INSTITUTE AND FACULTY OF ACTUARIES

EXAMINERS' REPORT

April 2022

SP9- Enterprise Risk Management
Specialist Principles

Introduction

The Examiners' Report is written by the Chief Examiner with the aim of helping candidates, both those who are sitting the examination for the first time and using past papers as a revision aid and also those who have previously failed the subject.

The Examiners are charged by Council with examining the published syllabus. The Examiners have access to the Core Reading, which is designed to interpret the syllabus, and will generally base questions around it but are not required to examine the content of Core Reading specifically or exclusively.

For numerical questions the Examiners' preferred approach to the solution is reproduced in this report; other valid approaches are given appropriate credit. For essay-style questions, particularly the open-ended questions in the Specialist Advanced (SA) and Specialist Principles (SP) subjects, the report may contain more points than the Examiners will expect from a solution that scores full marks.

The report is written based on the legislative and regulatory context pertaining to the date that the examination was set. Candidates should take into account the possibility that circumstances may have changed if using these reports for revision.

Sarah Hutchinson
Chair of the Board of Examiners
July 2022

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A. General comments on the *aims of this subject and how it is marked*

The aim of the Enterprise Risk Management (ERM) subject is to instil in successful candidates the key principles underlying the implementation and application of ERM within an organisation, including governance and process, as well as quantitative methods of risk measurement and modelling. The candidate should gain the ability to apply the knowledge and understanding of ERM practices to any type of organisation.

The SP9 examination generally requires bullet-point or short form essay style answers, together with concise mathematical applications. The answers given below are just one possible set of acceptable answers.

Candidates who give well-reasoned and relevant points, not presented in the marking schedule, are awarded marks for doing so.

B. Comments on *candidate performance in this examination.*

Well-prepared candidates, who were able to apply their knowledge of the core reading to the specific scenarios given in the questions, were successful in this diet. Many candidates found it challenging to grasp the scenarios presented in the questions and were unable to make good use of the background information supplied in the preamble.

Candidates who were able to draw upon on a wide range of risks, and who were able to articulate a sophisticated understanding of limitations of risk modelling scored well.

Questions that required idea generation, application of mathematical techniques, and in-depth discussion or expansion of points were not answered well by unsuccessful candidates.

C. Pass Mark

The Pass Mark for this exam was 52
150 presented themselves and 69 passed.

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Solutions for Subject SP9 - April 2022

Q1

(i)

Both companies will need to consider the risks that their business plans are exposed to. [½]
For Contestant A the main risk will relate to the production process of the chocolates [½]
including the cost of ingredients, [½]
and the manufacturing process. [½]
For Contestant B it is likely that they will need to source these parts from suppliers… [½]
likely they would not be able to design and manufacture the parts themselves. [½]
Therefore one of the main risks is being unable to source the correct parts on a timely basis to meet demand. [½]
There is a risk that the technology is not popular… [½]
or quickly becomes outdated [½]
which is unlikely to be the case for chocolates. [½]

The following areas will be different for each business, and therefore lead to differences in devising a risk management approach:
target market; [½]
growth prospects; [½]
main competitors. [½]
The availability of market information would differ between the two businesses. [½]

There is likely to be more public information about the chocolate industry than about the piece of technology. [½]
The key performance indicators and target rates will differ between the two businesses [½]
although both businesses will need to monitor these. [½]
The choice of stress testing, scenario testing and/or sensitivities will differ between the two businesses. [½]
Both businesses will have to employ key controls. [½]
Both businesses will need a corporate governance framework [½]
including structure, Board, Senior Management and governance arrangements. [½]

The risk management framework for both companies will include:
Risk appetite statements; [½]
Risk mitigation options. [½]

[Marks available 11½, maximum 8]

(ii)

Governance structure
For both businesses the structure will not be overly complex as it is a new business. [½]

