1. The executives of an established multinational detergent company are reviewing their technology and business strategy to make sure the company is ready to face significant changes in the market in the next 5 years. They expect changes as consequences of updates of trade frameworks, changing consumer preferences related to anthropogenic climate change and the Covid-19 pandemic. The executives are interested in identifying and taking advantage of new technologies to face this emergent uncertain future.

(a) Describe what is meant by *technology roadmapping* and explain, using examples from the scenario described above, how the company could use it to support the development of its strategic plans. [20%]

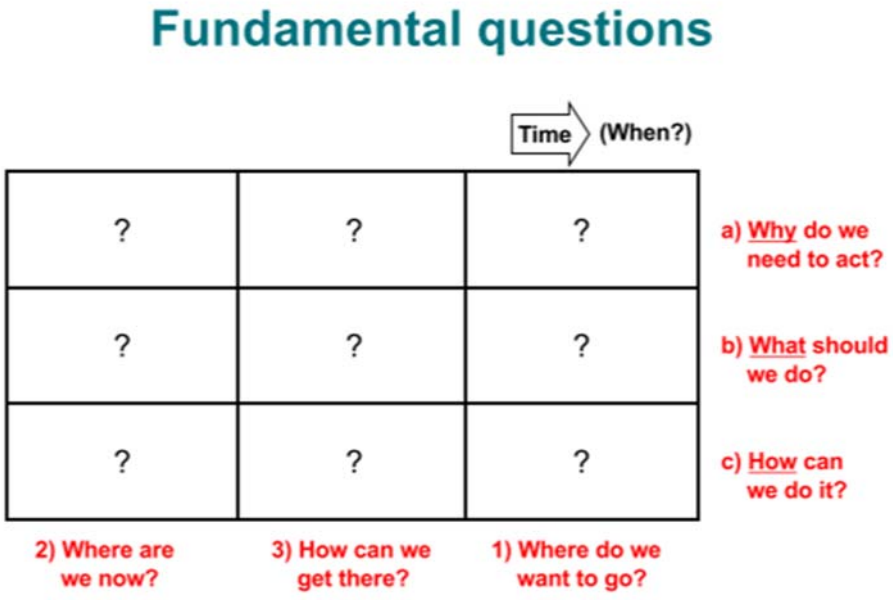
(b) Describe four other strategic *technology management tools* that the company could deploy and explain how these could be combined with technology roadmapping for its strategic planning. [40%]

(c) Discuss how the company could configure their *technology management processes* to support the development and implementation of the strategic plans. [40%]

Crib

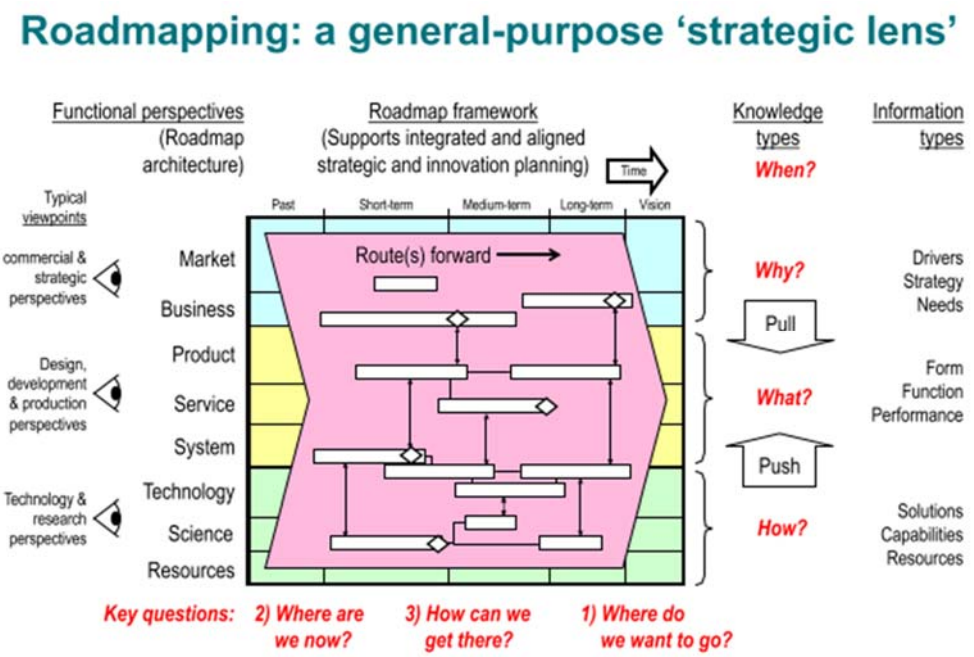
Part (a)

Basic answer: The students are expected to describe at least the basic characteristics of "roadmapping" (RM) as a strategic management tool (the alignment of elements in the vertical layers against the horizontal timeline), referring to the following slide which captures the fundamental questions. Some description of how the RM tool could be deployed (workshop based, at different levels in the organisation, bringing people from different backgrounds in, done and updated regularly etc.)

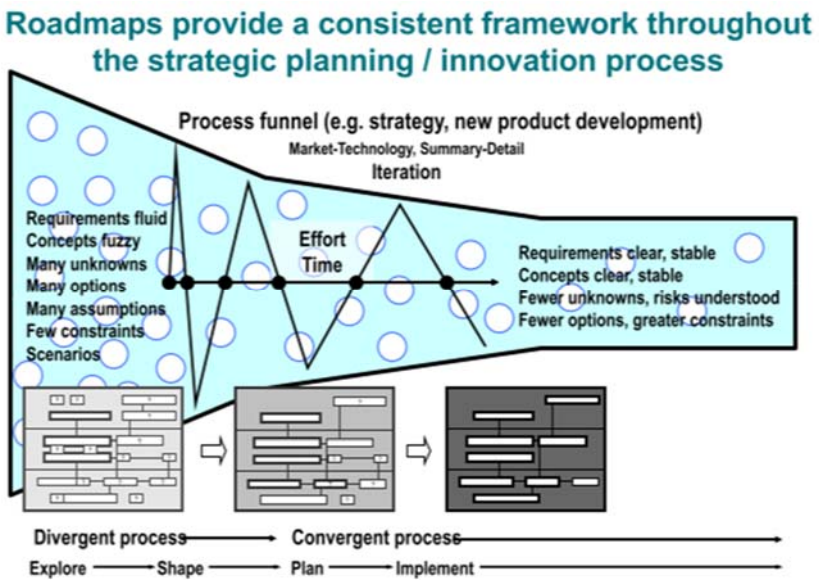


Good answer: Students might be able to improve the answer above, by adding one/all of the following e.g.

- Make reference to the slide below as a more detailed version of the one with fundamental questions only (See basic answer).
- Answers should refer to the given scenario and how the given trends would be reflected in the roadmap (e.g. as drivers in the top layer).
- Explain that roadmapping can be used to integrate strategic and technology planning



- Improve the explanation of how roadmaps could be configured to accommodate different specific planning needs (e.g. product and innovation plans within the larger strategic aims).
- be able to explain that roadmaps can be adapted to support the development of strategic plans using divergent/convergent processes which move from a generic strategic vision to a more specific set of future actions (see slide below)



Excellent answer: Will be those in which students, beyond describing the technicalities of the tool, also demonstrate an appreciation of the specific turbulent background described in the introduction and are capable of demonstrating an understanding of the potential factors affecting the deployment of the roadmapping in situations of high uncertainty. For this to be shown, the students will need to draw across the material presented in the whole TIM module and beyond, referring to material illustrated also in other modules (e.g. strategy and marketing, managing leadership):

