CAPITAL PROJECT APPRAISAL

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Abstract : ***This study has been undertaken to investigate any project where there is initial expenditure, & once the project comes into operation, a stream of revenues less running costs. For example, a capital project could involve the construction of a physical structure such as a bridge. However, a capital project does not necessarily involve the construction of a physical asset. For example, a capital project could involve modernising a computer system or launching a new financial contract. Capital project appraisal is the process of deciding whether a particular project should or should not go ahead***

IndexTerms – capital project, project appraisal, RAMP

I. INTRODUCTION

A capital project means any project where there is initial expenditure and then, once the project comes into operation, a stream of revenues less running costs. For example, a capital project could involve the construction of a physical structure such as a bridge. However, a capital project does not necessarily involve the construction of a physical asset. For example, a capital project could involve modernising a computer system or launching a new financial contract. Capital project appraisal is the process of deciding whether a particular project should or should not go ahead. The material in this chapter is based on the "RAMP" methodology. RAMP stands for "Risk Analysis and Management for Projects" and is a process that has been developed by a joint working party of the actuarial and civil engineering professions for the purpose of evaluating and controlling risk in major projects. More information on RAMP can be found from the website www.ramprisk.com. Many of the ideas in this chapter have already been introduced in Subjects CT1 and CT2. These ideas include:

- weighted average cost of capital
- methods used for project evaluation (NPV, IRR, payback etc)
- simulation, probability trees and certainty equivalents
- suitable rates of return for project evaluation.

Such material will form part of the assumed knowledge for this course and may be asked in the Subject CA1 exam. Therefore, if you are feeling unfamiliar with any of the topics listed, we would advise you strongly to take the time to go back to the relevant sections of Subjects CT1 and CT2 to refresh your knowledge of the above material before proceeding. Capital project appraisal, like the previous chapter on Project Management, is an area where the actuarial control cycle methodology comes to the fore. The appraisal of any project forms an important element of the specifying the problem and the developing the solution stages of the control cycle.

This chapter deals with the following areas:

- the definition of a capital project and an outline of the stages in a capital project appraisal
- initial project appraisal and detailed project appraisal
- evaluating cashflows and setting the risk discount rate to calculate the NPV of a project
- risk identification, analysis and mitigation
- the key written documentation arising out of the appraisal, ie the investment submission. There are also some Core Reading examples to reinforce some of the ideas discussed.

II. CAPITAL PROJECTS AND CAPITAL PROJECT APPRAISAL

1.1 Definition of a capital project

Here a capital project means any project where there is initial expenditure and then, once the project comes into operation, a stream of revenues less running costs. A capital project does not have to involve the construction of a physical asset.

In this chapter, we interpret capital project to mean only those projects where the investment has significant physical, social or organisational consequences, and exclude projects involving the transfer of ownership of an existing asset – eg the purchase of an ordinary share in an existing company. Note, however, that some of the considerations discussed will apply equally in this latter case.

1.2 Key stages in a capital project

The key stages in a capital project appraisal are given below.

Methods: Initial appraisal

We make the assumption that a project opportunity has been identified and that the organisation has a clear-cut view of what is to be undertaken. An initial appraisal will take place to assess whether the project seems likely to satisfy some fundamental criteria set by the organisation. These will involve some financial factors, but also political and strategic considerations. Many potential projects will not survive this level of analysis and will not, therefore, proceed to the next stage below.

Methods: Detailed appraisal

If the initial appraisal suggests that the capital project is likely to be viable, then a more detailed appraisal is undertaken. All the stages that follow form part of the detailed appraisal.

Project definition and scope

This involves formulating a detailed definition of the project and specifying timescales, budgets and responsibilities.

Evaluation of cashflows and choice of risk discount rate

The principal cashflows involved in any capital project include the initial expenditure, followed by ongoing revenues less running costs. There are various measures for evaluating the cashflows, eg NPV, IRR, payback period etc. One of the key decisions is the choice of the risk discount rate to be used to evaluate the cashflows of the project. Consideration is also given to obtaining a spread of results, eg a distribution of NPVs, using techniques such as scenario testing or stochastic modelling.

