MET IIB 2024 Paper 2 – Question 1, post-exam crib

(a) Explain the similarities and differences between management and leadership. Use examples from theory and practice to support your answer.

(30%)

(b) Two organisations are facing significant challenges to their operations. The first is a large automotive manufacturing firm that is attempting to transform its operations from producing internal combustion powered vehicles to battery powered vehicles. The second is the UK's National Health Service (NHS) that is struggling to deliver effective services and is seeking to adopt digital technologies to integrate activities and improve efficiency. For both of these situations:

(i) Discuss and contrast the people management challenges that the senior management team are likely to encounter when implementing these changes; and

(ii) Discuss approaches to address these challenges, providing examples to support your answer.

(70%)

Crib

(a)

Basic answers

Would cover basic dyads of operational vs. strategic; steady-state vs. change; business as usual vs. new directions; efficiency (doing things right) vs. effectiveness (doing the right things).

Should include references to basic models and tasks of management (HR focused - recruit, develop, retain, etc); maintaining positve culture (e.g. Schein)) and leadership (setting direction and enabling positve culture (Shein,), managing change (e.g. Kotter, Lewin, etc).

Should provide examples to illustrate each (these could draw upon the numerous examples discussed in the discussed in module, and can even be drawn from materials reviewed in the module assessment).

Better answers

Should be able to comment on the blurring of these roles and the interactions between them. Would also comment on the context-specific nature of these – organizational, technological, firm growth stage etc – as discussed in readings, lectures and guest speaker discussions. Should demonstrate more detailed understanding of concepts drawn from module readings.

(b)

(i)

Basic answers

Must demonstrate awareness of the features of these two different contexts, and how these will present some common but also some different people management challenges. There will be plenty of example material that the students can draw from the core lectures and guest speakers, and module readings. Basic answers should, as a minimum, demonstrate awareness of how difficult it will be to change the deeply embedded practices of a firm manufacturing a single, highly mechanical mature product, with long and complex supply chains. Key challenge includes how to ensure they have a workforce able to cope with this new technology. For the second case basic answers should demonstrate awareness of how difficult it is to bring in any meaningful change when all NHS activities are under such pressure to hit operational targets, and the workforce is exhausted. Key challenge includes how to ensure sufficent staff are available to run basic operational issues let along have capacity for change.

Better answers

Would build on the basic answers and reflect upon how for the automotive firm, the change they are seeking to implement is common to all similar automotive firms and, as such, they will be competing for the same talent across the industry. They will need to balance issues of internal development against external recruitment. For the NHS case, a major issue implementing change across such a huge and complex organisation. The stronger answers will be able to positon this as a challenge of organisational ambidexterity.

(ii)

Basic answers

Will be able to apply at least one of the change management models introduced in the module. The most obvious one would be Kotter, and the basic answers should be able to outline the main stages, and apply these to the two different contexts.

Better answers

Would not only apply one model, but reflect on the operational challenges likely to occur at each step of whichever model(s) they have applied. The better answers should also reflect in detail on the similarities / generic issues both organisations will face, as well as the context specific issues.

Post exam comments:

For part (a), most students could provide a description of some of the broad differences between management and leadership, but several failed to do the second part, i.e. "*Use examples from theory and practice to support your answer*". Stronger answers were those that did provide such examples, and were also able to reflect on issues such as links to core functions of a business, the lifecycle of the business, and individuals' career stages.

For part (b), most students were able to provide a response to part (i) by reflecting on the features of the two contexts and how differences were likely to lead to specific people management challenges – but also how there were commonalities to both (e.g. size, scale of change). For part (ii), all students could provide some general reflections on how change could be managed in these two contexts, and most could also link this to one or more of the change management models (e.g. Kotter, Lewin, etc). However, the strongest answers to (ii) were those that demonstrated an understanding of the specifics of how such models could structure change management programmes in these two different contexts.

MET IIB 2024 Paper 2 – Question 2, post-exam crib

(a)

A basic answer should cover the basic explanation of the market-based approach and the resource-based approach. The market-based view and the resource-based view come from opposite school of thoughts. Students should be able to clearly explain and compare the difference of both approaches. Using examples from class, students could discuss for instance the 7-eleven retail example from Japan, its market-based approach and its resource-based approach that contributed to the success and growth of the business.

The market-based view and the resource-based view come from opposite school of thoughts. Different, but complementary elements in building business strategies. The market-based approach and resource/capabilities-based approach are critical elements of business strategies.

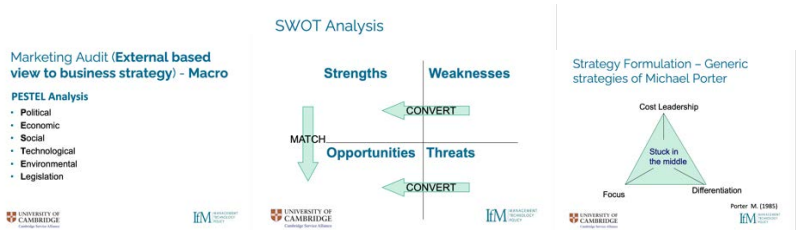
The *Market-based approach* – the market school of thought– argues that the organisation must focus on the external environment, the attractiveness of the market and the rivalry of the industry among others. Porter then introduces the Five-forces model centred on competitive rivalry within an industry. Furthermore, In the market-based view, Porter argues that companies should adopt one of the 3 Generic Strategies– cost leadership, differentiation and focus. The Disadvantages of the market-based approach is that they only view one side of the issue that competitive advantage comes solely from the external competitive environment and assumes that resources are homogeneous and mobile, but in reality they might not be homogenous and mobile.