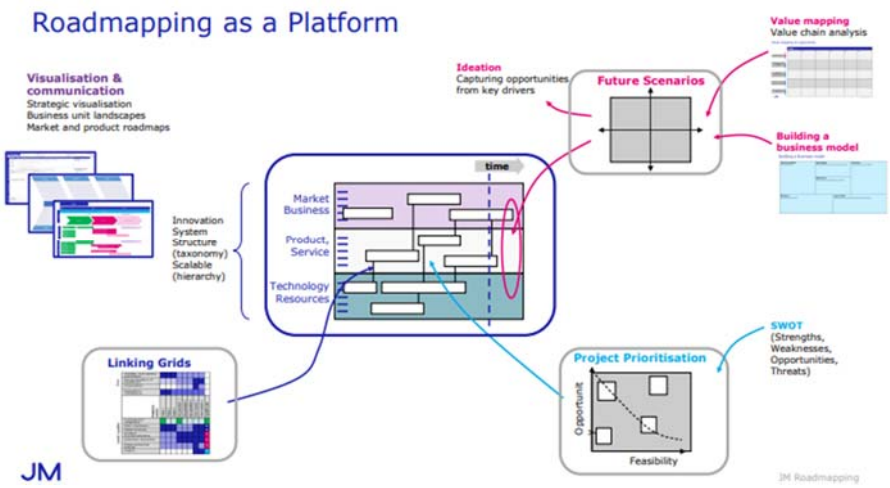
- Recognising that the company strategy is evidently market-driven, but that the company is trying to respond with technological innovation to support the development of a new strategy. Roadmapping is a good tool to make these points of view converge.
- Acknowledging the importance of human/organisational elements in the deployment of the tools (e.g. mentioning Not Invented Here Syndrome, organisational obstacles, needs of identifying a leadership for potential change – e.g. see managing people module)
- Highlighting the needs for creating cultural space for the functioning of such tools (involving right people)
- Using different types of visualisations to highlight important factors
- Recognize that roadmaps are an excellent communication tool to support the implementation of the strategy through getting different departments aligned with its strategic plan
- Emphasising the value of the light-weight nature of roadmapping (as there is much uncertainty, the tools need to be iterated fast to allow the company to remain agile)
- etc.

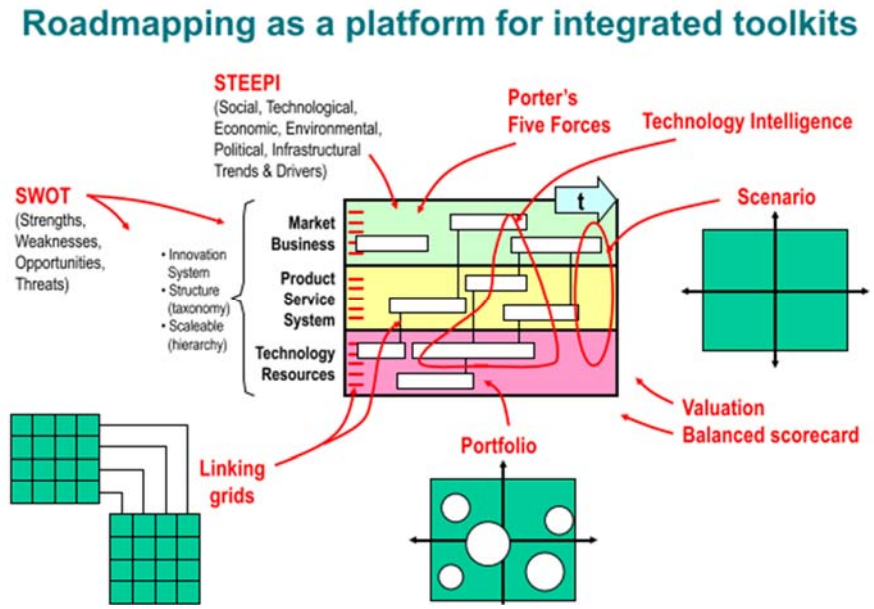
Post exam comment: Unfortunately, very few students actually drew a detailed roadmap template, which could have helped with structuring the answer, e.g. linking examples to the layers. Some students strongly emphasise that roadmapping links to very other tools. Some students have then even explained these other tools, which has not been asked for in this question. This has been subject to the second part of this question. Surprisingly, even though asked for explicitly in the question, a number of students did not refer to examples from the scenario.

Part (b)

Basic answer: The students list and describe 4 other tools that were introduced and discussed in the TIM module, such as scenario planning, linking grids, portfolio, STEEPI, valuation methods, balanced scorecards, and patent analysis. Importantly, students should be selecting tools and not choose theoretical concepts/frameworks, such as new product development processes or open innovation.

They might be able to reproduce few elements from the following slides to explain (with sketches or in writing) how roadmapping could provide a strong template to combine the analyses obtained with the other tools.





Good answer: The students should be able to go beyond listing and describing the basics of other tools (what are they for) and reproduce the diagram above with some accuracy providing some explanations of tools integration.

Excellent answer: The best students are capable of describing the pros and limits (e.g. patent data is always at least 18 months old) of the tools. In their descriptions of how the tools can be combined they draw up the sequences and the logics of their deployment in combination (e.g. starting with scenario planning to identify potential alternative visions of a future, for the most significant uncertainties, and then deploy roadmapping to structure a strategic plan).

Post exam comment: Some students only described the tools, but did not explain how they link to roadmapping.

Part (c)

This part of the question aims to understand whether the students have internalised the various approaches encompassed by the ISAEP process model and are capable of reflecting on the particular company circumstances to identify suitable approaches. Students might vary in their choices of activities which can be included, but it is expected that they will list some for each of the 5 technology management processes: Identification, selection, acquisition, exploitation and protection. Most pertinent answers will be acceptable, and the distinction between marks outcomes will depend on the depth of the justification provided.

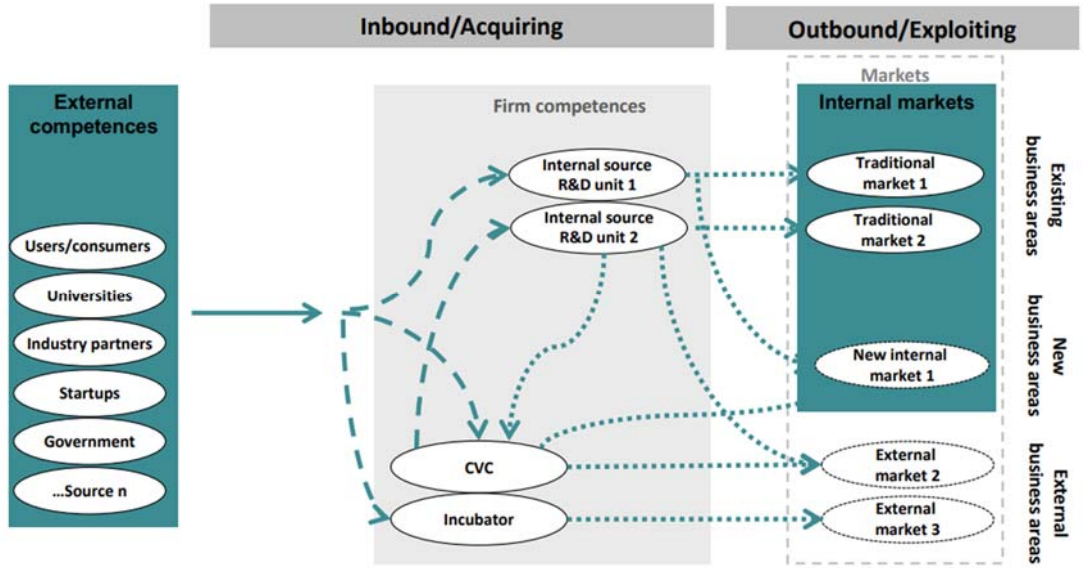
Basic answers are expected to describe some activities which a large company, such as the one in the introductory description, could implement to satisfy each technology management process. These answers will be weakly covering the explanation for the choice. As selection tools have not been covered extensively in the module, weak/no answers in this respect will not be considered negatively.