Dealing with risks

The other key factor within the appraisal is to consider all the risks that the project faces, as well as those that the project poses to its sponsor. Under the heading of risk, we discuss:

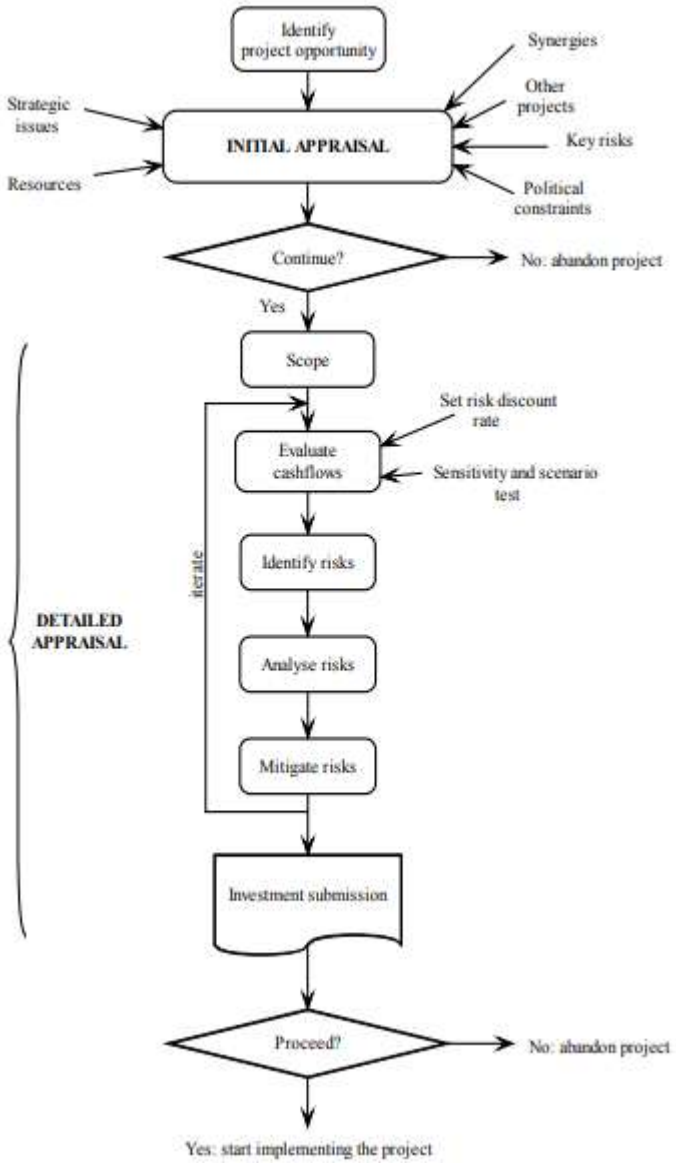
● Identification of risks – some techniques are discussed in this section that allow a good project manager to stay in control of the risks during the life of a project.

● Analysis of risks – this section considers how to quantify the financial effect of a particular risk, and how to assess the likelihood of that event occurring.

● Risk mitigation – having identified and analysed the various risks, it is now essential to take steps to reduce the potential impact of these risks on the project. Many risks are unavoidable. Indeed a project without any risks is unlikely to offer a worthwhile return. Risks that are not part of the basic project should and often can be eliminated. This can involve financial hedging, insurance, or alterations to the corporate structure of the company.

The investment submission

At the end of the work, it is important to bear in mind that most projects must be submitted before a committee of some description. The investment submission is the name of the written document that performs this function. If the project gets the go ahead, then the appraisal stage is over and the investment planning stage begins. The whole process is shown diagrammatically on the next page.



Methods: Initial appraisal

The main purpose of the initial appraisal of a proposed capital project is to ascertain whether the project is likely to satisfy criteria that have been established by the sponsoring organisation for projects it is prepared to authorise.

A key word here is "likely". If the initial appraisal suggests that the project is likely to satisfy the relevant criteria, only then will a more detailed and more expensive appraisal be undertaken to confirm or reject these provisional results. The sponsoring organisation may have a single set of predetermined criteria, or the criteria may be varied according to the particular project concerned. For example, a low-risk project might be required to produce an internal rate of return of 15% pa compared to 25% pa for a high-risk project.

