 2049. *Revisiting the complex adaptive systems paradigm: Leading perspectives for researching operations and supply chain management issues*. *Journal of Operations management*, pp. 80-92.

O'Byrne, R., 2019. *Supplier Appraisal: Does Your Company Have an Effective Process?*. [Online] Available at: <https://www.supplychainleadersacademy.com.au/the-importance-of-an-effective-supplier-appraisal-process/> [Accessed 4 February 2022].

Partner Ship, 2018. *The Impact of Natural Disasters on Freight Shipping*. [Online] Available at: <https://www.partnership.com/blog/post/the-impact-of-natural-disasters-on-freight-shipping> [Accessed 4 February 2022].

Paulson, H. M., 2015. *Dealing With China: An Insider Unmasks The New Economic Superpower*. 1st ed. New York: Twelve.

Pilkington, M., 2020. *Top 5 benefits of Third Party Logistics*. [Online] Available at: <https://supplychaindigital.com/logistics/top-5-benefits-third-party-logistics> [Accessed 29 January 2022].

Ptak, C. & Smith, C., 2016. *DDMRP Demand Driven Material Requirements Planning: An Intuitive Proven Planning and Execution Method for oday's Complex and Voletile Supply Chains*. 1st ed. Connecticut: Industrial Press.

Rathke, S., 2019. *When Politics Affects Supply Chains*. [Online] Available at: <https://www.globalsupplychainlawblog.com/international/when-politics-affects-supply-chains/> [Accessed 5 February 2022].

Ross, D. F., 2015. *Distribution Planning and Control: Managing the Era of Supply Chain Mangement*. 3rd ed. London: Springer.

Sebastian, H. J., Kaminsky, P. & Müller, T., 2015. Quantitative Approaches in Logistics and Supply Chain Management. 1st ed. Berkely: Springer.

Slack, N. & Lewis, M., 2017. Operations Strategy. 5th ed. Harlow: Pearsons.

Standish International, 1999. CHAOS: A Recipe for Success, Boston: The Standish Group International Inc..

Steel Times International, 2018. Adding value in a complex supply chain. Scholarly Journal, 42(5), pp. 38-40.

Tan, K. H., Tse, Y. K. & Chen, J., 2015. Global Supply Chain Quality Management: Product Recalls and Their Impact. 1 ed. Boca Raton: CRC Press.

Tracy, B., 2013. Time Management, New York: AMACOM.

Visvikis, I. D. & Panayides, P. M., 2017. Shipping Operations Management. 4th ed. Limassol: Springer.

Voehl, F., Harrington, H. J., Mignosa, C. & Charron, R., 2014. The Lean Six Sigma Black Belt Handbook: Tools and Methods for Process Acceleration. 1st ed. Boka Raton: CRC Press.