Good answers: Will be more complete with students posing more emphasis on the justification for some of the ISAEP processes. For instance, they might discuss in more details the need to support the identification process with intelligence processes, focussing on developing new ways to "target" information about potential applications of new technologies which could provide innovative solutions, providing examples of the sources to be monitored. They also might want to open up and reinforce the scanning activities, to pick up signals of "unknown-unknowns". Further they might pose emphasis on developing an awareness of different experts/companies from whom to acquire the technologies. Also, they might indicate the need to develop new ways to pay attention to the IP portfolio, which might include patents, copyrights and the other informal IP assets. They might reveal awareness to the fact that, since new technologies are emerging, they are likely to be outside the company remit and hence the organisation might be wise to reinforce the Acquisition though open innovation approaches. This might mean training individuals and aligning functions to become capable of deciding what to develop in house (make) and what to acquire externally through collaborations (buy). They may talk of the need to identify new business models to exploit the technologies etc.

Excellent answer: Students will do the above expanding their answers – i.e. each element of the ISAEP model will be considered in details with pros and cons, challenges, and options in relations to the company type, and their strategic needs. By doing so, they demonstrate a deep

appreciation for the content delivered in the TIM module, the links between each of the sessions and the applicability of the concepts to specific contexts. For example, for Identification they may cover specific needs for information emerging from the roadmapping/strategic plans and suggest to develop as a result an intelligence systems which responds to the need of information in trends from technology/competitors/ markets, describing specific challenges related to this type of activity such as the difficulty of evaluation the maturity of the technologies and the potential for creating technological discontinuity, the issue of convincing audiences of the meaning of the intelligence. For protection they might talk about the need for developing an IP strategy in response to the largest corporative strategic plans.

They might discuss the link between the Identification (the sources of technology at the right side of the slide below) with the acquisition and the exploitation and protection pathways.



Post exam comment: A number of students struggled with this question not providing a structured discussion, but rather a descriptive account of how a company can develop their strategic plans. Some students even had difficulties with the ISAEP framework, i.e. the five key technology management processes. Very few of the answers made any reference to the scenario.

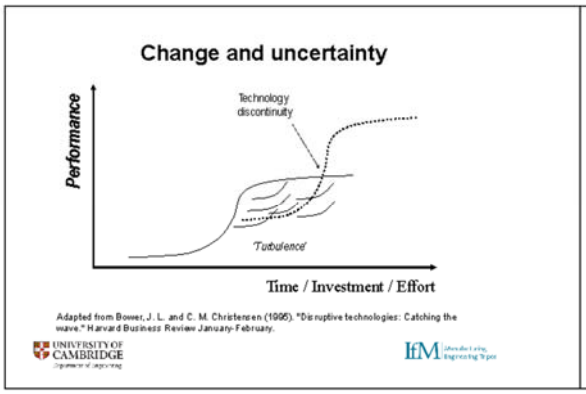
2 (a) Describe and explain the uses of:
(i) *Technology S-Curves*;
(ii) *Technology Readiness Levels* (*TRLs).* [30%]

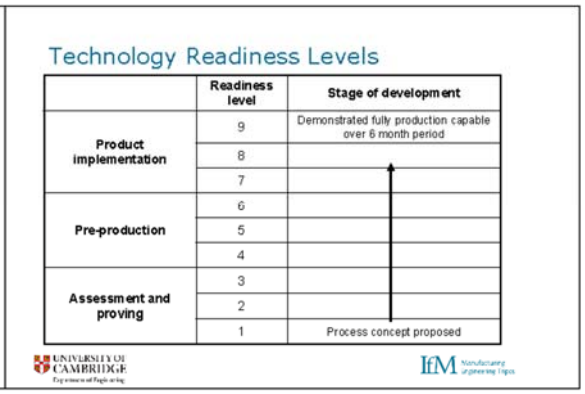
(b) Explain, giving examples, the concept of *disruptive technologies* and discuss why large, established firms find it difficult to respond to technologies which have the potential to become disruptive. [40%]

(c) Discuss how *open innovation* could be used to help firms deal with technologies that have the potential to become disruptive. [30%]

Crib
(a)

Basic answers will describe a technology S-curve, showing how it maps the evolution of the performance of a technology over its lifecycle allowing firms to compare different aspects of a technology's performance. For TRLS, the basic answer will show how they represent a way of classifying the maturity of a technology from proof of concept through to in-service application.



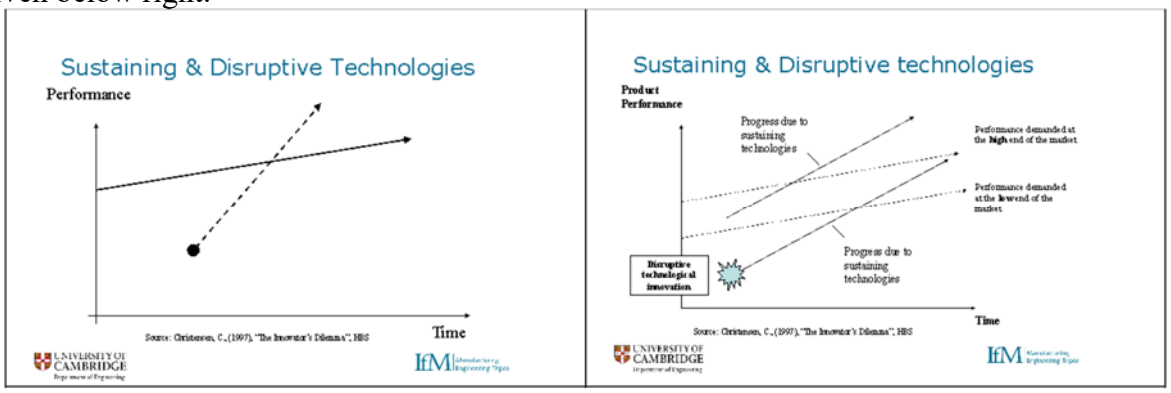


Stronger answers could also illustrate how s-curves can help firms assess the threats posed by emerging technologies through comparison of different benefits perceived by the customer. TRLs can be used by firms and governments to target investments and measure the progress of technologies from science to application.
Excellent answers will also show how these concepts are interconnected and can be used to support the lifecycle management of a portfolio of technologies and products. Excellent answers might also highlight the challenges of using s-curves (e.g. poor predictive value) and TRLs (e.g. overly simplistic representation of very complex process, although the steps are represented as equal, the progress from one maturity level to the next might involve very different resource amounts). Illustration with real technology examples will be also taken as a demonstration of capability to apply the concepts.

Post exam comments: the quality of the responses were better for the TRL than for the S-curves. Some students did not describe the S-curve correctly.

(b)
Basic answers will describe the concept of disruptive technologies either based upon the very simple summary slide shown below left, or exploring the more detailed description

given below right.



The basic answer should also address the key challenges that disruptive technologies pose for incumbent firms, i.e. problems assessing the relative impact that a potentially disruptive innovation might have, inertia in responding to such a threat resulting from scale and rigidity of existing operations, etc. Examples are scant and based on repeating the lecture notes.

Stronger answers would add to this by linking disruption back to concepts of s-curves (as shown above) and show how the integration of such frameworks/concepts can support decision making in response to potentially disruptive innovations. This could also be used to reinforce the challenges this presents for incumbent firms given the resources they will have embedded in the current technology, and the challenges of dealing with the 'noise' of resulting from multiple potentially threatening innovations. Examples are more rich and attempt to show that the author has internalised the concept of disruption.

