

Question 1

Question 1A

In order to assess the different offers, the Unit Total Cost method is used. A Unit Total Cost (UTC) calculation is based on both hard and soft costs, and thereby creates a clear picture of the actual costs for a given source of supply. It is an useful approach for selecting and negotiating with suppliers, and it follows a five step framework (Harding, 2007). First, identify all of the total-cost factors that are important to the organization. In this case it includes the quoted price, freight costs, delivery performance, quality, lead time. It is assumed that the EN 149:2001+A1:2009 standard is just as reliable as the Chinese KN95 certification (China GB 2626-2006). Furthermore, there has been put no emphasis of the origin of the suppliers, as this product is a highly standardized medical equipment. The most important aspects are the protection and the price, especially because we are going to buy thousands of them.

Secondly, a “price adder” should be developed to translate each total-cost factor into dollars based on the importance. For delivery performance the percentage of orders not delivered on time has been converted into a percentage increase based on the quoted price. The same has been done for quality, where percentage of defective orders has been converted to percentage increase of the quoted price. Finally, following Harding (2007) lead time adds one percent for each week of lead time.

Third, one should add to each supplier’s quoted price a credit or debit dependent on their performance. Fourth, add together all the costs and fifth and finally, award the supplier with the lowest unit total cost. The final steps can be seen in the picture below, and it shows that EuroCo has the lowest unit total cost, and therefore is the most preferred supplier.

Total-cost factors	DanCo	EuroCo	ChinCo
Quoted unit price	18,00	15,00	13,00
Freight costs per unit	0,15	0,16	0,45
Delivery performance	0,90	2,25	3,25
Quality	0,18	0,75	1,30
Lead time - 1 % per week	0,18	0,30	0,52
Unit Total Cost	19,41	18,46	18,52

It is also seen that the difference between EuroCo and ChinCo is very small, however it is also important to be aware of the large quantities as we are in need to “source thousands”. A final argument for choosing EuroCo is that the minimum order quantity is only 25.000, which is half of the Chinese 50.000 minimum order quantity. This enables us to order more often, and have less inventory if that would be preferred. However, in order to assess the optimal order quantity the EOQ model would be needed to calculate.

Question 1B

The Kraljick matrix seeks to categorize products in risk of supply availability and impact on the company's profit. This is done in order to categorize products into different procurement strategies. The matrix consists of non-critical items, leverage items, bottleneck items, and strategic items. I assume that my company is not in an industry where it is essential to wear and/or sell these masks as we are only told that there is a “growing demand for such PPE items in your company”. Therefore, the masks do not have a high impact on the profitability of the business. However, we know that the FFP2 masks (or equivalent) are “sought-after” and “rarely available”, which indicates that there is a high risk of supply availability.

Following the Kraljick Matrix, high risk and low value leads to the bottleneck procurement strategy. Therefore, suppliers should be treated carefully, and the company needs to design the bottleneck out of the portfolio. It could be done by placing orders with both EuroCo and ChinCo as their UTC were fairly similar. The main task is to ensure volume, security of inventories, and have backup plans. So a high safety stock, buy in advance, or buy from multiple suppliers would be the way forward in order to manage the procurement of the masks.

Question 1C

In order to keep a regular replenishment there are different reordering strategies based on the order-quantity and the time of ordering. Because of the pandemic and because of the bottleneck procurement strategy, an “always fill up” should be pursued. If the usage of masks increases one month, it is likely to do the same the next month or at least still be 10.000. Because of the one-time use masks, a high usage one month does not necessarily result in a low usage the following month.

Furthermore, in order to keep high control of the inventory, a reorder point system should be used. This result in the reordering strategy (s, S) of always filling up at a defined level of inventory. This defined level is called the reordering point, and is calculated as:

$$\text{Reorder point} = \text{demand per day} * \text{lead time} + \text{safety stock}$$

With a demand of 10.000 per month that equals a demand of 333,33 per day (assuming 30 days per month). And using EuroCo as the supplier, the lead time is 14 days. So the reordering point is:

$$\text{Reorder point} = 333,33 * 14 + 10.000 = 14.666,67$$

It can therefore be concluded that the company should follow a reorder point system with a safety stock of 10.000 units, and a reordering point of 14.667 units in order to ensure a regular replenishment of the masks.

Question 2

Question 2A

In order to compare Piaggio & C. SpA (PIAG) with Pierer Mobility AG (PMAG) the key performance indicators Cash to Cash (C2C) cycle and inventory turnover will be calculated and evaluated. The indicators will be calculated based on the following data about the companies:

Measure (All in Mio EUR)	PIAG	PMAG
Revenue	1.521.300	1.520.135
COGS	1.262.500	1.074.120
Gross profit	258.800	446.015
Net profit	46.100	186.092
EBIT	104.500	131.700
Accounts payable (average)	593.686	222.628
Accounts receivable (average)	84.617	175.196
Inventory (average)	254.901	346.074
Total assets	1.303.687	1.613.892
Total current liabilities	693.686	406.602
Net cash inflow from operations	- 40.595	257.880
Full time employees equivalent	6.424	4.368
Sales volume (in vehicles sold)	611.300	280.099