These criteria will typically be expressed in terms of the financial results expected and (sometimes) the risk that these results may not be achieved. However, there may be many additional criteria in practice, including:

● achieving synergy or compatibility with other projects undertaken by the sponsor For example, the project may involve the development of a new product that can be sold in conjunction with an existing product.

● satisfying "political constraints", both within and without the sponsoring organisation This means ensuring that it is acceptable or even desirable in the eyes of senior management and/or even political representatives, either or both of whom may need to give approval before the project can proceed.

● having sufficient upside potential

● using scarce investment funds or management resources in the best way.

These criteria often cannot be factored into a financial model, and a subjective assessment will have to be made of their impact once the financial results are available.

During the appraisal process it will be necessary to investigate the risks involved in the project and come to a view on the best course of risk mitigation, having regard to the costs involved. The remaining risks will need to be listed for the benefit of sponsors, lenders and investors, so that they can take these risks into account in the decision-making process.

3. Methods: Detailed appraisal

This involves several steps as follows.

3.1 Definition of project

The first step is to define the project and its scope carefully and to assess its likely length of operating life

The scope of a project might include:

● the success criteria of the project and how these will be measured
● the budget of the project
● the timescales involved including limits beyond which the project team's responsibilities and powers will not extend
● to whom (or which departments) the goals of the project apply (and who should not be affected)
● the exact responsibilities of the people involved in the project team
● a list of connected issues for which the project team is not responsible.

3.2 Evaluation of cashflows

There should then be an evaluation of the most likely cashflows for capital expenditure, running costs, revenues and termination costs.

The cashflows should allow for any consequential effects on the sponsor's other activities or costs.

In other words, if the project will reduce the market and profitability of another part of the company's core business, then that reduction should be included in the cashflow projections.

Accurate definition and evaluation of the most likely cashflows is crucial to the success of the subsequent work, as these constitute a baseline. All the assumptions should be carefully documented.

Appraisal techniques

Using these cashflows, the next step is to make an initial evaluation of the likely financial result of undertaking the project. A discounted cashflow approach is normally used. Calculations often made are of the:

● net present value (NPV)

● internal rate of return (IRR)

● payback period, ie the length of time before the capital expended on the project is recouped from the net revenues (consisting of the gross revenues less running costs), without discounting the cashflows

● discounted payback period – as per the payback period but with discounting the cashflows.

The IRR equation can sometimes have multiple solutions, especially if there are net negative cashflows at some points during the operating life of the project or at termination. In addition, if a project does not require a large amount of initial capital, a very high IRR could be generated, but the project could still make an inadequate absolute profit. These features have helped make the IRR less popular than the NPV as a measure of project worth.

Example (of multiple solutions to the IRR equation) A project plan for the construction and decommissioning of a power generation plant shows that the project will involve an initial investment at the end of Year 1 of $14 million. This investment will in turn generate profits of $10 million at the end of each of the next 5 years and then a decommissioning cost of $40 million must be paid at the end of the 7th year. Solving the equation 12 6 7 - + + + ++ + - + 14(1) 10(1) 10(1) 40(1) ii i i -- - - " gives i = 6.2% and i = 49% (IRR is taken as the lowest positive solution!)

The solution to the equation of value used to find the IRR can in principle have as many solutions as there are changes of sign in the net cashflows over time. The problems associated with the other appraisal techniques mean that the NPV is generally the most appropriate criteria against which to appraise projects. This does not mean, however, that it is used most often in practice.

Normally the result of a NPV calculation will be regarded as satisfactory if it is positive and the result of an IRR calculation will be regarded as satisfactory if it exceeds a predetermined "hurdle rate" set by the sponsor. The payback period will be regarded as satisfactory if it is less than a predetermined period set by the sponsor.

The results of these calculations will provide an initial appraisal of the financial viability of the project. A broad idea of the sensitivity of the results to varying assumptions can be obtained by assuming that all the costs are (say) 10% higher than the most likely values and all the revenues are (say) 10% worse than the most likely values. The results obtained might, if very unsatisfactory, suggest that further analysis is not worthwhile without some fundamental redesign of the project. If the results appear satisfactory, a detailed risk analysis should take place.

The choice of the discount rate used with the NPV or the hurdle rate with which the IRR is compared is therefore crucial.