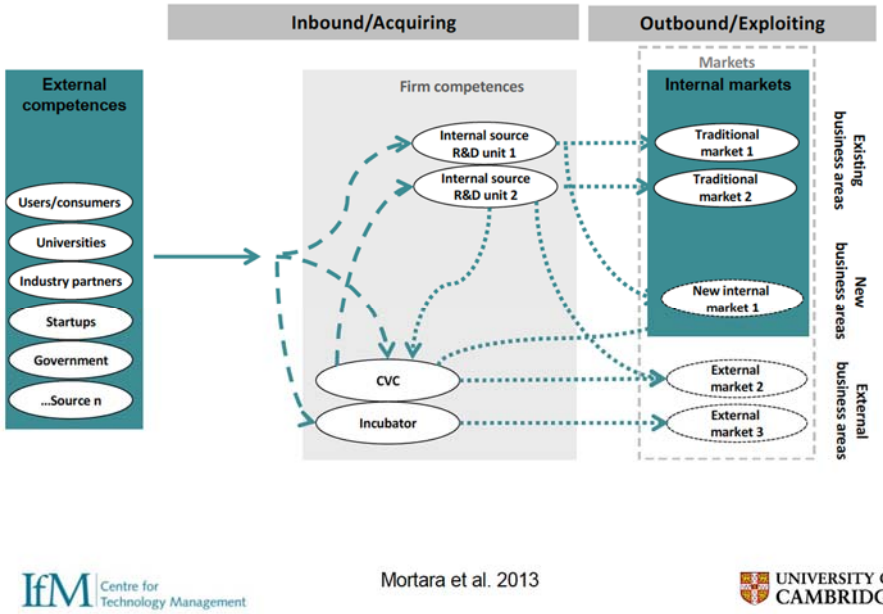
Excellent answers could explore some of the critiques of disruptive innovations (i.e. what does 'disruptive' really mean? Can you realistically ever assess 'disruption' until after it has occurred?, etc) as covered in the Christensen et al. (2015) paper, and /or discuss how such issues could be linked to national level issues such as policies to help firms manage disruptive innovations (linking to EGP module content). Examples venture to discuss a variety of technologies showing that the author is fully aware of the theory and applications of the disruption concept.

Post exam comment: not all answers did cover the explanation of the disruptive technologies besides a few generic words. Overall, the scripts had better quality answers for the challenges faced by incumbents in responding to the emergence of disruptive technologies.

(c)
Basic answers will explain what is meant by open innovation, and discuss the general point that open innovation provides multiple mechanisms for helping to identify and monitor emerging innovations, and a channel by which these innovations can be acquired once their real value and potential becomes clearer.

Stronger answers could also explore the relative merits of different open innovation mechanisms (formal, informal, financial, non-financial, etc) and partners (start-ups, universities, suppliers, etc), and how each of these provides different mechanisms for responding to disruptive innovations at different stages of development.

Excellent answers could also link these issues to topics covered in the EGP module relating to ways in which governments support open approaches via their investments in universities and innovation ecosystems which can provide support for firms seeking to respond to potential disruptions. These authors will use material broadly across the various modules to explain that OI allows to experiment (it reduces the risks in developing innovation, accelerates time to completion, increases the innovation rates etc.) and acquire knowledge in technologies which could be potentially be exploited in a variety of markets. In this way the company is able to open up to a broad set of market opportunities (right side of fig below), which go beyond the traditional ones, and has more ways to exploit innovation.



3. (a) Discuss the differences between the typical people management challenges a leader would be expected to address within the following contexts:
(i) a large, long-established multinational firm;
(ii) a large but fast-growing technology firm;
(iii) an early-stage technology firm backed by venture capital. [50%]

(b) Discuss the people-related issues that might need to be considered with the emergence and diffusion of industrial digitalisation technologies from the perspective of:
(i) a national government;
(ii) a large manufacturing firm. [50%]

Crib
(a)
Basic answers should be able to structure an answer that demonstrates awareness that all three types of firms will be addressing common issues (e.g. talent management (recruiting, developing, rewarding, exciting people); managing change, etc) but that the context within which they operate means that they will do this in different ways.

For example: (i) a large, long-established multinational firm; is likely to have developed an incumbent position and recruited and developed people based on certain level of stability. This will imply quite tightly defined roles within a defined hierarchy, and structured approaches to recruitment, reward etc. A significant issue is likely to be how the firm manages change in response to external factors. Students could draw upon the module readings from, e.g. Kotter, as well as examples discussed in the module of e.g. Microsoft and Vodafone.

(ii) a large but fast-growing technology firm; students need to demonstrate awareness that in this context, management and leadership faces an inherent dilemma: they are both big AND fast growing, so the 'normal' approaches of managing at scale (discussed in (i) above) don't completely apply, but the approach taken by a fast growing startup (to be described in (iii)) also don't necessarily work at scale. Issues of recruitment based on values rather than just on capabilities (as discussed in class with the Amazon example) is an example of the type of issue that could be discussed here.

(iii) an early stage, venture capital-backed technology firm. These firms will face the issues discussed both in IIA and IIB using the 'cycle of enterprise' including liability of newness (why would people join an 'unproven' firm), the demands of rapid growth and typically highly uncertain commercial environment meaning that roles are hard to define and/or may change rapidly, and demands of VC investors (see Stanford study introduced in the module).

Better answers would be able to structure answers to all three of these issues with links to the theories discussed / re-introduced at the start of the module, e.g. for change = Kotter plus developmental/transitional/transformative; for leadership = reference to four theories of trait, behavioural, contingency and new genre. These stronger answers could also reflect on issues of culture, motivation and organisational design in each of these contexts.

Excellent answers could also demonstrate awareness of differences within as well as across each of these contexts driven by, for example, the nature of the industry within which these firms are operating (defined by the technology sector, the 'clockspeed' of the industry etc), broader demographic issues (generational differences – baby boomers, millennials, Gen X, Y, Z, etc; aging population; impact of Brexit on free movement, etc).

Post exam comments:
Most students were able to address the basic issues identified above. Some answers to (ii) just implied 'it's a bit of (i) and (iii)', which didn't allow them to demonstrate the particular issues of managing growth and speed and scale. Some of the stronger answers also explored issues beyond the firm boundary and discussed people management issues with collaborators and suppliers. Stronger answers were also able to bring in relevant examples to illustrate key points, and use concepts from the lectures (especially the SPEC framework) to demonstrate a structured depth of understanding.

(b)
(i) a national government;
Basic answers would explain the nature of industrial digitalisation and generally what types of people issues might arise (e.g. What skills are needed? Does the current workforce have them? How do you develop the skills needed). Governments will be particularly concerned about issues of national competitiveness and employment, and the possible tensions between them (e.g. these technologies will make national firms more competitive but might make

people redundant). There will then be issues about whether there is a role for government in the development of the required skills (ideological issues may arise: free market c.f. interventionist). If there is a role for government, there should be a discussion of how governments could intervene to influence things (drawing upon material provided in the EGP module, the national AM strategy case study introduced in the MPL module, and readings provided on Moodle.

Better answers would be able to describe the nature of interventions that a government could make (in the context of the relevant ideology) such as development of training programmes and the use of demonstrators to support firms to develop relevant skills. These would also acknowledge the different timeframes involved from a national perspective, i.e. retraining those currently in the workforce as well as future workers who are currently in fulltime education.

Excellent answers might be able to enrichen the responses by illustrating the ways in which various national governments have done this, drawing upon material presented in the EGP module on various international approaches to supporting industry transformation, and the examples given in the MPL module. Such answers might also reflect on the role of government supported initiatives such as the UK Catapult centres.

(ii) a large manufacturing firm.
The **basic answer** should link to the response given to (a)(i) as this is about change management within a large organisation. The basic answer could just describe generic issues of change management within a large organisation (drawing up papers/models from Kotter, Satir, et al.) in response to an external change but should acknowledge some aspects of the specifics of this situation, determined by the nature of the change being driven by digital technologies which, unlike changes such as the arrival of CNC or AM, have the potential to affect the whole business and its supply chains. The different types of change (developmental/transitional/transformative) described in (a)(i) should ideally be referenced here.

Better answers could draw upon the material the students have explored through the analysis of Rolls-Royce in the module assessment to illustrate in detail the ways in which such companies have dealt with the people issues of such a transformation.

Excellent answers might reflect upon the different nature of the skills required for such a transformation ranging from those required for the adoption of existing digital technologies compared to those required for the development and adoption of future technologies. These answers could also reflect upon the ways in which digitalisation affects much more than just core manufacturing activities, and hence skills issues for a complete digitally transformed business could be mentioned. Issues of how the national issues affect (and vice versa) the single corporation could also be explored.

Post exam comments:
Most students were able to demonstrate the basic issues identified above. Part (i) was generally weaker than part (ii). For Part (i), we were looking for students to demonstrate awareness of the different roles of government in supporting emergence and diffusion, and the specific ones that impact people. Weaker answers just gave quite broad comments on digital technologies and training programmes the government might deliver. Stronger

answers provided a structured view of the roles of government (from EGP module), focusing on people issues across the different roles – from up-skilling existing workers to those in full-time education; preparing for potential job losses, etc. Responses to (ii) were stronger as this could be linked to part a (i), and focus on the people aspects of change management in response to a new technology. Strong answers considered the need to balance short, medium and long term, and the nature of the technology.

