16. Appendix I - Covering letter and questionnaire

The following questionnaire was used for the market research:

Dear Participant

RE: The Management of Risks in Business Change

South Africa has entered into the global village with the result that its markets have opened up to the competition and the pressures that accompany this. The rest of the world has been exploiting various contemporary world class management techniques and improvement initiatives. Many of these have however failed, resulting in less than expected results or even financial disaster.

While many management gurus have started writing about the risks, no formal integrated approach is available that attends to the appropriate management of business change, whether it be process re-engineering, TQM, downsizing and so on.

This questionnaire forms part of a doctoral research project aimed at formulating an appropriate model for managing the risks of business change. The purpose of this questionnaire is to provide insight into the relationship between business change and risk, understand the different types of risk and the way these risks are analysed and managed.

It is in this regard that I would be very grateful if you could complete the attached questionnaire and return it in the envelope provided. It is not necessary to divulge any confidential information and no reference will be made to any particular organisation arising from the results of the questionnaire.

Your co-operation will contribute to the growing body of knowledge aimed at improving the competitiveness of local companies in the light of international competition.

Yours faithfully

S. Bosman

I confirm that Stephen Bosman is a registered student at the University of Pretoria and that the information he requests is for research purposes. Your assistance is appreciated.

Professor P.S. Kruger
Promoter
Department of Industrial and Systems Engineering

THE MANAGEMENT OF RISKS IN BUSINESS CHANGE

PLEASE ANSWER THE FOLLOWING QUESTIONNAIRE IN LIGHT OF THE FOLLOWING DEFINITION OF BUSINESS CHANGE:

Business change refers to the change in the way a business is conducted in order to improve the financial attractiveness of that company. This change could involve corporate restructuring or the optimisation of financing mechanisms.

Section 1: Information regarding respondent

PLEASE PROVIDE THE FOLLOWING INFORMATION ABOUT YOURSELF AND YOUR ORGANISATION.

A.   Position in the organisation: _____

B.   Organisation:_____

C.   Telephone No.: _____

(Questions B & C are optional and will not be used to reveal specific responses from your organisation).

NOTE:

You organisation may be an entire company, a division, branch or plant. Please answer for the highest business level with which you are most familiar. Whichever you select, please answer the questionnaire consistently.

Some questions may have more than one answer.

Section 2: Demographic Information

1. What is the number of employees in your organisation?

Less than 100	101 to 500	501 to 1000	1001 to 5000	Over 5000

2. What is the primary nature of your business?

Manufacturing	Distribution	Retail	Mining	Financial services	Computer & associated services	Engineering & construction	Other

Please elaborate on "Other": _____

Section 3 - Organisation's experience with business change

3. How recently has your organisation undertaken a major business change initiative?

Have not	Less than 6 months ago	Less than 1 year ago	Less than 2 years ago	Less than 5 years ago	Longer than 5 years ago

If "Have not" go to question 7.

4. How many significant business change initiatives did your organisation undertake during this period?

1	2	3	4	5	6	7	8	9	10	More than 10

5. How would you rate the success of these initiatives in general?

Disaster	Failure	Inadequate	Success	Resounding Success

6. What type of change initiative was undertaken? Indicate more than 1 where relevant.

Continuous improvement:
(A range of small improvements across the company, including products, services, production, marketing, etc., e.g. TQM)

Procedure redesign:
(The change in the way certain processes are executed, aimed at problem solving and cost-cutting.)

Value-stream reinvention:
(Replacement/redesign across the organisation's value chain. Involves organisational change, resulting in time and cost savings and improving quality and service e.g. BPR)

Enterprise Redesign:
(Holistic redesign of the enterprise, e.g. new business units, strategic alliances etc.)

Strategic visioning:
(Ongoing cycle where direction is defined or redefined, e.g. markets, technologies, products, etc.)

Financial optimisation:
Changing the financial characteristics of an organisation (e.g. different financing mechanisms, tax breaks, etc.)