The *resource-based approach* –the capability school of thought– argues that the organisation should focus on the internal resources that are within the firm. This approach concentrates on the internal resources and capabilities of the firm rather than the external environment. This resource /capability-based approach (also name perspective) define resources and the firm's ability to control, improve, develop. Resources are tangible and intangible – human, physical and organisational.

The external market perspective vs the internal resource perspective and the macro and micro level. The Market-based approach is attributed to Michael Porter. In 1985, Porter argues that the principles of the market-based approach are central elements of the concept call 'competitive advantage', which is the development and implementation of a value creation strategy that is different and difficult to copy by existing or potential competitors. Over the years, the market-based view has been developed into the concept of sustainable competitive advantage.

A better answer should cover the above plus the following. Better answers should discuss the analytical tools for each individual approach at the macro and micro level of analysis.
In the *market-based approach*, Porter introduced the Five-forces model centred on competitive rivalry within an industry and the PESTEL analysis.
In the *resource/capability-based approach*, the SWOT analysis and the value chain are use as the main analysis tools of the internal resources and capabilities of organisations. The concept of value added within the firm can be linked back to Porter's Value Chain and the ability to identify the resources and capabilities and how these can be leveraged to gain competitive advantage over competitors.

Definition, illustrations and comparisons of the would include:
Porter Five forces: Potential entrants, barriers, substitutes, suppliers and industry competitive rivalry.
PESTEL analysis: Political, Economic, Social, Technological, Environmental, Legislation
SWOT analysis– strengths, weaknesses, opportunities and threats.
See slides:

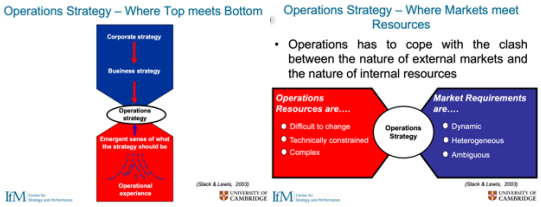


A 'best' answer should cover. The student should be able to compare and contrast the market-based approach and the resource-based approach and discuss the differences, but more importantly their complementary of both approaches in building business strategies. Students could draw examples from class – E.g. the analysis of Apple business (operations strategy slides 116 to 127).
Best answers should also discuss the strategic `fit and reconciliation' of the market and the resources (based on the examples taught in class from Nigel Slack and Michael Lewis (2022) and the Ryanair analysis (operations strategy slides 139-149) or any other business example.

(b)

(i)

A basic answer should cover an explanation and definition of the 'operations strategy' is defined as the decisions which shape the long-term capabilities of the company's operations and their contribution to overall strategy through the on-going reconciliation of market requirements and operations resources. It has to cope with the clash between the nature of external markets and the nature of internal resources (slack and Lewis 2003).



In operations strategy, the four areas of decisions (Slack and Lewis 2003). The decision areas are in the structural and infrastructural categories, and as given by Hayes and Wheelwright are:

Structural
Facilities – size, location, specialisation

Capacity – amount, timing, type
Span of Process – vertical integration, make or buy
Process – the transformation processes and the way in which they are organised

Infrastructural
Control Policies - production/inventory control, decision making
Human Resources – recruiting, training, motivating
Quality - defect prevention, monitoring, intervention
Suppliers – sourcing policies, supplier relationships
New Product Introduction - how to manage all the above when introducing new products

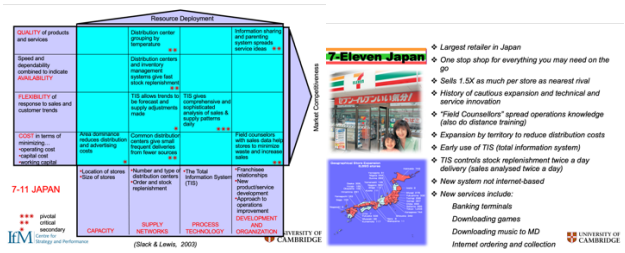
A better answer should cover the above in addition to explain a pattern of decisions, both structural and infrastructural, which determine the capability of a business and specify how it will operate to meet the operations objectives which have been derived from the business objectives. The patterns of decision areas and the relation to capabilities and operations objectives:
Structural Decisions:

- Require significant investment
- Have a long-term impact
- Refer to decisions about capacity, location, technology and vertical integration/relationships with suppliers
- They have a significant effect on physical assets
- Once they have been implemented, they cannot be modified in the short term

Infrastructural Decisions:

- Have a short-term impact
- Serve to support the production processes
- Refer to decisions about organizational structure work force management; and the systems for planning, stock control and quality management.

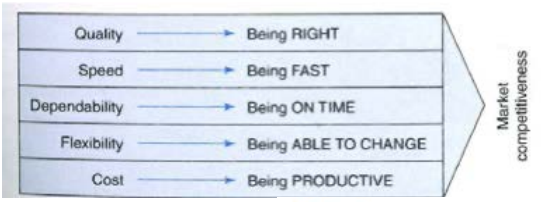
A 'best' answer should cover the above in addition compare and contrast the four Decision areas of operations strategy (slides 99-105) and tested with examples using the taught case of the 7-eleven Japanese retailer (slides 107-108).