4. (a) Define and explain the concept of *strategy* in the business environment. [15%]

(b) Within the broad concept of *strategy*, explain what is meant by *operations strategy*. [15%]

(c) Explain the concept of *strategic reconciliation* (also known as *strategic alignment*) in the context of *operations strategy* and *business strategy*. [20%]

(d) Discuss the interaction between *business strategy* and *operations strategy* with a focus on:
(i) *competitive priorities*;
(ii) *performance objectives*;
(iii) *strategy decision areas*. [25%]

(e) Discuss why *strategic alignment* might be difficult to achieve in practice. Give two different case examples of *strategic alignment* (or lack thereof) from your recent experiences or studies. [25%]

Crib

(a)
Good answers will generally start with a definition from course material or their personal research – e.g. based on Chandler's: Strategy is "the determination of the basic long-term goals and objectives of an enterprise, and the adoption of course of action and the allocation of resources necessary for carrying out these goals"(Chandler, 1962). Good answers will discuss timelines – typically 3-5 years. Good answers will discuss different levels of strategy:
• Corporate
• Business
• Operations – Marketing – Technology – other functional strategies

Better answers will also cover more concepts from the theory explained in the course and draw, for example, on Strategy Concepts described by Mintzberg and discuss different views/types of strategy such as differentiating between Intended vs Emergent Strategy.

Outstanding answers will be more critical and discuss the clock-speed of different sectors – eg electronics months/years, aerospace years/decades and even of different levels of management – "discretion time" of senior management in years, managers in months and day-to-day of staff.

(b)
Good answers will include a definition: e.g. operations strategy involve "… 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 …" (Slack & Lewis, 2003) Better answers might adopt comparisons /relationship /differences with other types of strategy (e.g. - Business Strategy – which aims at establishing a competitive advantage, trying to answer questions like
• How do we compete in this business?
• What is the mission of this business?
• What are the strategic objectives of this business?)

- Or functional-level strategies - which involve individual departments, functions, or roles within the company. (• What are the strategic objectives of the function?• How are resources managed in the function?• What technology do we use in the function?• What skills are required by workers in the function?)

Excellent answers will conclude with the need to Align/Reconcile Operations with Business Strategy, and functional strategy with operations strategy etc.

(c)
Good answers The concept of strategic alignment or reconciliation, depending on the literature of reference, is fairly generic. Answers will probably pick up on part b) and on the difference between Business and Operations Strategy and the degree to which they should be aligned in order to achieve common goals - usually dictated by the higher-level strategy – in this case Business Strategy. In this part of the question the student might be able to talk about vertical alignment and horizonal alignment – e.g. between Operations and Marketing (and possibly Technology).

Better answers: Candidates will probably discuss the Reconciliation of Strategy Objectives against Decision Areas and the necessary trade-offs. All Strategies should complement each other and other descriptors such as coherent, consistent and consensual may be used.

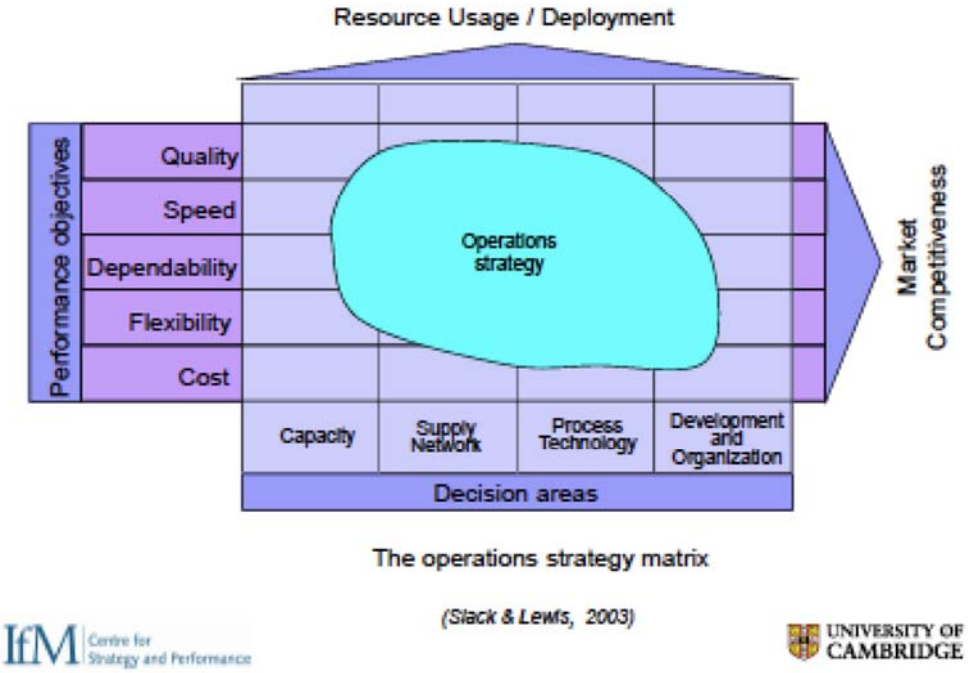
Very good answers will discuss the dynamics of strategy and evolution/development over time. The answer will also refer to the need of setting Performance Objectives against Decision Areas. It will also refer to tools which can help create operations strategy such as Porter's Value Chain and strategic roadmapping. 'Operations' and 'Sales and Marketing' are primary activities.

(d)
Good Answers could introduce the concept of Strategic Fit - the degree to which an organisation matches its resources and capabilities with the opportunities in the external environment. The matching takes place through strategy and it is therefore vital that the company has the actual resources and capabilities. Further, the internal relationships within businesses are too often not consensual and answers will include the tension and stress that exists between, say, Sales & Marketing and Operations and Manufacturing. More generally there can be issues with different targets for different units, communication, flexibility, culture and people to execute and support the strategy.

Better answers will include at least a relevant example, showing clear understanding of Strategic cross-functional alignment And/or the answer will not only provide examples but discuss possible solutions, i.e. tools for aligning strategies. will introduce Strategic Roadmapping and how it can be used to link/integrate the different levels of Strategy.

Excellent answers will be complete (explanation of tension and 2 examples) and will explain the examples contextualising them with wider research and referencing.

(e)
The question builds on the following slide which shows how the concepts in the question relate.



The operations strategy matrix

(Slack & Lewis, 2003)

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A basic answer will generically describe the need for a firm to position operation decisions considering the intersection between performance objectives and decision areas. (outline the operation strategy matrix)

A better answer will add more details (e.g. of performance objectives and their priority) recognising that the matrix is liked to market competitiveness

An excellent answer will contextualise the use of the matrices with examples from readings and personal experience

5. (a) Explain the key principles, benefits and barriers of the *Circular Economy* model, discussing how the principles could be implemented in industry. Provide examples where appropriate. [30%]

(b) Electric cars are dominating the mobility business in many economies. Tesla, Nissan and BMW are some of the leading innovators in this space.

(i) Using the technical cycle of the *MacArthur Foundation Circular Economy Approach*, explain and illustrate with examples the Circular Economy of Electric Cars [40%]

(ii) Using the *Value Exploration Approach*, explain and illustrate with examples the *value captured*, *value uncaptured* and *value opportunity* of Electric Cars. [30%]

Crib

1.
(a)
The circular economy (CE) is a systems solution framework that tackles global challenges like climate change, biodiversity loss, waste, and pollution. **CE is an industrial economy that is restorative or regenerative by intention and design".**
The Circular Economy moves:

- **from** a linear economy dominated by the sale of products: rewards are based on resource consumption.
- **to** an economy that rewards resource conservation and restoration.

The three key environmental principles of the CE are:

1. Eliminate waste and pollution. We need to consider waste and pollution as design flaws rather than inevitable by-products of the things we make. By changing our mindset and harnessing new materials and technology, we can ensure they're not created in the first place.