There would be, at a minimum, a Board where the roles of Chairman and Chief Executive are held by different people. [½]
In particular, the role of Contestant A and Contestant B would be important in the organisation. [½]
There is the potential for significant agency risk if they are seen to be dominant. [½]
Evidence of an independent presence on the Board. [½]
There should be criteria in relation to the consideration of risk and risk management in

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the business plan. [½]
identification of key risks that affect the company … [½]
and identification of controls to manage these [½]
identification of upside as well as downside risks… [½]
allowing a more holistic treatment of risk across the organization [½]
inclusion of KRIs (as well as KPIs) … [½]
and risk limits for these KRIs … [½]
and the management actions triggered if these are breached [½]
a statement on how (and how frequently) these risks will be monitored [½]
There should be criteria in relation to the link between ERM and the strategic objectives [½]
since a fundamental concept of ERM is that risk is integrated into strategic decision making. [½]

Example criteria include:
evidence of a risk appetite statement … [½]
and a link between this and the strategic objectives [½]
There should be criteria in relation to financial projections [½]
in order to indicate the extent to which risk has been considered in producing these. [½]

[Marks available 10, maximum 7]

(iii)
Questions that could be asked include:
Governance
Who is responsible for risk and risk management within the business? [½]
What actions are you taking to reduce agency risk? [½]
How is remuneration of senior staff linked to risk management? [½]
What skills gaps are there in your business and how will you address these? [½]

Risk and risk management
What is your company's risk appetite / tolerance / capacity? [½]
What are the key risks facing the business? [½]
How are these risks being managed / transferred? [½]
What Key Risk Indicators (KRIs) are in place? [½]
What risk limits are in place? [½]
What is the escalation policy when limits are breached? [½]

Business planning
What market research have you performed and how has this affected your business strategy? [½]
What lines of credit have been agreed with banks/investors, in case of additional capital being required? [½]

Contestant A specific questions
How advanced are your discussions with potential suppliers of the ingredients? Have any pre-contracts been signed? [½]
Please can you provide more detail on how you have used chocolate industry data to inform your risk appetite and tolerances. [½]
Please provide more detail over your key outsourcing partners (such as the production plant where the chocolate is being made). [½]

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Contestant B specific questions

As a technology parts business, there will be higher setup costs. How certain are you of your sources of funding and what contingency plans do you have? [½]

What expertise do you and your management team have over this technology? [½]

You would be a new entrant into a market for which branding is important. Why would customers trust you? [½]

Please provide more detail over your key suppliers. [½]

Which monitoring processes do you have over your supply chain? [½]

[Marks available 10, maximum 7]

(iv)

With Z£1,000,000 tangible assets, it appears that CACC has moved production in-house and has purchased a significant amount of equipment. [1]

so there is a key operational risk. [½]

To mitigate this, insurance would have been purchased as part of the other costs. [½]

Bank debt of Z£1,800,000 is higher than the value of the cash + tangible assets + debtors [½]

Therefore there is insufficient security to meet the debt if it is called… [½]

or the bank is placing a value on the intangible assets. [½]

The intangible asset is a large portion of the total assets… [½]

it is likely to represent the brand and/or the recipe for the chocolate. [½]

The value of the intangible asset may fall in future… [½]

and the company has a large exposure to this occurring (e.g. reputational risk). [½]

Interest on bank debt of Z£90,000 is a significant portion of the profits (Z£130,000), so debt levels are high. [½]

The debt: equity ratio is Z£1,800,000/Z£700,000 which is 2.6 which is high. [½]

CACC may find it difficult to obtain further funding. [½]

The cash ratio is Z£300,000/Z£200,000 = 1.5, which is a healthy ratio. [1]

If interest rates increase, this may lead to an increase in the interest due on bank debt… [½]

especially if bank debt is linked to a floating rate). [½]

Debtors are Z£400,000 with annual profits of Z£130,000. This implies that invoice management could be improved. [½]

Retained earnings are Z£200,000 and annual profits are Z£130,000. This implies that the firm is growing or has had a good year. [½]