We can distinguish between sensitivity analysis and scenario testing.
- Sensitivity analysis investigates how the profitability of the project changes in response to a change in a single assumption in isolation.
- Conversely, scenario testing varies several assumptions simultaneously and in a mutually consistent fashion

The detailed appraisal process will be iterative between the evaluation of cashflow stage and the identification, analysis and mitigation of risk stages. With each subsequent and more detailed analysis of the viability of the project and its risks, the financial model of the project is made increasingly complex and sophisticated, so as to generate more accurate projections of the likely financial outcomes of the project. For example, making more accurate (or indeed any) allowance for factors such as:
- tax
- inflation
- risks and their mitigation options
- the sensitivity of cash flows to different economic scenarios. For example, in practice, we will be interested in the NPV of a project net of any tax payments, or equally the net-of-tax IRR. However, tax may be excluded from the early iterations as an unnecessary complication and only brought into the equation later on when there is more certainty relating to other factors, eg the method of financing on which the tax payable will depend.

4 Choice of risk discount rate

The choice of the risk discount rate to be used to determine the expected net present value of a project is of vital importance, as an incorrect choice could lead to the misleading appraisal of a project.

4.1 General considerations

The main considerations to take into account in determining the discount rate to use in NPV calculations are summarised below. Similar considerations apply to the determination of hurdle rates of return. The normal practice in financial services projects is to factor inflation into the cashflows, and use a nominal risk discount rate.

So nominal cashflows are discounted using nominal discount rates. It is also important that the appropriate inflation rate is used to project any future cashflows. For example, wages and prices will in general increase at different rates – wages usually increasing faster than prices.

The rate of inflation used to project future cashflows may be constant or may be assumed to vary in different future years – perhaps tending towards some long-run average value.

Projects with inherently high risks which cannot be sufficiently taken into account by specific risk analysis, should usually be appraised on the basis of a higher discount rate than projects having normal degrees of risk. Thus an international company might apply a higher discount rate to projects located in countries with unstable political regimes.

One way to allow for the risk attached to any particular cashflow is to multiply the cashflow by an estimate of the probability of its occurrence. The resulting expected value of each cashflow is then used in the calculation of an expected NPV. This method forms the basis of the specific risk analysis, which is discussed further in Section 6. The difficulty with this approach is obtaining sensible estimates of the probabilities involved.

An alternative approach that is often used in practice is simply to vary the discount rate used in order to reflect the level of risk or uncertainty attaching to the cashflows. Consequently a higher interest rate is used to discount more risky or uncertain cashflows. This is the means by which we allow for systematic risk as defined below.

4.2 Systematic risk and specific risk

The risk associated with any project can – conceptually at least – be broken down into two distinct components, namely systematic risk and specific risk. Systematic risk is that part of the return on a project which cannot be eliminated by investing in the same type of project many times over, or by diversification, because investing in a number of projects cannot reduce this part of the variability to zero.

Systematic risk can vary from one project type to another. Systematic risk is also sometimes known as non-diversifiable or market risk.

Specific risk, on the other hand, can be thought of as the element of risk that can be eliminated either by repeated investment in the same project, or failing this by diversification over a number of different projects. Specific risk is also sometimes known as probabilistic risk.

Consider the following case: if we invest repeatedly in the same project, then by the law of large numbers, the overall variance of the returns that we receive will reduce. For example, if we throw a pair of fair dice once, the total score could be anywhere between 2 and 12. If, however, we throw the same pair of dice a thousand times, we can be confident that the average score will be extremely close to 7.

Similarly, if we spread a fixed sum of money over more and more investments, then the specific risks attaching to different projects will tend to cancel each other out, as the success of some projects is offset by the failure of others.

Example

An investor can eliminate some of the specific risk of mortality by investing in a diversified portfolio of life assurance companies. However the investor is still exposed to the specific risk that all life companies suffer higher than expected mortality due to factors such as AIDS, shortening life expectancy, etc. Although this can be diversified away by investing in other company shares, there remains the systematic risk associated with general movements in the stock market as a whole.

Specific risk can and should be allowed for by specific risk analysis as set out in Section 6. Systematic risk should be allowed for by varying the risk discount rate used in the model, as discussed in the remainder of Section 4 below.

4.3 Choosing the discount rate for projects with a normal degree of systematic risk

In the remainder of Section 4, the use of the word risk refers to systematic risk.