2. Circulate products and materials. We can design products to be reused, repaired, or remanufactured. But making things last forever isn't the only solution. When it comes to products like food or packaging, we should be able to keep them in circulation, so they don't end up in landfill. Examples could include but not limited to replenish, repurposing products and materials, the design for serviceability to extend the life of products and assets, operate with user-oriented services that maximise the use of products such as leasing, pooling, optimization of transport and logistics, among others

3. Regenerate nature. There's no concept of waste in nature. Everything is food for something else – a leaf that falls from the tree feeds the forest. By returning nutrients to the soil and other systems, we can enhance natural resources. Examples could include but not limited to residual supply chains, etc.

The circular economy (CE) is an industrial model that is regenerative by intention and design and aims to improve resources' performance and fight the volatility that climate change might bring to businesses. The CE model has benefits and also barriers of implementation.

Benefits are operational as well as strategic and brings together a huge potential for value creation within the economical, business, environmental and societal spheres.

Benefits include:
- Fewer greenhouse emissions
- Increase potential for economic growth
- Employment growth
- Volatility reduction and safeguarded supplies
- New profit opportunities
- Demand for new services
- Getting to know clients better

Barriers include:
Social and environmental externalities are not considered in prices, privileging financial market signals instead of people and nature when economic decisions are made;
Prices of raw materials are fickle and at low prices alternative, good quality secondary resources are not competitive;
Circular economy business models are harder to develop, as most investors are still working under a linear economy logic and sometimes upfront investments are required;
The demand for circular products and alternatives is still small.
Insufficient technical knowledge to support the growth of CE. There aren't still many qualified professionals with technical or 'information and communication technology' (ICT) knowledge.

Excellent answers will provide a good description all three principles of the CE, and will provide critical analysis of their relative impact. The minimisation of waste and pollution by product/technology design will positively impact the maximisation of the circularity and reuse products, and in turn, will positively impact the residual waste of products at the end of life by repurposing. Student could take the angle of materials or long-lasting product or process design or design for serviceability. Further, these answers will include a good description of the benefits and barriers of the circular economy model and will provide a critical analysis by comparing and contrasting the benefits and barriers. While the benefits of having positive environmental impact leads to potential strategic diversification of opportunities, the transition to fewer greenhouse emissions have consequences: new investments, internal change management, customer/consumer/user's readaptation, supply-contracts' change, new training needs, process reengineering, readaptation to new monetization models and social acceptance among others. A variety of examples from different industries of how the CE principles can be applied in industry are expected, including their benefits and barriers. For example, IKEA has set up a Circular Hub and re-sell used furniture for their range. This allows furniture to live longer and hence this example support both the reduce waste (first principle) and circulate products (second principle).

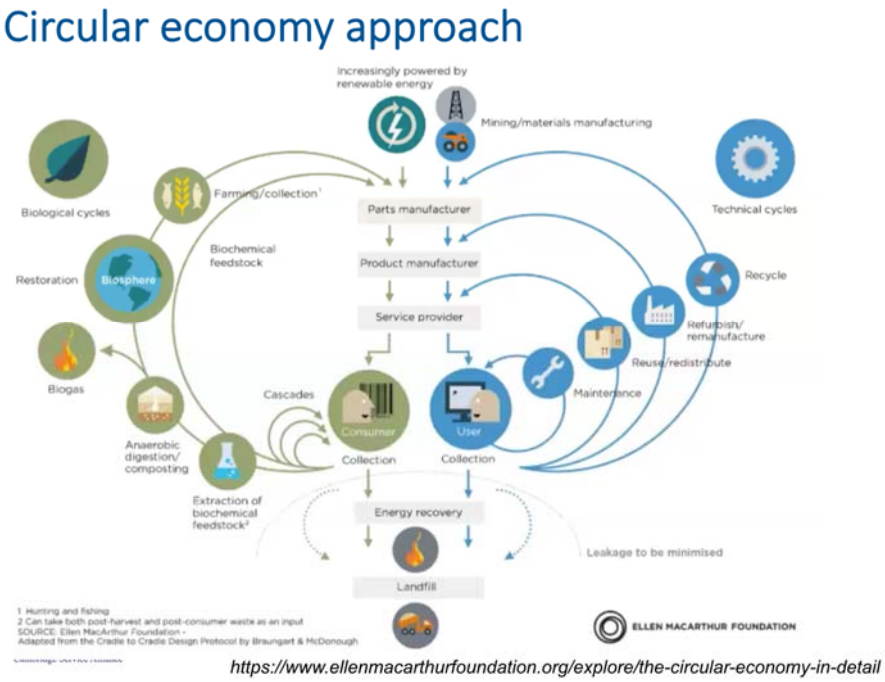
Good answers will provide a reasoned discussion of the key principles, their benefits and barriers and will make reference to few examples. For example, the comparison between the benefit and barriers could be concentrated only the economic impact such as, investment and

new monetization models, leaving behind the internal business change management, customer/user/consumer readaptation, supply-contracts' change, new training needs, process reengineering, and social acceptance among others.

Basic answers may focus on the part of the description of the key principles without much discussion, and will not be able to draw from examples so leaving significant gaps in coverage.

2.

(a)
The electric car circular economy should specifically discuss the technical cycle (see blue part of the Figure below) explaining and discussing which CE processes of the technical circle are/could be designed in the product lifecycle. The students should discuss and consider the impact of different solutions, including solutions from the design (e.g., for power feeding, electric batteries and others elements of the car) and how the maintenance and use models (including the leasing, renting, pooling models) influence the repurposing and recycling of assets.
Using the Ellen MacArthur Foundation Circular Economy Approach (see Figure below). The Circular Economy (CE) explains the two basic paths: the biological cycle and the technical cycle. The technical cycle Man-Made things, such as technology. The CE principles explain that things should not be consumed, but they should be USED. This is why the model reference to the 'consumer' and 'user'. The technical cycle – man-made: the biggest point on the Ellen MacArthur Foundation Circular Economy Approach – we try to make use of MANY inner LOOPS AS POSSIBLE – of MAINTENANCE AND RE-USE, to maximise the use of assets. Then as we continue in the optimization of the circularly, the circle will open and move to outer loops – REFURBISHMENT. The In-Out Cycle IS RECYCLE that should dominate all the journey of this approach. This is because as you move to the outside activities the activities become more resourced and energy intensive. So, we try to stick to the inner loos for as long and as frequent as possible.



https://www.ellenmacarthurfoundation.org/explore/the-circular-economy-in-detail

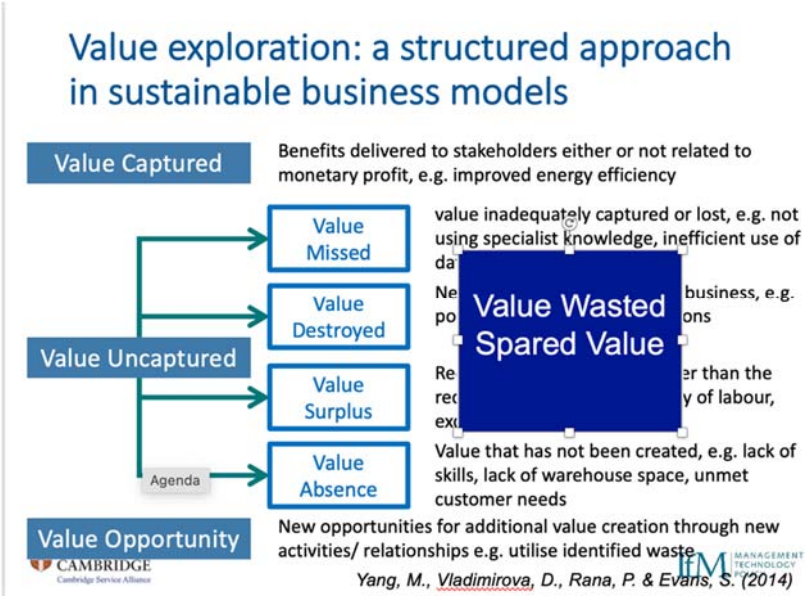
Excellent answers will consider all the elements of the technical cycles of the approach, and will provide examples and critical analysis of their complementarity among them. Strong insight into a wide range of illustrations will broaden the circularity from the source of energy that electric cars need to charge the electric batteries to the point of use such as parking and different model of use/ownership to encourage the maximisation of use. The most advanced answers will criticise that in a properly built circular economy, one should rather focus on avoiding the recycling stage at all costs. It may sound straightforward, but preventing waste from being created in the first place is the only realistic strategy."