First, the C2C cycle is an important metric in both accounting and supply chain management (Farris, M.T. and Hutchison, P.D., 2002). The most common definition by Schilling (1996) says that it measures the interval between the time cash expenditures to purchase inventory are made until the funds are received from the sale of the finished product. It is measured in days and is dependent on three measures. First, the days of inventory held (DIH), which includes the storage and production time. Secondly, the days of sales outstanding are added (DSO), which is the average accounts

receivable period. Third, the days of payable outstanding (DPO) are subtracted, which are the average days of accounts payable. According to Farris & Hutchison, a shorter C2C cycle is closely related to a higher firm valuation, because of the higher NPV cash flows. However, not only for accounting purposes, but also for supply chain management purposes, a shorter C2C cycle results in higher on-time delivery performance and less inventory, which can translate into a potential savings of 3 to 6 percent of the revenue.

In this case the C2C cycle for PIAG has been calculated to -77,6 days and for PMAG it is 84 days. Therefore, it can be concluded that PIAG has the best C2C cycle, however they do not only have the best overall cycle, they actually perform better in all three parameters. The reasons for this will be further discussed in Question 2B. PIAG does on average receive payment for their sold products after 20 days, while PMAG receives the cash after 42 days. The days of inventory held are 73,7 days for PIAG and 117,6 days for PMAG. Finally, the period between the purchase of an input and the payment of that purchase is 171,6 days for PIAG and 75,7 days for PMAG.

C2C cycle = DSO + DIH - DPO	PIAG	PMAG
+ DSO = AR / (revenue/365)	20,3	42,1
+ DIH = Inventory / (COGS/365)	73,7	117,6
- DPO = AP / (COGS/365)	171,6	75,7
C2C cycle	- 77,6	84,0

Secondly, inventory turnover is a parameter that can be used to measure the inventory management performance in a firm. The ratio is an indicator of how well the firm is at managing its inventory, and while the average ratio is around 10, well-performing firms can achieve a turnover of 50 or higher. A low ratio may indicate that a firm does not manage their inventory very well, however there can be exceptions. The inventory turnover ratio is calculated as:

$$\text{Inventory turnover} = \frac{\text{Cost of all goods sold in a year}}{\text{Value of average inventory held throughout the year}}$$

The inventory turnover for neither of the two firms seems pretty good, however the evaluation of the ratios will be further discussed in the following question. The inventory turnover for PIAG is 4,95, while the ratio for PMAG is 3,10.

Inventory turnover	PIAG	PMAG
= COGS/inventory	4,95	3,10

Question 2B

Starting with the C2C cycle, PIAG performs better in all three parameters, and therefore of course has the best C2C cycle. Their days of inventory held is 73,7 days compared to 117,6 days of PMAG. This indicates that PIAG is approximately 50 % faster at converting the stock of raw materials into sold finished products. PIAG is better at receiving payments from their customers, however the biggest difference between the firms can be found in the days payable outstanding. PIAG does on average wait almost a half year to pay their suppliers, which in total helps giving them a negative C2C cycle, which enhances their financing and transfers risk to their supplier just like in the Dell-case.

In terms of the inventory turnover, neither of the firms perform very well, however it is again PIAG that performs best because of their higher turnover ratio. This indicates that PIAG is better at managing its inventory when comparing these two companies alone. If industry data was available it could be easier to determine whether both of the ratios are lower than average or not. However, their lower inventory turnover could be because motorcycles are only for a limited number of consumers, and they are very often sold in small quantities.

So it can be concluded that PIAG performs better in both of the two indicators, because of their lower C2C cycle, and their higher inventory turnover.

Question 2C

For PMAG to improve their C2C cycle, they should focus on their accounts payable, accounts receivable, and inventory period (including storage and production. First, to improve their accounts payable they could review and renegotiate their terms with their key suppliers in order to get a longer period to pay. Furthermore, they could pursue a vendor managed inventory which would improve their inbound inventory stock. For the supplier this could be an advantage if they gain access to PMAG's information about inventory level, and the supplier could better plan its production and distribution.

Secondly, to improve the accounts receivable PMAG should implement strategies to speed up the invoicing process. This can be done by reducing billing errors, or by quick identification of the slow-

paying customers. PMAG should analyze the slow-paying customers and whether the Pareto Principle exists. If it does, they can identify the 20 % most slow-paying customers, who might account for around 80 % of the slow-payments. And in order to speed up the payments, PMAG should improve the discounts for paying quickly and especially focus on the most important customers if the Pareto Principle is in place.

Third, PMAG could improve their inventory by identifying actions to reduce or eliminate slow-moving inventory. Here an ABC-analysis would as it separates the most critical and important SKUs that require more attention from the more trivial ones. This way, the company can get an overview of where to direct its focus and use differentiated reorder strategies. A better overall demand planning and procurement strategy could help reduce and eliminate any excess inventory. As well as improving the days of inventory held, this would also increase the inventory turnover.