(ii)

A basic answer should cover the type of operations firm and its firm's strategy and then provide clear explanation of the five objectives, at least three dimensions per objective – and examples of their correspondent metrics.

As presented below, five operation performance objectives – quality, dependability, speed, flexibility and cost – and discuss their correspondent dimensions, as shown in the example for 'Quality', in the context of a multinational aircraft engines business operating in the aerospace industry, which is focused on delivering industry-leading products and services to customers. Quality is paramount, particularly the 'serviceability dimension of the quality objective' would be explained as –how easy is the product to servicise – and the example metrics could include: time spent in servicising the product, frequency of servicisation of the product, the customer experience rating of the service provided, etc. See:



1. Quality: operations performance objectives

Quality Dimensions

Dimension	Types Costs in Measuring Quality Definition
Conformance	Reference to conformance to specification
Performance	How well the product performs its primary function
Features	What additional features the product contain
Reliability	How well the product continues to perform
Technical Durability	How long the product lasts before becoming technical obsolete
Serviceability	How easy the product is to service
Aesthetics	The look and feel of the product
Perceived Quality	The customer's perception of the product's quality
Value for Money	The customer's perception whether it worth the paid money

A better answer should cover the above in addition to how these objectives and dimensions from the specific context of the company – a large multinational aircraft engines manufacturing firm with a strategy focused on delivering industry – leading products and services to customers and achieving profitable growth for the shareholders. E.g. a version of the example given in the lectures for a Steel Mill as shown below.

Performance Dimensions	Steel Plant *Associated competitive factors include....*
Quality	• Percentage of products conforming to their specification • Absolute specification or products • Usefulness of technical advise
Speed	• Lead time from enquiry to quotation • Lead time from order to delivery • Lead time for technical advise
Dependability	• Percentage of deliveries on time in full • Customers kept informed of delivery dates
Flexibility	• Range of sizes, gauges, coatings, etc. • Rate of new product introduction • Ability to change quantity, composition and timing of an order
Cost	Price of products, technical advise, discount, payment terms

A 'best' answer should cover the above in addition discuss the level of importance of each dimension relatively to others to fulfil this firm's strategy. For this firm's strategy – strategy focused on delivering industry- leading products and services to customers and achieving profitable growth for the shareholders. Arguments will be focus on the discussion of objectives that primarily support the 'industry- leading products and services to customers. Key arguments will be in favour of primary objectives such as flexibility and speed, followed by quality, dependability and costs. Best answers will argue that in delivery fantastic leading products and services the flexibility of mass customization and personalisation, particularly for those high profitable loyal customers, is the crucial.

Post exam comments:

For part (a), most students were able to demonstrate understanding of the basic differences between the MBA and CBA. Some stayed at the very basic level and just talked in general terms of 'internal' versus 'external' approaches to strategy. Better answers were those that not only described each approach in more depth and used relevant models to highlight key aspects, but also showed which analytical frameworks were suited to each (e.g. MBA – 5 Forces or PESTEL; CBA – SWOT). The strongest answers gave a balanced response to explaining how different contexts (e.g. company resources, history, maturity, market, etc) might affect the choice of approach.

For part (b)(i), the strongest answers were those that demonstrated a clear understanding of operations strategy and decision areas using not only a clear statement of what each meant, but applying the explanatory frameworks from, e.g. Slack and Lewis, breaking things down into structural and infrastructural issues, and then using such a structured approach to illustrate the how this applied to GenCo. The weaker answers just talked in very general terms about strategic choices, and the need to balance external and internal issues. For part (ii), again the strongest answers were those that drew upon the lecture material on operations performance objectives (quality, speed, dependability, flexibility, cost) and related frameworks (e.g. sand cone model), framing these in the context of GenCo, linking across to issues given in the answer to part (i). Weaker answers simply talked in general terms about possible performance objectives that GenCo could deploy.

MET IIB – Paper 2 – TIM question

CRIB

1)

Most students answered this question quite well showing a good understanding of three important technology protection instruments. What appeared to be more important for the marking is that the student answers reveal a coherent argument, so simply stating the answer was not sufficient to be considered an excellent answer. Accordingly, if an answer provided a strong, convincing and coherent argument arriving at a different suggestion, this answer might have still be considered correct, e.g. in case where creatively some additional details have been assumed.

The conventional, most likely choices of protection instruments with some of the main arguments are provided below:

a) Defensive publishing: This option offers very little additional competitive advantage, but is not considered to be very inventive that could be patented or would not be worth making efforts to keep secret. There is not a point of preventing others from not doing the same and little risk that one needs to maintain freedom to operate. Battery life extension can be widely communicated to customers as a product improvement. Hence, patenting does not appear to be an option (lack of inventive step, i.e. being obvious, rather than novelty, about which we know little given the information provided), so what remains is the choice between defensive publishing and keeping it as a trade secret. What speaks in favour of the defensive publishing is that it can likely be reengineered and can be used as a customer argument (e.g. battery life extension).

b) Keeping secret: This is considered a process innovation that would be hard for competitors to reengineer. Hence, if it would be patented and thereby published, competitors would be enabled to also implement the solution. Thus, it appear to be more suitable for being keep secret.

c) Patent: This new feature has potential to be also adopted for other products and is likely to be quite visible for competitors. Appears to fulfil patentability criteria but can possibly be reengineered, so keeping secret appears to be difficult. So best to patent, thereby avoid that competitors can implement and use the same feature. Thereby, increase competitive advantage, at least for a while, until competitors might have found a solution to invent around.