The following looks at the method of choosing a discount rate for projects deemed to carry a "normal" degree of risk and then considers how the discount rate should be increased if there is a higher than usual degree of risk.

It assumes that the sponsor is a commercial company. Special considerations, which will not be considered here, apply in choosing discount rates for use by the public sector.

In the public sector, we might want to allow for social benefits and costs that are not captured explicitly in the cashflows yielded by the project, for example, both the savings in travelling times and the enhancement of the quality of life resulting from the building of a new bypass.

The starting point is the current cost of raising incremental capital for the company in order to carry out the project.

In other words, the cost of raising additional finance to fund the project via a rights issue or a new issue of debt, based upon current required rates of return in the marketplace.

One way of looking at this cost considers it to be the rate of return that needs to be earned on the capital if the existing shareholders are to be no better off and no worse off.

This should be the company's normal cost of raising capital, taking this as a weighted average where the weights are based on the optimum capital structure for the company as between equity and debt. (If the company's capital structure is not currently optimum, it could be made optimum through a separate decision).

You will recall that a company's weighted average cost of capital (WACC) can be defined as:

$$WACC = \frac{Market\ value\ of\ debt}{Market\ value\ of\ debt + equity} \times debtholders'\ required\ return$$

$$+ \frac{Market\ value\ of\ equity}{Market\ value\ of\ debt + equity} \times shareholders'\ required\ return$$

It can be argued that this should be the case regardless of exactly how the project in question is to be financed. The decision to finance the project – or indeed the company as a whole – in a manner that is inconsistent with the company's minimum WACC is independent of the choice of WACC used to discount the cashflows from the project and should not therefore influence that choice. The cost of debt capital should be taken as the cost in real terms of new borrowing by the company. This is calculated by taking an appropriate margin over the current

expected total real return on index-linked bonds, having regard to the company's credit rating, and multiplying by (1) - t , where t is the assumed rate of corporation tax.

The cost of equity capital is the current expected total real return on index-linked bonds plus a suitable margin to allow for the additional return that equity investors seek to compensate them for the risks they run.

Here we normally have in mind government index-linked bonds

This gives a real discount rate, to be applied to cashflows expressed in presentday monetary values, or adjusted by the assumed future inflation rate and used with cashflows in nominal terms.

4.4 Choosing the discount rate for projects with a higher than normal degree of systematic risk

If the company is considering a project with a degree of systematic risk higher than is usual for its projects, the discount rate used should be greater than that which the company normally employs.

A suitable upward adjustment is therefore made to the cost of capital discussed above in order to reflect the higher level of systematic risk. There is more than one way of determining the value of the adjustment to be applied.

Look at other companies

One guide might be to consider the discount rates appropriate for use by companies that habitually engage in such projects. In practice such data may be hard to obtain and there may be no alternative but to make an arbitrary addition to the discount rate.

Another problem here is that those companies that habitually engage in such projects may have more a greater experience of such projects and hence be better able to mitigate the inherent risks involved. If this is the case, then a slightly higher discount rate might actually be appropriate.

Life insurance companies

In a life assurance company, projects are frequently financed from within the long-term insurance fund. This is often the case for with-profits companies, or companies with significant free reserves, and always the case for mutuals. Here the decision is whether the project is a better investment for the owners of the capital than other forms of investment, after allowing for any risk differential. The starting point for the risk discount rate (in nominal terms) might therefore be the expected long-term return on equity-type investments.

4.5 Other factors to consider

It is not uncommon for companies to use very high discount or hurdle rates when appraising proposed projects. However, the use of a discount rate that is too high distorts the relative weights placed on the short term and on the longer term, thereby leading to mistaken decisions as it does not generate a uniform contingency margin.

A higher discount rate places lower relative weights on cashflows further into the future. Its use may therefore lead to, or indeed reflect, too short-termist an approach to capital projects.

For example, this leads to the danger of the incorrect acceptance of a risky project with a high apparent NPV or the incorrect rejection of a low-risk project with a negative NPV, which would have a positive NPV if this were calculated on a lower but more appropriate discount rate.