The total revenues are Z£400,000, this could be considered low considering the likely size of the chocolate market. [½]

Staff costs of Z£70,000 pa (appear to be covered by the retained earnings, so there appears to be sufficient working capital for a winddown scenario. [½]

Other costs of Z£30,000 and IT costs Z£10,000 could be investigated to determine whether these costs are being applied optimally. [½]

ROE is 117/700 = 16.7% which appears healthy, although should be compared to other competitors in the sector. [1]

RAROC is 117/500 = 23.4% which appears healthy, although should be compared to other competitors in the sector. [1]

Capital is Z£500,000. Therefore, an additional Z£250,000 has been needed over and above the prize investment. We should investigate whether this was obtained at the start or required. [1]

There is no indication of currency risk or from transactions with a foreign country. [½]

[Marks available 15, maximum 10]

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(v)
Regulatory capital = standard deviation * 2.576 = 150 * 2.576 = Z$386,400. [1]
Alternative calculation of regulatory capital that uses a 99.5th percentile risk measure [1]
The capital on the balance sheet is higher than this value, so the company appears sufficiently capitalised from a regulatory perspective. [1]
The VaR also considers the maximum loss at 99.5th percentile [½]
so is Z$386,400 *(same answer if we use the formula)* [1]
The TVaR considers the expected loss given that the VaR has been exceeded. [½]

$$\mathrm{TVaR}_p(X) = \mu + \sigma \frac{\phi\left[\Phi^{-1}(p)\right]}{1-p}.$$

Where

$$\phi(x) = \frac{1}{\sqrt{2\pi}} \exp\left(-\frac{x^2}{2}\right)$$

TVaR = Z$433,600. [1]
A normal distribution may not be appropriate for modelling the liabilities. [1]
In particular, it may not allow for fat enough tails … [½]
in turn understating the 99.5% VaR and TVaR [½]
We should question the accuracy of the parameter values (mean, sd), i.e. whether the data set used to determine them is credible. [½]
[Marks available 8½, maximum 5]

(vi)
The risk of the supplier failing to deliver on its obligations is the main risk to Contestant A's business (i.e. counterparty risk). [1]

Due to:
Poor weather leading to poor cocoa bean crop. [½]
Delays in delivery. [½]
Regulatory or trade restrictions. [½]
Operational issues (e.g. machinery failure or lack of labour). [½]
[Marks available 3, maximum 2]

(vii)
Key actions that CACC can perform when mitigating counterparty risk include:
Due diligence [½]
Continuous evaluation of the supplier will need to be performed, as this is the major contract that CACC will be involved with. [½]

Areas of due diligence will include:
Financial situation/ratios. [½]
Past delivery performance/reputation. [½]
Contract terms [½]

Areas of mitigating counterparty risk in the contract include:
Ensuring the contract is tightly worded/legally robust. [½]

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Minimum performance requirements (e.g. delivery and payment terms). [½]
Penalties if any of the minimum requirements are breached. [½]
Provision of credit terms to ensure payment terms do not affect timely supply of goods. [½]
Pre-agreed process for dealing with breach of contract. [½]

Other areas to mitigate counterparty risk
Maintain a minimum level of stock in-house in case of shortages. [½]
Monitor the performance of the supplier against risk tolerances. [½]
Seek to diversify exposure by having more than one supplier. [½]
Diversifying to other products/chocolate ranges which do not require the bean. [½]
Hold insurance or risk mitigation for major perils which may result in counterparty failure (e.g. weather derivative). [½]
Consider whether CACC can produce the beans itself or buy a company that can. [½]

[Marks available 8, maximum 6]

[Total 45]

Candidates in particular performed well on parts (vi) and (vii), showing good knowledge and application of the course material on counterparty risk and risk mitigation.

Candidates in general found it challenging to structure their responses to parts (i), (ii) and (iii). Candidates would have benefited from planning their ideas ahead of preparing their response to these questions parts.