Every good answer should not only list pro/cons for the different options but is expected to arrive at a clear recommendation.

Excellent answers appear to be more well-structured answer, potentially with a short preamble setting out the approach of how the question was addressed or a brief explanation of why it is important to consider protecting technology. Such answers also might refer to examples from outside the three given suggestions, e.g. explaining other companies that have used trade secrets (e.g. Coca Cola). Excellent answers are likely to compare and contrast the three options concluding the preferred one based on clear arguments with examples, i.e. reference to different parts of the three suggestions. In general, excellent answers provide richer and more detailed answers than good answers, e.g. for B) explaining the difference between a process and product innovation. Such

answers are also likely to explain the criteria for the three types of protection, e.g. three patenting criteria (novelty, non-obviousness, industrial applicability). Excellent answers also are more precise. For instance, distinguish the concept of inventiveness from being innovative. Excellent answers are likely to be multi-argumentative (in contrasts to good answers, which might be single-argumentative), i.e. do not conclude based only on a single argument (e.g. not suitable for a patent, so much be kept secret). In excellent answers the student might also refer to associated legal concepts, e.g. freedom to operate, right to exclude.

2)

Overall, many students provided good answers but surprisingly with few examples, even though the question has asked specifically for examples to be provided. Even fewer examples were provided for specific advantages/disadvantages rather than the actual acquisition model.

Good answers generally identify that the question is associated with the topic of "technology acquisition" and associated lecture material. Please note that the question did not ask students to actually perform an evaluation or make a recommendation.

Basic answers tend to merely list a small number of advantages/disadvantages for each option providing only short explanations and basic examples. Better answers provide more detailed explanations for each option.

Excellent answers are well structured providing rich explanations with detailed examples. Such answers address this question more systematically, i.e. by using a structure or a framework to compare and contrast advantages and disadvantages of the three options, e.g. the make-or-buy matrix. These answers tend to make reference to the lecture material, some of them defining criteria against which the three options are compared, e.g. internal/strategic fit, technology, partner fit.

3)

Students were asked to conduct a feasibility-opportunity analysis as this was introduced in the Technology Selection lecture. One student did not answer this question.

For marking the answers, it was not too important which technology a student finally recommends as there is not a right or wrong answer. Actually, a recommendation was not asked for in the question, which says "Evaluate both technologies and reflect on the process you followed". Rather the question suggests that the answer should address two parts: 1) the evaluation process and 2) the reflection. In general, however, most answers only completed the first part, while considerably fewer also addressed the second part of the answer, of which the quality of the answers was also weaker. Students did well in working with the tables and numbers. Most students understood that the numbers need to be aggregated, while some students applied more weight to those factors of strategic relevance (according to the CEO) or at least accounting for that in their discussion. For the first part, several students only presented a narrative answer not making much use of the scoring tables.

Basic answers describe the process of how to conduct such an analysis in reasonable detail. Basic answers might miss to consider the weightings that should be applied to the scores based on the preferences that the CEO indicates. Basic answers tend to not strictly follow the process, e.g. by just

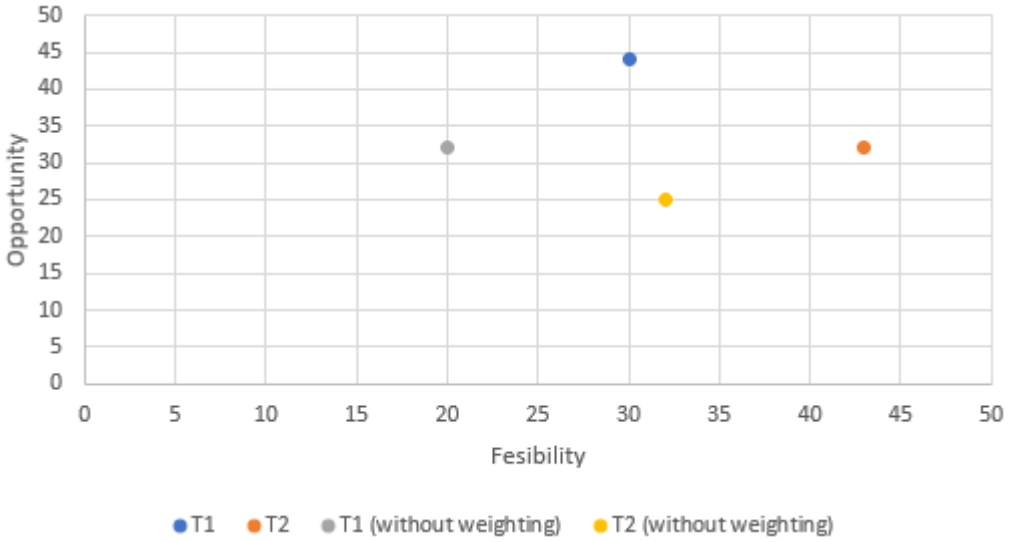
cumulating the scores across both tables, i.e. not distinguishing between feasibility and opportunity scores at all.

Any good answer clearly reveals that the student is aware of the technology selection scoring process as introduced during the lectures. Such answers provide a more detailed explanation of the process than basic answers. These answers also show that the student understands that the hints of the CEO indicate that the mentioned factors could be considered more important and inputted with higher weights into the analysis. Some excellent answers present more than one approach, such as in sequential order, e.g. (1) starting with simply summing up the scores, then (2) using weights or (3) only calculating the scores for the key criteria according to the CEO, then comparing and contrasting the results.