On the other hand, too much precision in setting the risk discount rate is unnecessary since the results of NPV calculations are not usually very sensitive to small changes of, say, 1% pa in the discount rate. It would usually be appropriate to carry out the NPV calculations on two alternative discount rates (say 6% and 10% pa real), and if both results are satisfactory, then there is no need to worry too much about determining the most appropriate discount rate precisely.

Risk identification The steps necessary to achieve an effective identification of the risks facing the project can be summarised as follows:

● Make a high-level preliminary risk analysis to confirm that the project does not obviously have such a high-risk profile that it is not worth analysing further.

● Hold a brainstorming session of project experts and senior internal and external people who are used to thinking strategically about the long term.

The aim will be to:
– identify project risks, both likely and unlikely, and upside and downside
– to discuss these risks and their interdependency
– to attempt to place a broad initial evaluation on each risk, both for frequency of occurrence and probable consequences if it does occur
– to generate initial mitigation options and discuss them briefly.

● Carry out a desktop analysis to supplement the results from the brainstorming session, by identifying further risks and mitigation options, researching similar projects undertaken by the sponsor or others in the past (including overseas experiences), and obtaining the considered opinions of experts who are familiar with the details of the project and the outline plans for financing it.

● Carefully set out all the identified risks in a risk register, with crossreferences to other risks where there is interdependency. High levels of correlation between individual risks will lead to a higher overall variance of the investment returns from the project, as the individual risks are less likely to cancel each other out.

If you have studied Subject CT2, another type of structure used for risk identification and analysis, called a risk matrix. This is a very useful tool for the risk analyst because it acts as a reminder to consider particular types of risk, which may not have been sufficiently considered. It also provides a convenient categorisation for risks. The cells in the matrix can be ticked off to show whether the risk in question applies to the particular project, with a cross-reference to the appropriate entry in the risk register.

If you have not studied Subject CT2, we have included an outline of the operation of the risk matrix below.

The rows in a risk matrix represent the stage of the project at which the risk arises. The columns represent the causes (or types) of risk.

A risk matrix for a typical project may look as follows:

		Causes (types) of risk						
		Political	*Natural*	*Economic*	*Financial*	*Crime*	*Project*	*Business*
Stages in the project	*promotion of concept*					✓	✓	
	design					✓	✓	
	contract negotiations				✓		✓	
	project approval	✓					✓	✓
	raising of capital	✓		✓	✓	✓	✓	✓
	construction	✓	✓	✓	✓	✓	✓	✓
	operation and maintenance	✓	✓	✓		✓	✓	✓
	receiving of revenues	✓	✓	✓	✓	✓	✓	✓
	decommissioning	✓	✓		✓	✓	✓	✓

Both the columns and the rows would be further subdivided. For example, Natural causes of risks may be subdivided into earthquakes, hurricanes etc.

Analysis of risks

The risk identification process will be followed by an analysis of the specific risks, to ascertain the:

- frequency of occurrence
- consequences if the risk event occurs
- correlations between risks
- controllability of the risks.

The financial consequences of a given risk are likely to be expressed as an expected NPV figure. This will be calculated by summing over all years, the probability that the (specific) risk event occurs in a given year multiplied by the discounted NPV of the consequential cashflow(s) if the risk event occurs in that year. The analysis will concentrate on the independent risks, regarding the dependent risks as their consequences.

Any risks which would have very serious or disastrous consequences, but where the expected NPV is low because the probability of occurrence is small, would be retained for further analysis along with the risks having higher expected NPVs.

Distribution of NPVs

The process of calculating the expected NPV of a particular risk can be extended to calculating the expected NPV for the project.

Scenario analysis

The first method is to construct a series of future scenarios, each representing a combination of possible outcomes for the major risk events and each having its own probability of occurrence, obtained by combining the probabilities of the various independent component risks. The outcomes selected for the purpose of the scenario analysis will in practice often be the mid-points of a range of possible values.

Stochastic modelling

Core Reading example

A method for analysing capital projects is set out on the RAMP (Risk Analysis and Management for Projects) website www.ramprisk.com, which contains the results of a joint exercise between the Actuarial Profession and the Institution of Civil Engineers.

This example illustrates a simple process for appraising competing projects and choosing between them, using RAMP methodology for risk assessment, combined with a suitable investment model. A practical example of the process is given, together with a method for deciding whether risk mitigation is financially worthwhile or not.