In Part (iv) most candidates found it challenging to identify sound conclusions to accompany the balance sheet ratios they had calculated.

Part (v) was answered reasonably well.

Q2

(i)

ERM frameworks should be proportional to the size and nature of a business. [½]
Lofty and Compact operate in different industry sectors… [½]
and may be of different sizes [½]
and so we would expect the ERM frameworks to be different. [½]
If Lofty simply tries to 'impose' its framework on Compact, it is unlikely to be popular and taken on. [½]
Work must first be done to sell it to Compact's Board members, senior management and employees. [½]
Lofty and Compact may be at different stages of ERM maturity, e.g. Lofty advanced, Compact at a much earlier stage. [½]
Enterprise Risk Management would have the same principles for both companies. [½]
A holistic approach. [½]
Consideration of downside and upside risk. [½]
Measurement of risk. [½]
Unquantifiable risk. [½]
Responses to risks/risk management/risk management. [½]
The Compact group would have transferred some of their risk to the Lofty group by providing some of their food... [½]

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this needs to be considered in the combined group. [½]
Lofty group would need to tailor its ERM framework to make it suitable for Compact group. [½]
Risk profile (due to Compact group's focus on food and events). [½]
Capital structure (due to the investments in farms). [½]
Risk culture (boutique vs. luxury hotel). [½]
Risk taxonomy. [½]

Specific areas where the risk profile will differ between the Lofty group and Compact group will include:
Credit risk - Lofty group focuses on revenue from guests, so short term payments. Compact group focuses more on the events industry and food sales which will be on credit and trade terms. [½]
Liquidity, expenses and revenue - reliance on prices of hotel rooms vs food prices. [½]
Investments - for Lofty will be the hotel premises, while for Compact there will be investments in farms and machinery relating to the production and making of food. [½]
Regulations would differ between the hotel and food industries. [½]
[Marks available 12, maximum 8]

(ii)
Lam's "Lessons Learned" provides details which the Board would need to consider:
Know your business [½]
Lofty will need to spend time getting to know Compact's business, such as past performance, the previous framework. [½]
They will not be able to impose a framework which is suitable for hotels but will need to understand the specifics relating to the food/events industry. [½]
Set limits and boundaries [½]
Lofty will have its own processes or setting limits and boundaries, which will need to be tailored for each of the businesses. [½]
The hotel business, food business and events business would need to be considered separately, to understand areas such as those mentioned in part (i). [½]
However, the approaches will need to be part of a consistent group framework. [½]
Use the right yardstick [½]
Performance measures will need to be set in reference to the limits and boundaries previously identified. [½]
We would expect any targets themselves to differ between Lofty and Compact (and within the various departments). [½]
However, the limits and metrics should be consistent for similar roles, with consideration for specific issues, for example, for a certain quality criteria for the food arising from farms. [½]
Pay for the performance that you want [½]
Compensation should be aligned to the performance criteria. [½]
Consideration should be made for performance criteria which Compact currently holds, and communication is needed to detail any differences. [½]
There should be consistency between Lofty and Compact for similar roles to prevent dissatisfaction. [½]
Establish checks and balances [½]
Care should be taken to identify any areas of increased risk (e.g. due to the food supply chain) and, if necessary, establish additional checks. [½]

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There may be the need to consolidate some roles in the new group, but care should be taken not the give one person too much concentration of power/responsibility. [½]
Keep your eye on the cash [½]
Lofty has a different cashflow profile to Compact. [½]
It is important that the cashflow monitoring approach is refined to reflect both profiles. [½]
Balance the yin and the yang [½]
The acquisition may be unsettling for staff. The company should consider the softer side of integration to ensure a combined culture is suitable for both companies. [½]
This includes considering the benefits of both existing cultures, rather than just using Lofty's culture. [½]

[Marks available 12, maximum 7]