By executing the scoring, good and excellent answers were expected to find that the scoring in the matrix reveals two problems. First, even when not considering the weights, the feasibility-opportunity analysis alone does not provide a straight-forward answer. While T2 scores higher on the feasibility side, T1 scores higher on the opportunity side. Introducing weightings even creates a bigger dilemma. The weightings are not given by the CEO and assumptions need to be made. It is also not clear if all criteria weight equally. The scoring might result in quite different outcomes depending on how the weights are chosen. If, however, all criteria are given the same “extra” weight (whether this is small or larger), the analysis still does not produce a clear “winner”. None of the two technologies will score higher than the other on both dimensions. Excellent answers would reflect on this in more detail than good answers.

To overcome the ambiguous results, good answers might suggest that the feasibility-opportunity analysis should be used in combination with other technology management tools, e.g. roadmapping. Other answers that were considered excellent reflect on the missing information for the scoring or discuss the scores in context of the risk profile of the decision makers.

While student answers were expected to produce a graph like the one shown below, surprisingly no student provided it.



Excellent answers also tend to reflect on the way how scores for the two dimensions are calculated. The scores for the five, respectively six factors could be summed up or multiplied. Also, for those factors, different weights could actually be introduced. Excellent answer also tend to discuss the ambiguity of matching feasibility / opportunity factors to the four preferences expressed by the CEO.

Question

As a manager in a UK manufacturing firm, you are tasked with analysing and potentially redesigning your company's supply chain to enhance its resilience against climate change.

(a) Identify specific vulnerabilities the company may face related to climate change. Provide examples to support your answer. [30%]
(b) Outline the key considerations involved, and the steps you would take to redesign the supply chain. [40%]
(c) Explain how these changes would address the vulnerabilities identified in your answer to part (a). [30%]

Crib

Students will address questions as a manager in a manufacturing firm. The following analysis and action plan draw on supply chain risk and resilience concepts:

(a) Identifying Vulnerabilities:

- Climate-Induced Disruptions: The firm faces risks from extreme weather events (e.g., droughts, floods) that can disrupt raw material availability and logistics.
- Supplier Dependency: Heavy reliance on single or limited suppliers, particularly in climate-vulnerable regions worsens risk exposure.
- Inflexible Production Processes: Current production processes may lack the flexibility to adapt to supply fluctuations caused by climate-related disruptions.
- Technology Gaps: A lack of advanced digital technologies limits our ability to forecast disruptions and respond proactively.

Students are expected to expand on these bullet points, providing clear rationale for their answers.

(b) Redesigning Supply Chain for Resilience:

- Dual Sourcing Strategy: Implementing a dual sourcing strategy reduces dependency on a single supplier or region. This approach involves identifying and partnering with alternative suppliers in diverse geographical areas.
- Digital Technology Integration: Incorporating advanced technologies like digital twin and control tower along with AI for predictive analytics enhances our ability to anticipate and manage risks. Digital tools can provide real-time data on supply chain operations, enabling quicker response to disruptions.
- Adaptive Inventory Management: Adopting a more dynamic approach to inventory management, such as just-in-time (JIT) combined with safety stock strategies, can provide flexibility in handling supply fluctuations.
- Redesigning Products and Processes: Rethinking product designs for adaptability to different materials and conditions, and modifying production processes for greater flexibility in response to supply chain disruptions.

(c) Addressing Identified Vulnerabilities:

- Mitigating Climate-Induced Risks: Dual sourcing and adaptive inventory management can mitigate risks from climate-induced supply disruptions. Having alternative suppliers ensures continuity, while flexible inventory strategies accommodate supply variability.
- Reducing Supplier Dependency: By diversifying suppliers, our firm becomes less vulnerable to disruptions in any single region. This approach is crucial in managing risks associated with climate change.
- Increasing Process Flexibility: Redesigning production processes to be more adaptable allows the firm to adjust operations swiftly in response to material shortages or logistic challenges.
- Leveraging Technology for Proactive Management: Digital tools enable us to predict potential disruptions and plan accordingly, thereby enhancing our capacity to respond to unforeseen climate-related events effectively.

Basic answer will make generic references to concepts without applying them to the company's specific situation. It may lack examples or contextual details. Good answer will demonstrate a solid understanding of the concepts linking them directly to climate change resilience. The answer includes more detailed strategies. Very good answer will present critical analysis, such as comparing and contrasting different approaches, considering short-term versus long-term benefits, or discussing implementation challenges.

Examiners comments: This question was based on the issues of supply chain resilience discussed in the AOM module. It was a popular question, answered by 24 candidates. Part (a) required candidates to identify key risks arising from climate change to a UK based manufacturer. The question was answered reasonably well, with many students structuring their responses around issues on extreme weather impact, indirect impact arising from changing regulations, material shortage and lack of visibility. Many candidates used appropriate examples to illustrate these issues. Weaker responses provided generic responses rather than focussing on climate change. Part (b) required candidates to describe the approach they would take to address the risks. Excellent candidates described the traditional and configuration-based approaches, and argued which one is better, and suggested concrete steps to address the problems. Again, weaker candidates provided generic answers. Part (c) required candidates to discuss how the suggested approach would address the risks. This was done well by many candidates, with some candidates choosing to combine answers to (b) and (c), which was marked appropriately.