Finally, PMAG's production system should pursue a "push" based strategy. We do not know if already does this, however by following a "push" based strategy, also known as just-in-time (JIT), they could be able to gain advantages also seen in Toyota, when they developed the Toyota Production System (TPS). PMAG should follow a lean production to eliminate any wasteful activities and to make sure that value is added in every step of the process. Because of the lack of information about PMAG's production system this cannot be commented further, but they should seek to eliminate waste along the seven key areas.

Question 3

First it is important to define supply chain management and supply chains in general in order to understand the concept of practice and discipline. Thereafter, it will be told how this is manifesting itself when it comes to the design of global supply chains.

A supply chain is defined as the network of organizations that are involved in upstream and downstream linkages, in the activities that produce value in the form of products and services in the hands of the ultimate customer. Management of the supply chain distinguishes from vertical integration as supply chain management (SCM) does not need to imply any ownership or control of the supply chain partners. SCM is the management of a network of relationships and involves an "end-to-end"

perspective from the upstream to the downstream end of the supply chain. This further implies that the aim of SCM is to take a cross-functional perspective, which is why the future supply chain manager will require a “T-shaped” skills profile.

When designing a supply chain it is important to keep the holistic view, and this implies that there are many parameters and externalities to consider, here including different drivers and contingency factors in the future of SCM. Therefore, when it comes to the design of a global supply chain the characteristic of a “T shaped” skills profile manifests itself in order to understand the whole supply chain from the downstream to the upstream activities. This together with knowledge about the complexity of working on a global setting, having a geocentric view to avoid any potential culture clashes as described by De Koster & Shinohara (2006).

One of the key drivers is the need for accessing low-cost labor, materials, and energy. This has primarily resulted in offshoring to China, Mexico, and other low-cost countries. This offshoring has resulted in a containerization and in general huge container shipments across the globe, which also have given directional imbalances. However, a recent de-globalization has resulted in examples of nearshoring or backshoring. Together with the increasing offshoring to China in order to gain low-cost labor, another driver is the need to access customers in emerging markets. Here especially China and the Southeast Asia with their growing middle-class population are important players in the emerging markets.

A third driver is the development from a mass market supply to more tailored offerings (Kopczak & Johnson, 2003). Private consumers in a higher degree demand greater product variety, which increases the supply chain complexity and the need for an responsive/agile supply chain.

Finally, an important contingency factor is the digital disruption, which is transforming traditional relationships in the freight and logistics business (Accenture, 2017). The pressures supply chains to adapt to the new technologies and incorporate technologies such as blockchain, IoT, and AI into their future supply chain design. If they continue with business as usual, they can expect to lose competitiveness and value (Accenture, 2017).

One of the most relevant design elements was overseas sourcing, which however brings complexity and monitoring problems. A study shows that supply chain capability and collaboration is related to the size of a company's revenue (Boyson et al., 2004). The study says that the benefits of supply chain management for small and medium sized enterprises (SME) may be difficult to achieve, which is why increased complexity with a global supply chain may be a too big of a challenge for SMEs.

Another design element that brings complexity to especially global supply chains is the digital disruption. Incoterms are widely accepted across the world and new Incoterms has just been released in 2020 and the digitization of documentary paperwork (DP) has begun, however there are still a long way to go before the digitalization of global supply chains. Schramm and Kolar (2020) suggest four ways to establish a paperless trade environment, however none of them seem realistic at the moment based on the reluctance in the past together with the overall complexity of implementing such regulations.

Finally, with global supply chains not only the flow of materials become more complex, but also the flow of information. With a global supply chain there may be cultural and time differences together with very different IT capabilities. This has a negative impact on the flow of information and may make it difficult to collaborate. As seen in the case "A pain in the supply chain", lack of collaboration and coordination between different actors in the supply chain can lead to bullwhip effects. The bullwhip effect should be mitigated through information sharing of e.g. demand forecast including POS data and electronic data interchange (EDI) in general.

A real example of a great supply chain is Zara, which have built a business model within fashion based on a leagile supply chain. Zara uses the lean elements up until the decoupling point, from where on it is agile and allows them to react to the market responses. Zara's way of finding the push-pull boundary is a great example of how today's competition is more based on supply chain vs. supply chain rather product vs. product. Together with a lean production, another example to decrease inventories is using cross-docking and thereby eliminate inventories in warehouses.

Another example of a supply chain is BMW, who has fully implemented the just-in-time production system with a long S-model. When one orders a car they first have to start producing that car in Munich. It follows the global production network called “The Porsches”, which has local sourcing and producing but global distribution. This is very common for industries within luxury goods, automotive, and original equipment manufacturers (OEMs).

The potential future of global supply chain design will most likely still be very global with a high degree of integration and collaboration along the supply chain. With the digital transformation and improved technologies, the opportunities for further collaborating and information sharing enhances and should make the world flatter. Especially 3PLs and the software industry should seek to address the growing gap between large enterprises and SMEs with innovative services and products, so SMEs can also take advantage of a global supply chain design. As earlier discussed, consumers seek more tailored made offerings and together with the digital disruption, the omnichannel strategy seems to be the future for supply chains. An integrated solution of both offline and online fits well with the forecast of the future of shopping (Rigby, 2011).