Good answers will provide a reasoned set of examples of the most common element of the technical cycles, and will focus the examples in the electric car and illustrate to the use and maintenance of the electric batteries, the maximisation of use of breaks and tyres.

Basic answers may focus on only part of the cycles, examples might be basic leaving significant gaps in coverage to the core elements of re/use, maintenance and manufacturing. Elements might focus on the batteries and their recycle, and use.

(b)

The value exploration is a structured approach to design and evaluate sustainable business models. This has three elements the value captured, the value uncaptured and the value opportunity (see Figure below).



The three elements:
The Value Captured: Benefits delivered to stakeholders either or not related to monetary profit, e.g. improved energy efficiency, use clean energy and leaves behind the need of fossil fuels. The energy is generative by promoting the use of solar panels technology, currently tax in electric cars are inexistent (although this might change in the future).
The Value Uncaptured: has four dimensions.

- Value missed: value inadequately captured or lost, e.g. not using specialist knowledge, inefficient use of data,

- Value destroyed: Negative outcomes of current business, e.g. pollution, bad working conditions, production of electric cars are not carbon neutral, whist building eco-friendly cars the manufacturing of electric cars do not massively differ from the manufacturing of normal petrol cars. Future scarcity of lithium for electric batteries.
- Value surplus: Redundant value which is larger than the requirement, e.g. over capacity of labour, excess functionality, imbalance between the transportation needs and the electric car potential, generally consumers over consume and under use.
- Value absence: Value that has not been created, e.g. lack of skills, lack of warehouse space, unmet customer needs, business models dedicated to selling the use of electric batteries, similarly to the Rolls-Royce model of leasing airplane engines.

The Value opportunity: New opportunities for additional value creation through new activities/ relationships e.g. utilise identified waste, repurposing of electric batteries, repurposing of the back log of petrol and diesel cars and their part.

Excellent answers will discuss all the elements, will provide examples and critical analysis of their complementarity among them. Strong insight into a wide range of illustrations will broaden examples from the electric car industry, the circularly of clean energy generation by solar and wind turbines and investment of that energy into the electricity needed for electric cars. The most advance answers will criticise the social, environmental and societal aspects of the value captured, value uncaptured and value opportunity.

Good answers will provide a reasoned set of examples of the three element of value opportunity, and will focus the examples including the electric cars, batteries, recyclable electric car components. Good answers will also broader discussion and examples of a particular examples from key companies such as BMW, Tesla and compare their business models of renting vs owning an electric car.

Basic answers may focus on only part of the value, examples might be basic leaving significant gaps in coverage to the core elements particularly in the value uncaptured- missed destroyed and value surplus.

6. Tetra Pak, founded in Sweden in 1943, is the world's largest food packaging company with annual sales of €11.5 billion and around 25,000 employees operating out of 160 countries.

In 1954, the Company developed the first 500ml tetrahedron milk packaging machine. During the 50s and 60s the Company invested massively in Research and Development and by the 70s had developed the most advanced equipment and packing material on the market, carefully protected by various patents. Their aseptic packaging technology has been called "*the most important food packaging technology of the 20th century"* by the Institute of Food Technologists. Leveraging their innovation in both machinery and carton material the Company adopted a business model of selling the machinery to customers linked with exclusive supply of the carton material. Tetra Pak material was only sold to Tetra Pak machinery customers and these customers were barred from using carton material from other suppliers. By 1985, Tetra Pak had 91.8% of the EU market in aseptic filling machines and 89.1% of the market in the relevant cartons. In 1986, Tetra Pak acquired the Liquipak Group who had developed and patented a different but comparable technology. The EU Commission became concerned that Tetra Pak was using anti-competitive trading techniques in contravention of EU regulations. Court action dragged on for many years, but in the late 1990s the courts ruled against Tetra Pak and the company was fined for anti-competitive trading behaviour. In 2000, the Company started a complete review of its business strategy.

(a) Using the information above and stating any assumptions, use *Porter's Generic Competitive Strategies* tool (1985) or *Treacy & Wiersema's value disciplines model* (1995) and not more than 2 other marketing/business model tools to:

(i) Discuss Tetra Pak's business strategy up to 2000 (20%)
(ii) Outline and justify a strategy that Tetra Pak should adopt for the start of the 21st century (30%)

(b) Following the legal case, Lars Andersson, the Group Operations Director for Tetra Pak, was considering reviewing the Company's operations. The *Overall Equipment Effectiveness (OEE)* of the two plants in Dijon and Wrexham was under discussion to establish whether and how to rationalise manufacturing. One of his trusted lieutenants made the following observation: *"The factory at Dijon has a 7-colour printer which runs at 85% OEE – that's World Class! The same printer in Wrexham has an OEE of only 56%. Why not shut Wrexham and move the machinery to Dijon where the expertise of the French printers will give you a higher output at much lower cost?"*. The OEE models for the Dijon and Wrexham sites are shown in Table 1 and Table 2 respectively.

Dijon				
Reference Period	1 week			
OEE	85.6%			
Scheduled Time	120 hours = 100%			
Unaccounted OEE Losses	0.3 hours = 0.2% of Scheduled Time			
Loss Analysis				
	Number of events	**Average event duration (min)**	**Total time (hours)**	**Percentage of Scheduled Time**
Breakdowns	4	75.0	5.0	4.2
Short Stops	15	10.0	2.5	2.1
Speed Losses	1	90.0	1.5	1.3
Lack of Materials	2	45.0	1.5	1.3
Set-ups	3	120.0	6.0	5.0
Tool Change	0	0.0	0.0	0.0
Scrap	1	30.0	0.5	0.4

Table 1

Wrexham				
Reference Period	1 week			
OEE	55.8%			
Overall Scheduled Time	120 hours = 100%			
Unaccounted OEE Losses	0.8 hours = 0.7% of Scheduled Time			
Loss Analysis				
	Number of events	**Average event duration (min)**	**Total time (hours)**	**Percentage of Scheduled Time**
Breakdowns	4	30.0	2.0	1.7
Short Stops	10	7.2	1.2	1.0
Speed Losses	1	300.0	5.0	4.2
Lack of Materials	2	45.0	1.5	1.3
Set-ups	50	48.0	40	33.3
Tool Change	2	60.0	2.0	1.7
Scrap	1	30.0	0.5	0.4

Table 2

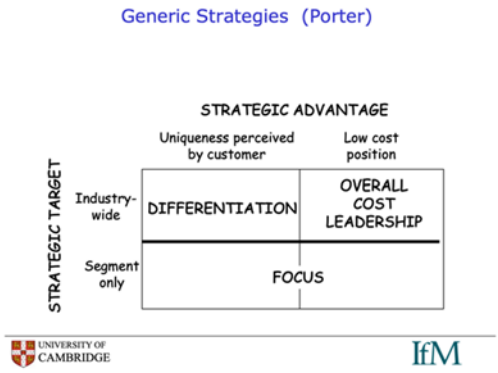
(i) If the company is to shut a plant, should it be Wrexham? Justify your answer. Assume distribution costs are similar from either site. (25%)

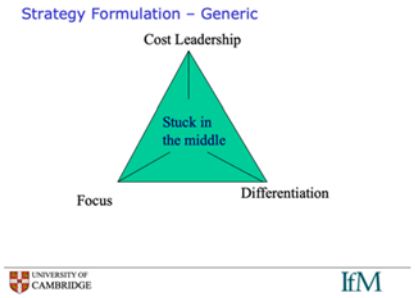
(ii) Based on the analysis above, and stating any assumptions, discuss the options available to Lars Andersson with regards to the Dijon and Wrexham plants when considering the different operational strategies that are available to the Company.
(25%)

Crib

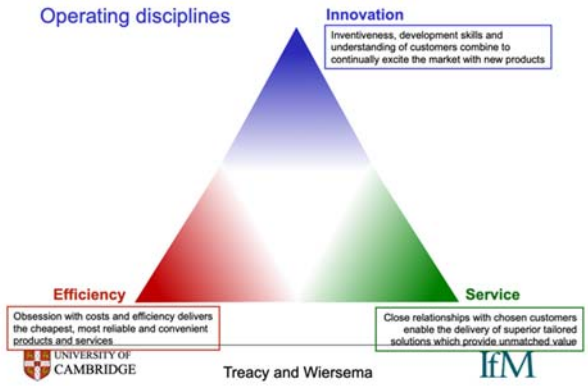
(a) (i).