METIIB Paper 2 Sust Man Crib v4

5 a (i) Zero Loss Yield Analysis is part of a suite of tools used to improve manufacturing efficiency. It compares material input to useful output, allowing materials efficiency performance to be benchmarked against the theoretical minimum amount of material required. It can be used to identify and eliminate assumed constraints that may hide opportunities for improvement. Benefits can be quantified in financial terms, as well as environmental benefits (commonly some sort of carbon footprint). The results of the analysis will be used to identify opportunities for improvement, and will be incorporated into the business plan.
The information required is:

What material is present in the manufactured part?
Where is the excess going?
What are the costs of materials and what are the costs/value of waste?

The data will be gathered from documents that should be available in the company.

Materials input quantities and costs: Invoices, receipts.
Material required: Original design, bill of materials.
Waste: Mass of manufacturing waste and numbers of scrap parts from company records. Also costs and any scrap income.

The ZLYA should ideally be carried out between two stock checks, to ensure accuracy of information about materials and finished products in stock.

Also required is information about stock inventory. Increases in this will count as a loss in the analysis: materials have been bought in but are not included in sales. The analysis should be refined to account for this (and the imbalance tackled as part of improving efficiency).

ii) Candidates should analyse the material flow and use the data provided to identify the following sources of loss. Sample calculations are provided for clarity, but credit will be given to candidates who make reasonable assumptions and get numerical answers that are close to those given below.

ZLY estimation
The most basic answer calculates Zero Loss Yield using the simplified formula:

(Design mass * Sales) / raw material purchased

The two materials (Low grade steel, LGS and high grade steel, HGS) should be treated separately, but the most basic calculation might just add them together.

This approach gives a total mass of:

57,500kg (LGS) + 34,000kg (HGS) = 91,500 kg purchased

Design mass Blade A: 0.3kg * sales blade A: 150,200 = 45060 kg sold to customers

Design mass Blade B: 0.5kg * Sales blade B: 50,100 = 25050 kg sold to customers

This gives a total ZL efficiency of (45060+25050)/91500 = 77%

Better answers will attempt to account for inventory changes in their calculations, as well as treating the two material flows separately.

The analysis for Blade A would then note that:

1) The stock of LGS raw material decreases from start to end of the year
2) The inventory of finished Blade A product also decreases

With the implications that:

1) The quantity of LGS consumed is greater than that purchased – and so the larger (consumed) value should be used in the Zero Loss calculation
2) The sales were partly made up by the decrease in finished product inventory, so not all of the products sold were manufactured this year. Therefore only the products manufactured this year should be included in the Zero Loss calculation (sold products – decrease in inventory)

This gives a ZL efficiency for LGS of:

$$\frac{(Blade\ A\ sold - decrease\ in\ Blade\ A\ inventory) * mass\ per\ blade\ A}{\big(LGS\ sheets\ bought + (Decrease\ in\ LGS\ stock)\big) * mass\ per\ sheet}$$

$$= \frac{(150200 - (4000 - 1000)) * 0.3}{\big(10000 + (2000 - 200)\big) * 5.75}$$
$$= 65.1\%$$

The analysis for Blade B is similar, but in this case:

1) The stock of HGS material increases
2) The inventory of finished products decreases

With the implications that:

1) The correct value to use for ZL calculation is the purchased amount, but the stock increase should be treated a loss contributing to the <100% efficiency
2) The correct value to use for the ZL calculation is the sold amount, but the inventory increase should be treated as a loss contribution to the <100% efficiency

This gives a ZL efficiency for HGS of:

$$\frac{(Blade\ B\ sold) * mass\ per\ blade\ B}{(HGS\ sheets\ bought) * mass\ per\ sheet}$$

$$= \frac{(50100) * 0.5}{(8000) * 4.25}$$
$$= 73.7\%$$

Known materials losses for both blades:

The approximate rejected product loss is given as 1%

Assuming that this is of products produced, this is ~ 451kg of LGS ~ 271kg of HGS. These values are small (~0.7%-0.8% of the total mass produced). However, it is equally reasonable to ascribe a proportion of skeleton losses to these faulty products, increasing the value.

The skeleton loss can be estimated by taking the mass of finished product and multiplying by the factor 0.2/0.8 for LGS and 0.15/0/85 for HGS. This is because the finished product represents 80% of the area (&mass) of the LGS sheet, and 85% of the HGS.

This gives estimates for skeleton loss of:

LGS = 11040kg (~16% of total purchased mass)

HGS = 4421kg (~13% of total purchased mass)

HGS also requires an estimate for raw material stock increase (treated as a loss): 2125kg or ~6%

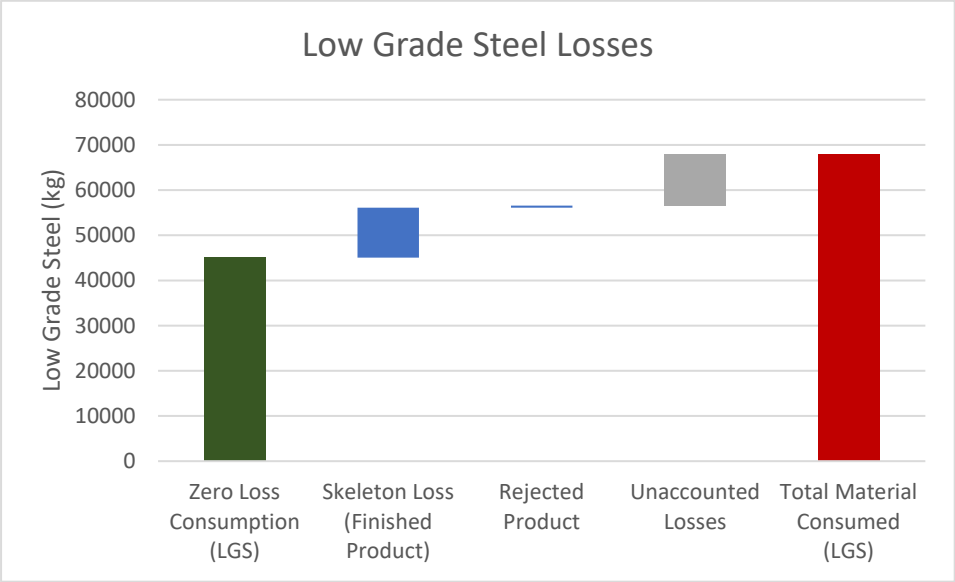
HGS also requires an estimate for finished product inventory increase:

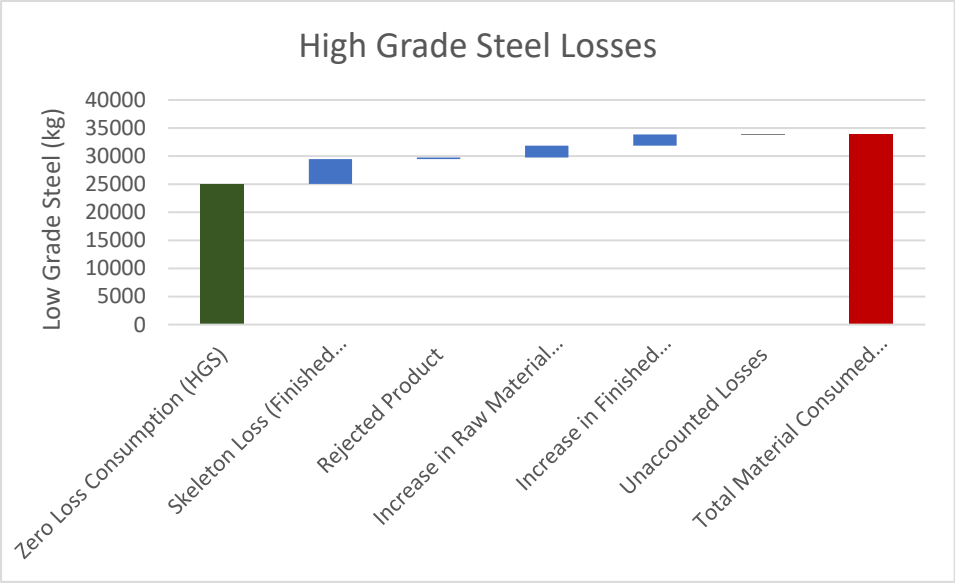
Candidates may estimate that the recycled material represents approximately 13% of material purchased.
Good candidates will not include this in either Zero Loss calculation as it is not required for ZL yield calculation. In addition, it is not possible to attribute it as a loss to either material as 1) we cannot separate out the materials, and 2) it would be double counting the skeleton losses, as we don't know what proportion of skeleton losses are in fact recycled.

Alternatively, candidates may state the assumption that the mixed recycled steel is low grade and attempt to include it in LGS. Full credit may be given for this if the assumption is clearly stated an attempt is made to avoid double-counting the skeleton waste.

The best candidates will note that while most (99%) of the HGS is accounted for by the above losses, there is a large (11,300kg/16.7%) unaccounted loss of material for LGS.

Exceptional candidates may represent the losses with sketches of bar charts/waterfall diagrams similar to the following (sketches that show the approximate relative sizes of the losses should get full credit):





Exceptional candidates will note that this is less than the estimates of 20% and 15% respectively because we cannot assume that all of the material gets to the stamping process and therefore suffers the skeleton loss.

Comments and refining the analysis

The dominant factor for both blades is the skeleton waste. Scrap rates are comparatively low.
The total skeleton waste as a proportion of total loss appears lower than the estimates of skeleton waste per sheet (16% and 13% rather than 20% and 15%) but this is because we cannot assume that all of the purchased material gets as far as the process that generates the skeleton waste.

Implications of inventory waste:
This material/these products are not necessarily lost. However there is a capital cost associated with purchasing the material (as opposed to a Just in Time), a storage cost, and a risk of stock/inventory becoming damaged or obsolete (if, say, a customer cancels future orders).

There is significant unaccounted loss of LGS (Blade A). More investigation is needed to account for this material . Some credit can be given for illustrative examples of possible causes of losses (e.g. rework, missing inventory, higher skeleton waste than estimated), as long as it is clearly stated that these are speculative and not possible to certainly determine from the information given – hence the need for further investigation.

It should be noted that not all of the lost material is recycled as the recycled mass is ~3000kg lower than even conservative estimates of the skeleton waste.

Mixing the recycling streams represents a loss in value. There is currently incomplete data on the relative quantities of the two materials.

No information is provided on the relative value of the low grade and high grade raw materials.

(iii) Deriving a single metric to compare Zero Loss assessments across a range of materials requires a way to turn the relative value of each material into a single shared metric, typically financial cost, or embodied carbon, using the price per kilo or embodied carbon footprint of the material. Missing factors may have been identified in the answer to (ii), but the major omission is the absence of materials costs for the two materials.

The choice of environmental or financial impact for the single metric will affect the decisions made as a result, and should be guided by the objective of the analysis: minimising environmental impact, or maximising financial performance. Using environmental impact is more likely to lead to environmentally optimal choices, but framing the analysis in terms of financial impact will increase the likelihood of action being taken as a result.

b i) There are four categories of uncaptured value: missing, destroyed, surplus and absent.