We look at the practical example below but consider the risk mitigation aspect later on in Section 7.4 of this chapter.
The other main method is to build a computer-based stochastic model, in which the various risks are modelled and a series of simulations is then run in order to get a probability distribution of the NPVs.

Obtaining a Probability Distribution of NPVs. This is an example of the first of the methods described in Section 6.1 above, ie scenario analysis.

The following projected cashflows could result from analysing a proposed project:

Scenario	*A*	*B*	*C*	*D*	*E*
Year	£'000s	£'000s	£'000s	£'000s	£'000s
1	–1000	–1000	–1000	–1000	–1000
2	300	500	–300	200	–300
3	400	400	300	300	200
4	400	400	400	300	300
5	400	400	400	300	300
6	–	–	400	–	300
Net cashflows	500	700	200	100	–200
NPV	292	481	–64	–54	–391
Probability of occurrence	55%	10%	15%	10%	10%

We can draw various conclusions about the project from the data above.

● Expected (weighted average) NPV = 155.

● On 65% of occasions such a project would show a profit but on 35% of occasions it would show a loss. Scenarios A and B have a positive NPV. The probability of occurrence of scenarios A and B is 55% + 10% = 65%.

● The loss could be as high as £391,000 but might be even more. We remember, from the description in Section 6.1 above that the cashflows in each of the years for each of the scenarios, will be based on mid-point cashflow values.

● On average a large number of such projects would show a profit.

7 Risk mitigation

7.1 Ways of mitigating risk

For each major risk, consideration would be given to identifying the main options for mitigating the risk, by such methods as:

● avoiding the risk (eg by redesigning the project)

● reducing the risk, ie either reducing the probability of occurrence or the consequences or both (eg by modifying the design or building in safety margins or procedures)

● reducing uncertainty (eg through further research or a feasibility study) ● transferring risk (eg through engaging a sub-contractor on a fixed price contract)

● insuring risk

● sharing risk with another party (especially where the other party is able to control the risk to some extent). Each option for mitigating a particular risk will be evaluated, assessing:

● likely effect on frequency, consequence and expected value

● feasibility and cost of implementing the option

● any "secondary risks" resulting from the option A strategy that reduces one element of risk, could introduce an additional, but less important, element of risk (eg insurance introduces the small risk that the insurer could go bust).

● further mitigating actions to respond to secondary risks For example, insurance could be arranged with a number of insurers instead of just one.

● overall impact of each option on the distribution of NPVs.

Example A French-based fashion clothing retailer, which is considering setting up a new internet subsidiary to sell its clothing range into the US market. Currently it has no distribution outside France. Identify the major risks involved in launching the subsidiary together with ways that these risks might be mitigated.

Hints

Use the seven causes of risk within a risk matrix and identify an example of a risk for each:

● Political

- Natural
- Economic
- Financial
- Crime
- Project
- Business

Use the mitigation options listed in Section 7 to come up with examples of how to mitigate the risks identified.

The major risks involved in launching the subsidiary and ways that these risks might be mitigated are set out below:

Risk	*Mitigation*
Language (Business)	**Employ people who are bi-lingual**
Web security, *ie* risk that data supplied to the retailer is not secure (Crime)	**Employ software firm to advise on suitable package**
Credit Card Fraud (Crime)	**As above**
Fashion, *ie* the subsidiary may be offering the wrong type of clothing for the American market (Business)	**Make sure thorough market research has been conducted and do not offer "high fashion" unless one is certain that it will sell**
Stock, *ie* ensuring there is enough stock to meet demand without meaning there is an excess of stock (Business)	**Market research**
Supply, *ie* ensuring that the clothes will be delivered to the customer within the promised timescale (Project/Business)	**Investigate the companies offering third party delivery services and choose one that can fulfil the company's needs**
Returns, *ie* how will unwanted goods be handled? (Project)	**Set up a suitable internal system to monitor returns**
Competition, *ie* what are other e-retailers doing and how will it impact on this subsidiary? (Business)	**Monitor competition**
Presence, *ie* how will customers be attracted to the website and will they recognise the subsidiary's name? (Business)	**Advertise**
Pricing, *ie* is the price charged competitive with other retailers both on the internet and in the shops? (Business/Financial)	**Monitor prices**
Currency, *ie* how will movements in exchange rates affect the prices the subsidiary can charge for its goods and how will it affect the profitability of the company when expressed in Euros? (Economic)	**It might be possible to hedge the currency, at least in part**
Market risk, *ie* the stock market may regard the subsidiary as very risky and put a lower valuation on the whole group (Financial)	**Explain to investors what the plans are and what strategies are being put in place to minimise the risk and maximise the return**

If you didn't get the exact list of risks in the table above, don't panic! There are several equally valid risks that you may have identified. The examiners will have been looking for is breadth of thought (types of risk) and sensible mitigation options.