(iii)
Probability of default

Method of either calculating its own probability of default using data [½]
Or the use of external ratings [½]
or internal ratings. [½]
The choice of distribution used to model probability of default. [½]
If Compact is using its own data, the method of data segregation could be examined. [½]
Recovery rates and the method of calculating these needs to be examined. [½]
The percentile(s) used and justifications for these percentiles against its risk appetite. [½]

Loss given default
The exposure measure used (whether this is based on actual data or a proxy). [½]
The time horizon used. [½]

Other
Has systemic risk/contagion been considered? For example, a hotel-wide issue may affect the ability to repay Compact. [1]
Controls/governance over the process. [½]
Documentation of approach. [½]
The choice of approach / model is a key issue. [½]
For example, Compact could fit a distribution to the probability of default / loss given default [½]
or use a structural model (such as Merton / KMV) [½]
or use a reduced form model (such as a credit migration model). [½]
Structural models react quickly to changes in market conditions … [½]
although this means the results can be too sensitive to current market conditions, which can [½]
reflect short-term market sentiment rather than longer-term fundamental changes in credit risk. [½]
Credit migration models reflect an average probability of default over time, but it should be recognised that the past is not necessarily indicative of the future. [½]

[Marks available 10½, maximum 5]

(iv)(a)

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Rating	Bond value	Transition probability for C-rated bond	Transition probabilities for C-rated bond (adjusted for unrated assets)	Weight transition probability by bond value	Weight transition probability by square of bond value
A	110	0.1%	0.11%	0.121	13.31
B	105	2.0%	2.20%	2.31	242.55
C	100	80%	87.91%	87.91	8791
D	95	8.0%	8.79%	8.3505	793.2975
E	90	0.4%	0.44%	0.396	35.64
F	80	0.3%	0.33%	0.264	21.12
Default	60	0.2%	0.22%	0.132	7.92
				99.4835	9904.8375
					7.87

Expected value is 99.48 and variance is 7.87. [5]

(b)
The alternative bond has a higher expected value and a lower variance so is more suited to Lofty [1]

However, there are other considerations, such as:
Cost of investment (i.e. the price of bond). [½]
Term of bond (or duration). [½]
Diversification with existing investments. [½]
Asset-liability mismatches (or reference to cashflow matching). [½]
Investment objectives (e.g. ethical investment, risk appetite). [½]
Currency of bond. [½]
Credit rating/perception of riskiness. [½]

[Marks available 9½, maximum 8]

[Total 28]

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In Part (i) candidates struggled to capture concisely the key points of difference between Lofty and Compact.

Part (ii) was reasonably well-answered, although some candidates found it challenging to apply the lessons learned to the context given in the questions, and instead supplied generic descriptions from the core reading.

In Part (iii) candidates did not master the application of the technical concepts of probability of default and loss given default.

For part (iv)(a), only well prepared candidates were able to correctly adjust the transition probabilities to take account of non-rated assets. Part (iv)(b) was generally well-answered.

Q3

(i)

<u>Overarching points relevant to both eSportC and CFL</u>

Lower take up (turnout) than expected.	[1]
Entry fees are perceived to be too high or unattractive.	[½]
Negative publicity (or failure of) sponsors, causing reputational damage by association.	[½]
Negative publicity due to behaviour of players/online participants.	[1]
General technology / systems failure.	[½]
Online infrastructure cannot cope with demand placed on it (i.e. oversubscribed)	[½]
Cyber risk - eg hacking.	[½]
Lack of sponsorship for attractive prizes.	[½]
Prize money not paid out.	[1]

eSportC

Holding fixtures at venues would incur significant initial expenses, which may affect the perception/credibility of the venture.	[½]
Poor quality of (or failure of) one or more of the neutral venues, causing reputational damage to CSL by association.	[1]
Well-established or well-known players/teams do not join the league.	[½]
Bribery and corruption of players, e.g. to deliberately 'throw' a game.	[½]

CFL

The competition needs to meet regulations	[½]
in particular if a licence is needed to operate.	[½]
and protection of data provided by entrants.	[½]
Player collusion to manipulate scores, leading to loss of credibility of competition.	[½]