Some candidates will opt for Porter's model below to analyse the strategy of Tetra pak. They might argue that Company has adopted a mainstream differentiated strategy based on technical innovation supported by massive R&D or has acquired technology from outside





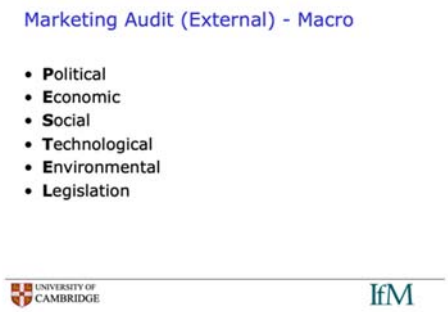
Some candidates will opt for Treacy and Wiersema and will probably conclude that the Company has adopted a product/technology leadership strategy. Stronger candidates will observe that for this case study T&W is a more flexible tool than Porter's.



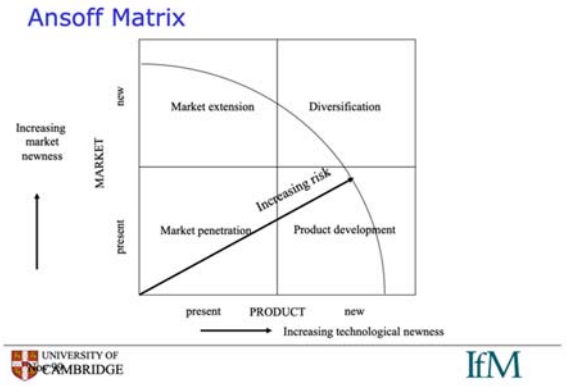
Some candidates may compare and contrast the two models and their relevance to the case. During the module about a dozen of the most popular business model tools and frameworks were covered. But many of them would be of limited value because there is insufficient data in the case. However, two obvious tools which could help the discussion of the case are PESTEL and Ansoff.

The PESTEL model would tease out the Political/Legal aspects. Social – customers do not like monopolistic behaviour. The Legal action by the Commission will have damaged the brand and reputation of the Company. Technological leadership. Smarter candidates will note that the IP window for the patents is running out – although this is unlikely to have the same impact as in other industries such as Pharma.

PESTEL/PESTLE/PEST



Using Ansoff the students would be able to highlight the fact that the Company has developed a near monopoly position in Quadrant 1 (existing markets/products). This prompts the question where can the Company grow?



Some candidates may try to use other tools (eg BCG) and these should be marked on their merit – but will be less relevant to the analysis.

Basic answers will identify and describe some of the models and try to apply them to the case.

Better answers will show understanding of the models (and their limitations) and will use them to analyse the case and link insights.

Good answers will display good understanding of the case and draw parallels with present day cases such as MicroSoft and the international tech companies. They will also flag up the very aggressive, monopolistic culture that could be a problem in the future.

(ii).
This question has no univocal answer! Students are expected to continue the analysis using the tools at their disposal and explained in the lectures.

For example: Using Porter, one option is to carry on with their differentiated strategy. A second option would be to move to a cost leadership position – but this is difficult and questionable. A third option might be a hybrid approach, pushing differentiation but also driving down costs (BMW and JCB claim this approach).
Basic answers will have a stab at a strategy – eg choose one of the above approaches and try to justify
Better answers will discuss different options – eg will consider 2 or 3 different approaches and try to justify which is likely to be the most successful
Good answers will discuss different options and the difficulties and risks of moving to different strategies. Really good answers will comment on what the students have observed from examples known/learnt in class about other companies.

(b)
(i)
This question invites students to interpret the data in the tables and to reach a logical conclusion.

Worked example – this would be the underpinning to a good answer:

The OEE (%) is the Value Added (VA) time over the planning time (i.e. the time that the equipment is available to make stuff).

The planning time (run time) in the exercise is 120hours – 5x24 hours (5 full days)

VA time + (measured) losses + (unaccounted) losses = 100% (ie 120 hours)

From the charts, Dijon has a better OEE. However, Wrexham is 'better' at sorting out breakdowns and SMED – but has a lot more changes to handle (it is likely that the factory has a different type of business and is dealing with smaller orders/batch sizes etc…). From the data in the plot it emerges that it is likely that the increased OEE in Dijon is because of an easier type of orders (larger batches, which allow them to change the setup less often) and that is the main reason they appear on the top line as more efficient.

If the Wrexham machine (VA Time =120x55.8%=67 hours) is moved to Dijon, it will likely run for the VA Time and the same losses at Dijon's rates. In Dijon each Breakdown time is 75 minutes not 30, and one could argue that the number of breakdowns will also rise. This means that the lost time each week would increase. The consequence of moving the Wrexham machine to Dijon is therefore that both machines will have to run 7 days per week rather than 5 to keep up with demand.
Using the same figures, but in reverse, the Dijon volume and mix could be produced in Wrexham in 8 hours less, allowing an additional 7.3 Value Adding hours to be produced (at new OEE of 91.6%).

Poor Answer – Yes, shut Wrexham. The OEE is low and there isn't an easy way to get it to improve. It would be better to put the printer in Dijon where they achieve a World Class OEE.

Basic Answer – No. Although the OEE is lower, it is the loss profile which matters. Each key loss is higher per event at Dijon, so transferring the machine from Wrexham would result in lower performance and the required output can't be achieved in a standard week

Better Answer – No, followed by detailed explanation of the exact number of hours required to be run at Dijon in order to run the same volume with Dijon loss profile on the Wrexham machine.

Good Answers – as for "Better" but showing the contrast that capacity becomes available if you put the Dijon machine in Wrexham with Wrexham loss profile for Dijon's work.

(ii)
This part of the question aims to help the students discuss the operations excellence of Tetra pak, linking the business strategy considerations (for example which type of customers to serve and what type of 'leadership' to aim for (e.g. many specialised, potentially high value customers – such as the plant in Wrexham seems to be doing vs serving only customers requiring large batches of cartoons) to the operational characteristics of the various plants.
Some candidates will recognise that the move completely away from the 'Product Leadership' (Flexibility highly customised production operations) to the 'Cost Leadership' (capability to run the plant with larger order and make a profit by lowering costs), may miss an opportunity to delight the customer using service specialities, etc.
Others may recognise that it can sometimes be possible to drive the manufacturing effort towards Cost Leadership (highly efficient plants capable of delivering large quantities of product at competitive costs), while at the same time using more sophisticated methods (e.g. logistics and storage approaches), to offer the benefits of the Product leadership approach. This combined approach however would be expected to incur in high setup costs and hence there needs to be an analysis to ascertain that the benefits outweigh costs significantly, and can be sustainable long term.
Some candidates will consider the difficulties and risks associated with different options.

Poor Answers – shows little understanding of the link between strategy and operational practice.

Basic Answers – will choose an option and try to justify it.

Better Answers – will discuss a range of options

Good Answers – will display a clear understanding of the options, challenges and risks and will mention strategic alignment and possibly cultural alignment – the case suggests that the Company has a very aggressive monopolistic culture. Is it capable of developing a new strategy that is coherent and consensual? Excellent answers will argue that the needs of the customer need to be clearly identified to understand the customers' needs better and improve the customer experience. They might challenge the argument that the Company should actually close a site.