WARWICK BUSINESS SCHOOL
THE UNIVERSITY OF WARWICK

Masters Programmes: Group Assignment Cover Sheet

Student Number:	**5586227, 5575928, 1954859, 5504970, 5556354**
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Question Attempted: *(question number/title, or description of assignment)*	**15% Group Assignment**
Have you used Artificial Intelligence (AI) in any part of this assignment?	**No**

Academic Integrity Declaration

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Academic integrity means committing to honesty in academic work, giving credit where we've used others' ideas and being proud of our own achievements.

In submitting my work, I confirm that:

- I have read the guidance on academic integrity provided in the Student Handbook and understand the University regulations in relation to Academic Integrity. I am aware of the potential consequences of Academic Misconduct.
- I declare that the work is all my own, except where I have stated otherwise.
- No substantial part(s) of the work submitted here has also been submitted by me in other credit bearing assessments courses of study (other than in certain cases of a resubmission of a piece of work), and I acknowledge that if this has been done this may lead to an appropriate sanction.
- Where a generative Artificial Intelligence such as ChatGPT has been used I confirm I have abided by both the University guidance and specific requirements as set out in the Student Handbook and the Assessment brief. I have clearly acknowledged the use of any generative Artificial Intelligence in my submission, my reasoning for using it and which generative AI (or AIs) I have used. Except where indicated the work is otherwise entirely my own.
- I understand that should this piece of work raise concerns requiring investigation in relation to any of points above, it is possible that other work I have submitted for assessment will be checked, even if marks (provisional or confirmed) have been published.
- Where a proof-reader, paid or unpaid was used, I confirm that the proof-reader was made aware of and has complied with the University's proofreading policy.

Upon electronic submission of your assessment, you will be required to agree to the statements above

Executive Summary

The executive summary investigates the trade-off between cost efficiency and carbon emission reduction within the DHL supply chain. With the growing awareness of CO2 emissions and concerns regarding environmental sustainability, there could be potential transformation in the supply and demand driven by carbon emission regulations, fluctuating fuel prices, and evolving consumer demands. Both opportunities and risks will arise from the transformation and shape the direction of the industry. Analysing the relationship between profitability and environmental sustainability will show us the different perspectives of the models and navigate through the environmental sustainability issue faced by the industry.

Model 1: Minimizing Cost Disregarding CO2 Emission

Model 1 aims to find the best sourcing strategy while minimizing the total cost (production cost + shipping cost) without taking account of the CO2 emissions from production and shipping to the distribution centre in Shanghai.

Model 2: Minimizing CO2 Emission within 3 billion (CNY)

Model 2 aims to minimize CO2 emission from production and shipping to the distribution centre in Shanghai but within a budget of 3 billion.

Model 1 Results		**Model 2 Results**	
LCD42 ODM 1 via mode Regular Air	46,000 units	LCD42 ODM 1 via mode Road Network	92,000 units
LCD42 ODM 1 via mode Road Network	92,000 units	LCD42 ODM 1 via mode Water	228,000 units
LCD42 ODM 1 via mode Rail	138,000 units	LCD42 ODM 4 via mode Regular Air	46,000 units
LCD42 ODM 1 via mode Water	44,000 units	LCD42 ODM 4 via mode Rail	138,000 units
LCD42 ODM 4 via mode Water	600,000 units	LCD42 ODM 4 via mode Water	416,000 units
LCD32 ODM 1 via mode Regular Air	53,000 units	LCD32 ODM 1 via mode Regular Air	53,000 units
LCD32 ODM 1 via mode Road Network	79,500 units	LCD32 ODM 1 via mode Road Network	79,500 units
LCD32 ODM 1 via mode Rail	79,500 units	LCD32 ODM 1 via mode Rail	79,500 units
LCD32 ODM 1 via mode Water	318,000 units	LCD32 ODM 1 via mode Water	318,000 units
Total Cost (CNY)	2,999,985,597.10	Total Cost (CNY)	2,999,985,597.10
Total CO2 Emission (KG)	7,944,511.03	Total CO2 Emission (KG)	7,401,972.77

The models are done based on a few assumptions such as considering using at least 1 from each category (air, road, rail, water) for each product regardless of the ODM to make supply chain more resilient. The models also leverage economies of scale by ensuring the minimum production for any LCD is 200,000 units per contracted ODM. Whereas the maximum production for both LCDs combined of 600,000 units regardless of ODM. Although, the CO2 emission rate does not take account of bad weather conditions nor idle emission rate due to the lack of information, we can still calculate using the general emission rate of each transport mode. It is also important to note that the demand for LCD32 and LCD42, production cost and shipping cost are historical information. With the increased awareness for environmental sustainability, demand, raw material prices and fuel prices will fluctuate.

Both models resulted in the same total cost of approximately 2.99 billion. On the other hand, the total CO2 emission from model 1 is higher than model 2 by 7.33%. Although the difference in CO2 emission is only 7.33%, we are anticipating government legislation aiming to reduce the emission of CO2 through tax incentives which allow the company to benefit from this environmental effort. The environmental approach also acts as an opportunity to enhance the company's brand value through heightened customer awareness of sustainability initiatives. The potential benefits are estimated to increase the budget for this supply chain by 10%. Reducing CO2 emissions without additional cost will potentially bring the budget up to 3.3 billion and improve brand value for future development. Hence, it is advisable for the company to prioritize minimizing the CO2 emissions of this supply chain.

With the higher budget, DHL could utilize faster transport modes to maintain a satisfactory safety stock level to counter the changing demands. Having a lower lead time from the faster transport modes allows the centre to reduce their inventory cost by holding a smaller amount of safety stock as it can be replenished faster. However, due to the increased awareness of the company approach towards environmental stability, customer order cycles will experience a change and could potentially cause a bullwhip effect on the supply chain. The sudden surge in demand in high frequency will deplete the safety stock level and cause a shortage. To minimize the damage from bullwhip effect, we could use faster shipping methods such as air express, regular to ship more products as they will allow the distribution centre to replenish the stock in approximately 2 days and keep a satisfactory safety stock level to meet the demand.