Mixing the high grade and low grade recycling streams reduces the value of the high grade steel. This is as an example of Value Destroyed because of the difficultly in extracting contaminants from a mixed grade of steel.

Separating them is a good idea, but there may be additional logistical and/or labour costs . The value of the recycling the high grade steel separately will need to be greater than this cost.
The financial value created by separating the streams will be shared between the recycler and the factory. The proportion allocated to the factory must exceed the costs in order to justify the change.

ii) There is a tradeoff between the Value Created (improved efficiency of the turbine) and the increased skeleton waste.

Better candidates will estimate the impact of this increase quantitatively by estimating the total mass of steel required to make the old and new designs:

Old Blade: Mass = 0.5kg Skeleton Waste = 0.5 * 20/80 = 0.09kg Total = 0.59kg

New Blade: Mass = 0.4kg Skeleton Waste = 0.4 * 32/68 = 0.19kg Total = 0.59kg

The total amount of steel required to make the blade is the same. The main sustainability improvement comes from the increased efficiency of the turbine. The increased skeleton waste may be recycled, which reduces value uncaptured to some extent.

This illustrates the principle of sustainability by design. The new design does not increase the waste, it just shows that some of the material that went into the original blade was unseen waste that has now been identified. There might be cost implications for the manufacturer or the customer in making/adopting the new product.

Basic answers will identify some of the factors in the analysis and calculations, and show some understanding of the principles involved, but the work may be superficial and inaccurate.
Good answers will show competence across all the topics discussed, and may give some insights into the more detailed factors.
Excellent answers will demonstrate some critical analysis of the problem, drawing together material from a range of sources to propose improvements to the analysis and future actions for the company.

Examiner's comments
(a) (i) Most candidates had reasonable understanding of the concept of zero loss yield, although few gave exact definitions. Descriptions of the data required and how it could be obtained often lacked detail.
(ii) A range of approaches, but generally sensible assumptions were made. Calculations were often incomplete.
(iii) Omitted by a number of candidates, and answers were generally rather weak.
(b) Most candidates were familiar with the concept of value uncaptured, and there were a number of good answers.

MET IIB 2024 Paper 2 – Question 6, post-exam crib

(a) Explain what is meant by a *logic model* in the context of policymaking. Use examples to support your answer.

[15%]

(b) The UK government wants to encourage smaller manufacturing firms to adopt technologies likely to reduce their climate impact. Describe how *technology management tools* could be used to identify and select which technologies the government should be encouraging such firms to use.

[40%]

(c) Discuss how a *logic model* could be used effectively to support the planning and implementation of a policy programme for the diffusion and deployment of the technologies identified from the use of tools described in part (b).

[45%]

Crib:

(a)

Basic answer

- Demonstrate understanding of what a basic logic model is (I-O-O-I), how it is used in the context of policy (i.e. Policy design and programme planning, monitoring and evaluation, communication, consensus-building, budgeting and fundraising).
- Provide at least one example of such logic model applied to a policy context – could be from lecture (Business Finland and HVMC examples) or elsewhere.

Stronger answer

- Demonstrate understanding of the characteristics of an effective logic model (participatory, cause-effect, feasibility, etc).
- Use a range of examples to show the different ways logic models can be applied.

(b)

Basic answer

- Identify that the most relevant tools would be those related to identification (e.g. tools used to support the process of technology intelligence) and selection (e.g. roadmapping).
- Describe the use and TRM tools to identify climate change mitigation and adaptation technologies relevant for manufacturing firms and, specifically, those appropriate for use in smaller, resource constrained firms.

Stronger answer

- How such technologies, once identified and selected, could be acquired and made available for use by such smaller manufacturers. This would also cover the use of tools to support with the assessment of maturity levels for technologies, the level of accessibility (e.g. IP-related issues).
- Should also address context specific issue of smaller manufacturing firms – limited resource, time, absorptive capacity. etc

(c)

Basic answer

- Demonstrate understanding of the difference between the diffusion and deployment activities, and of the process for both planning and implementing a new policy using a logic model.
- Would then describe examples of how such an approach could be used (e.g. use of energy monitoring technologies – **diffusion**: how connections could be made between larger more experienced firms and smaller ones, how standard approaches could be shared etc; then **deployment**: development of training programmes, access to support services, etc).

Stronger answer
Will cover:

- The broader context within which the logic model is developed (agenda setting, policy formation, monitoring and evaluation etc).
- Would describe the common challenges facing diffusion and adoption – limited awareness, lack of funding, etc.
- Would describe the common barriers to diffusion and deployment – especially in the context of smaller, resource-poor manufacturing firms.

Post exam comments:

For part (a), all students could describe, at least in very basic terms, the stepped approach of a logic model, and what its purpose is in the context of policymaking. Better answers were able to provide more detail to demonstrate greater depth of understanding, and illustrate their answer with an example.

For part (b), stronger answers were those that picked specific tools for identification (e.g. technology intelligence) and selection (e.g. roadmapping), and described their application in this specific context. Weaker answers just described technology management tools - or even generic strategy tools – without demonstrating understanding of their relevance to this specific context.

For part (c), the stronger answers demonstrated clear understanding of how the logic model could be used to support both planning **and** implementation for both diffusion **and** deployment. The weaker answers just described possible policy initiatives to address the required need.