7.3 The financial consequences of risk mitigation

The result of adopting a particular option ought to be to reduce the downward volatility of the NPVs but in addition it normally either:
- increases the expected NPV, or
- decreases the expected NPV. In the former case, the mitigation option is beneficial and should be built in to the project.

Risk has been reduced and expected return increased. Consequently the project has been unambiguously made more attractive.

Core Reading example
This is a continuation of the RAMP Core Reading example in Section 6.2.

The external contractor who will carry out the work is prepared to bear the whole of any extra development costs arising after year 1 (as in scenarios C and E), provided that the contract price is increased by £80,000. Is it worthwhile for the sponsor to accept this offer?

The various scenarios can be evaluated again, assuming that this new condition applies, as follows:

Scenario	A	B	C	D	E
Year	£'000s	£'000s	£'000s	£'000s	£'000s
1	–1080	–1080	–1080	–1080	–1080
2	300	500	–	200	–
3	400	400	300	300	200
4	400	400	400	300	300
5	400	400	400	300	300
6	–	–	400	–	300
Net cashflows	420	620	420	20	20
NPV	212	401	139	–134	–188
Probability of occurrence	55%	10%	15%	10%	10%

The investment submission

A decision will now need to be taken on whether the project should proceed. The investment submission, which is to be used as a basis for this decision should assume that the best possible combination of mitigation options will be implemented. It should show the expected NPV (allowing for both upside and downside risk and for an appropriate contingency margin to cover probabilistic risks which have not been fully analysed) and the probability distribution of NPVs.

The residual risks should be fully identified and analysed. Particular attention needs to be paid in the submission to any remaining risks that could have a serious or catastrophic effect on the outcome of the project as a whole, even if they have a low or uncertain probability of occurrence. The method by which it is proposed to finance the project should be specified, and an analysis provided showing the likely effect on investors after taking account of expected price inflation, borrowing, tax, etc.

The aim of the investment submission should essentially be to discuss how the project relates to the sponsor's criteria for judging whether or not to proceed with a project.

In the second, and more normal, case, judgement will have to be exercised on whether the mitigation option in question should be adopted. In this more usual case, risk has been reduced at the expense of a reduction in expected return.

Such judgements would be made having regard to the views of the sponsor and the prospective lenders and investors.

The decision makers will need to pay attention not only to the submission but also to a range of intangible considerations that are outside the scope of the formal analysis. Such considerations might include:

- allowance for any likely bias or possible approximations in the estimates
- "hunch" This means any gut feelings or instincts that cannot be quantified, perhaps based on previous experience – care should be taken, however, to ensure that these do not override the results of the formal appraisal process
- knowledge not in the possession of those who have prepared the submission
- last-minute developments
- doubts about feasibility or quality of implementation
- overall project credibility, etc.

They will also consider whether the upside potential has been estimated realistically. Finally, judgement will be required on whether, taking all these aspects into account, the project meets the sponsor's criteria sufficiently to justify a decision to proceed. If the decision is taken to proceed with the project, then it is important that all aspects of the project are reviewed regularly, to assess its ongoing profitability. Comparison of actual outcomes with those projected within the project appraisal also enables the updating of the appraisal assumptions and will assist with better future modelling of both this and other projects. Should the project be rejected, it is important to bear in mind that circumstances may change in such a way that it becomes appropriate to start the project at a later date. For example, an economic upturn may enhance the projected profitability of the project to the extent that it is deemed viable at a future date. Thus, in each time period we could think of the decision to be made as a choice between:

- starting the project now, and

- deferring the start of the project until at least the next time period, at which point we will revisit the choice in the light of the conditions then prevailing

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