Other (1):

Other (2):

7. What business change initiatives are your organisation currently involved with?

Total Quality Management (TQM)
Business process re-engineering (or variant) (BPR)
Theory of constraints (TOC)
Just-in-time (JIT)
Downsizing/rightsizing
World class manufacturing
Total productive maintenance (TPM)
Strategic alliances
Reduce overheads
Streamline the organisation
Benchmarking
Outsourcing
Increase sales
Activity based costing
Empowerment
Change in business direction
Intrapreneuring
Management by walking around
Empowerment
Teamwork
Learning organisation
Strategic management
One-minute managing
Other (1)
Other (2)

8. Please rate (A) the following list of risks that a business may face during a business change initiative. Indicate whether the risk is generic and attributable to business change initiatives in general (B), unique to the type of change initiative (C), and or particular to your industry or business (D). Use the following scale for (A):

Not a factor	Unimportant	Indifferent	Important	Critical
1	2	3	4	5

	(A)					B	C	D
Mis-use/misinterpretation of business improvement technique.	1	2	3	4	5			
Too much time is spent understanding the current situation.	1	2	3	4	5			
No or inadequate top management commitment and action.	1	2	3	4	5			
Implementing modern management techniques but using traditional management paradigms.	1	2	3	4	5			
Innovation is not cultivated and exploited.	1	2	3	4	5			
Implement solution without proper testing.	1	2	3	4	5			
Undertake the initiative too slowly.	1	2	3	4	5			
Limit the scope of the change initiative without taking the holistic consequences into account.	1	2	3	4	5			

	(A)					B	C	D
Use an inappropriate implementation method.	1	2	3	4	5			
Use inappropriate tools.	1	2	3	4	5			
Ignore the concerns of employees.	1	2	3	4	5			
Do not take the financial implications of the initiative into account up-front.	1	2	3	4	5			
No, lack, or unsuitable vision.	1	2	3	4	5			
Activities/initiatives are misaligned with the strategy.	1	2	3	4	5			
Not focusing on the needs of the customer	1	2	3	4	5			
Not using experienced specialists, e.g. consultants.	1	2	3	4	5			
Aim for minimal gains.	1	2	3	4	5			
Failure to appreciate the risks.	1	2	3	4	5			
Failure to anticipate the energy and their resources required by the initiative	1	2	3	4	5			
Attempt to achieve too much with the project.	1	2	3	4	5			
No or poor communication.	1	2	3	4	5			
Insufficient change management attention.	1	2	3	4	5			
No sense of urgency.	1	2	3	4	5			
Not planning for short term successes.	1	2	3	4	5			
Declaring success too soon.	1	2	3	4	5			
Not anchoring changes in corporate culture.	1	2	3	4	5			
Other.	1	2	3	4	5			
Other.	1	2	3	4	5			

Section 4 - Organisation's approach to risk management

9. Does your business formally practice risk management in business change initiatives?

| YES | NO |

If **YES** then answer question 11 and all subsequent questions.
If **NO** then answer questions 10, 18 and all subsequent questions.

10. Do you intend to introduce a formal risk management practice in your business?

| YES | NO |

11. Does someone in your organisation have specific responsibility for managing the risks in business change?

| YES | NO |

12. Do you intend training more resources in business change risk management?

YES (Within the next 12 months)	YES (Sometime in the future)	NO

13. The following describes a generic life-cycle of a business improvement initiative. Please indicate whether a formal approach is currently used (YES or NO) to manage the risk in each phase or whether you believe there should be (Should). Leave blank otherwise.

Need for improvement	YES	NO	Should
Generate alternatives for improvement	YES	NO	Should
Assess the alternatives	YES	NO	Should
Select solution(s)	YES	NO	Should
Develop the solution	YES	NO	Should
Provide contingencies	YES	NO	Should
Implement solution	YES	NO	Should
Operate solution	YES	NO	Should
Phase-out	YES	NO	Should

<u>NOTE:</u>

A solution may be derived using techniques like BPR, TQM, overhead cost reduction, acquisition, sell-off, etc.