[Marks available 10½, maximum 8]

(ii)

Overarching actions to manage risks

Diversify the sponsors to reduce the risk of single sponsor failure.	[½]
Due diligence on sponsors before contracting.	[½]
Tightly-worded contracts with penalties for failure to deliver on agreed services.	[½]
Thorough testing of systems in advance or back-up systems.	[½]

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Partner up with a well-respected technology company, which specialises in these events. [½]
Strong advertising and publicity to encourage take up. [1]
Research market in advance to target advertising and publicity appropriately. [½]
Research entry fees for similar activities, and ensure fees are comparable. [½]
Take out insurance against system failures/cyber-attack. [½]
Have a Code of Conduct for players/participants. [½]

eSportC
Ensure the neutral venues are well-located and dispersed around Country X. [½]
Ensure that the quality of the neutral venues is consistent across Country X, e.g. could
Use a well-established chain of venues. [½]
Fines / bans for cheating players to act as a disincentive. [½]
Offer to pay for 'top' players to participate to encourage others to enter [½]

CFL
Research regulations applicable to data protection and licensing of such ventures. [½]
Prevent players of Sport C from participating in CFL or make them ineligible for prizes. [½]
[Marks available 8½, maximum 5]

(iii)
Project success criteria would need to be set up for each option. [½]
e.g. IRR, profit margin, take-up rate [½]
The expected cashflows under each option would need to be determined. [½]
Sponsorship. [½]
Prize money. [½]
Entry fees. [½]
Running costs (including salaries and ongoing costs). [½]
The expected timing of the cashflows would need to be determined. [½]
Deterministic or stochastic modelling/assumptions? [½]
Allow for correlations/interdependencies. [½]
e.g. between entry costs and take-up rates, or prize funds and take-up rates. [½]
Obtain expert opinion to set and validate the modelling assumptions. [½]
Consider qualitative factors (e.g. unquantifiable risks, margins for error around
modelling assumptions, practical modelling constraints, availability of expertise). [½]
Consider modelling of risk-mitigating factors e.g. insurance. [½]
Check model outputs for both options against success criteria. [½]
Develop scenarios to test reasonableness of model output. [½]
Perform sensitivities on results. [½]
Review, validate and discuss results. [½]
[Marks available 9, maximum 7]

(iv)
Committee/Board of CSL [½]
Interested in ensuring that the company is operating successfully/profitably. [½]
Regulators [½]
Interested in solvency/financial security of company. [½]
Interested in preventing bribery/corruption/collusion. [½]
Players/Teams [½]

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Interested in being part of a successful and financially sound venture in order to secure income. [½]
Employees [½]
Interested in being part of a successful and financially sound venture in order to secure income. [½]
Credit Rating Agencies [½]
Interested in ensuring their assessment of SC's creditworthiness is accurate/up-to-date. [½]
Competitors [½]
Interested in the viability of the venture and potentially running their own leagues. [½]
Investors/shareholders/bondholders [½]
Interested in the financial health/soundness of the company (i.e. security of investment). [½]
Interested in maximising reward given the level of risk taken. [½]
Prospective investors [½]
Will assess the statements against their own investment criteria to determine whether to invest. [½]
Sponsors of the eSportC league [½]
Interested in the viability of the league as there is a reputation risk on the sponsors if the league is unsuccessful. [½]
Suppliers (e.g. website providers, venues) [½]
Interested in ongoing viability of company, to secure future income streams. [½]

[Marks available 11, maximum 7]

[Total 27]

This question was well-answered overall.

Candidates were able to generate a good breadth of ideas for parts (i), (ii) and (iv), showing a good understanding of the question scenario and relevant stakeholders.

Part (iii) was reasonably well-answered, although many candidates found it challenging to identify the key cash flows involved.

[Paper Total 100]

END OF EXAMINERS' REPORT

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