14. Please indicate the importance that your organisation currently (A) places on the following factors. Also indicate the importance (in your opinion) that they should (B) have in managing the risks or business change. Use the following scale:

Not a factor	Unimportant	Indifferent	Important	Critical
1	2	3	4	5

	Current					Should				
Risk analysis is done in parallel which business change analysis.	1	2	3	4	5	1	2	3	4	5
Benefits and risks are known and quantified before the change solution is selected and implementation commences.	1	2	3	4	5	1	2	3	4	5
Formal, clear implementation plans exist and are accepted.	1	2	3	4	5	1	2	3	4	5
A contingency plan clearly mapped to the implementation plan exists and is accepted.	1	2	3	4	5	1	2	3	4	5
Benefits and risks are made known to all being affected indirectly or directly by the execution of change.	1	2	3	4	5	1	2	3	4	5
Implementation of the change is manage, with the benefits and risks being reviewed regularly.	1	2	3	4	5	1	2	3	4	5
Sufficient resources for implementation and contingencies exist.	1	2	3	4	5	1	2	3	4	5

	Current					Should				
Post implementation risk management plans are drawn up.	1	2	3	4	5	1	2	3	4	5
Use is made of carefully selected qualitative and quantitative methods to manage the risks of business change.	1	2	3	4	5	1	2	3	4	5

15. What techniques does your organisation use (A) to minimise the risks in business change? Please rate (B) those that your organisation uses on a scale of 1 to 5. Also indicate if you believe your organisation should (C) use the technique. If your organisation does not use the technique, or you don't think they should, please leave blank. Use to following scale to rate the techniques your organisation currently uses (B):

Inappropriate	Some Use	Useful	Very Useful	Excellent
1	2	3	4	5

	Use	Rate Use					Should
Ensure that a vision is established.	YES	1	2	3	4	5	YES
Manage risks through the complete life-cycle (including phase-out).	YES	1	2	3	4	5	YES
Ensure the technique is fully understood.	YES	1	2	3	4	5	YES
Train resources in all the skills required for the project.	YES	1	2	3	4	5	YES
Align initiatives with the business strategy (goals, etc.).	YES	1	2	3	4	5	YES
Empower employees.	YES	1	2	3	4	5	YES
Limit the time spent on understanding the current situation.	YES	1	2	3	4	5	YES
Plan for the change management.	YES	1	2	3	4	5	YES
Begin and end exercise with strong committed leadership.	YES	1	2	3	4	5	YES
Encourage creativity.	YES	1	2	3	4	5	YES
Use experienced consultants.	YES	1	2	3	4	5	YES
Test solutions before implementation.	YES	1	2	3	4	5	YES
Plan for results within 12 months.	YES	1	2	3	4	5	YES
Prevent scope creep.	YES	1	2	3	4	5	YES
Use a holistic approach.	YES	1	2	3	4	5	YES
Use implementation methods suitable to the initiative.	YES	1	2	3	4	5	YES
Address employees needs during and after the process.	YES	1	2	3	4	5	YES
Undertake cost-benefit assessments up-front.	YES	1	2	3	4	5	YES
Understand the risks and develop contingencies.	YES	1	2	3	4	5	YES
Change the management paradigms to suit the new initiative.	YES	1	2	3	4	5	YES
Put performance measures in place.	YES	1	2	3	4	5	YES
Focus on delivering benefits to the customers.	YES	1	2	3	4	5	YES
Focus on changing behaviour.	YES	1	2	3	4	5	YES
Articulate compelling need to change.	YES	1	2	3	4	5	YES
Ensure a high level of communication.	YES	1	2	3	4	5	YES
Use modelling and simulation tools.	YES	1	2	3	4	5	YES
Nurture and use leadership.	YES	1	2	3	4	5	YES

	Use	Rate Use					Should
Plan for short term wins.	YES	1	2	3	4	5	YES
Institutionalise new approaches.	YES	1	2	3	4	5	YES
Other:	YES	1	2	3	4	5	YES
Other:	YES	1	2	3	4	5	YES

16. Do you use (A) any of the following tools to assist in the management of risk in business change initiatives? If not leave the box blank. If you use the technique for this purpose, please rate its effectiveness as shown (B). Us the following scale:

Inappropriate	Some Use	Useful	Very Useful	Excellent
1	2	3	4	5

	Use	Effectiveness				
Scenario planning	YES	1	2	3	4	5
Net present value (NPV)	YES	1	2	3	4	5
Internal rate of return (IRR)	YES	1	2	3	4	5
Expected monetary value (EMV)	YES	1	2	3	4	5
Return on net assets (RONA)	YES	1	2	3	4	5
Return on investment (ROI) (variants)	YES	1	2	3	4	5
Mathematical modelling of processes	YES	1	2	3	4	5
Simulation	YES	1	2	3	4	5
Linear programming.	YES	1	2	3	4	5
Forecasting	YES	1	2	3	4	5
Utility theory	YES	1	2	3	4	5
Capital asset pricing model (CAPM)	YES	1	2	3	4	5
Arbitrage pricing theory (APT)	YES	1	2	3	4	5
Option pricing theory	YES	1	2	3	4	5
Burke-Litwin change management model	YES	1	2	3	4	5
Option pricing theory	YES	1	2	3	4	5
Unwritten rules change management model	YES	1	2	3	4	5
McDonald Gandz change management model	YES	1	2	3	4	5
Insurance	YES	1	2	3	4	5
Hedging	YES	1	2	3	4	5
Systems reliability analysis	YES	1	2	3	4	5
Portfolio management	YES	1	2	3	4	5
Hold excess liquid assets	YES	1	2	3	4	5
Contingency management	YES	1	2	3	4	5
Life cycle analysis (LCA)	YES	1	2	3	4	5
Market research	YES	1	2	3	4	5
Value engineering	YES	1	2	3	4	5
Ring-fencing	YES	1	2	3	4	5

Use	Effectiveness				
Contracting	YES	1	2	3	4	5
Outsourcing	YES	1	2	3	4	5
Other:	YES	1	2	3	4	5
Other:	YES	1	2	3	4	5

17. What product do you use to support the tools and techniques described above. Please indicate, what technique or tool this supports and who the vendor is (indicate internal if this is internal).

No.	Product	Tool/technique	Vendor
1			
2			
3			
4			
5			
6			
7			
8			

Section 5 - Respondent's opinion of risk management in business change

18. Do you feel that all modern-day change initiatives are aimed at changing the behaviour of people?

YES	NO	Unsure

19. Do you feel that the failure of business change initiatives are largely attributable to the lack of thorough management of risks associated therewith.

YES	NO	Unsure

20. What do you believe the <u>benefits</u> of a formal risk management approach are? Please rate using the following scale.

No benefit	Minor	Moderate	Significant	Major benefit
1	2	3	4	5

	1	2	3	4	5
The possible problems of the initiative are identified and contingencies put in place.	1	2	3	4	5
Facilitates understanding of the complexity of the business.	1	2	3	4	5
Facilitates the change management process.	1	2	3	4	5
Provides an unbiased, holistic evaluation of a solution.	1	2	3	4	5
A responsible risk-taking culture is developed.	1	2	3	4	5
Provides a longer term focus.	1	2	3	4	5
Minimises exposure to failure.	1	2	3	4	5
Provides an audit trail for reviewing decision-making.	1	2	3	4	5

Encourages an average higher level of risk taking.	1	2	3	4	5
Other:	1	2	3	4	5
Other:	1	2	3	4	5

21. What do you believe the <u>problems</u> of a formal risk management approach are? Please rate using the following scale.

No problem	Minor	Moderate	Significant	Major problem
1	2	3	4	5

	1	2	3	4	5
Too formal an approach could limit creativity.	1	2	3	4	5
Some high yielding solutions may not be selected due to unacceptable risk levels.	1	2	3	4	5
It requires time, effort and additional skills.	1	2	3	4	5
It adds another dimension of complexity to business change management.	1	2	3	4	5
There are currently no suitable, integrated methods and tools to assist in managing the risks.	1	2	3	4	5
Other	1	2	3	4	5
Other	1	2	3	4	5

22. Do you believe that a generic approach can be used for the management of risks in business change?

YES	NO	Unsure

23. Please indicate any other important factor(s) to be taken into account in managing the risks in business change.

_____
_____
_____
_____
_____
_____
_____

THANK YOU FOR YOUR VALUABLE TIME AND EFFORT

17. Appendix J - Detailed descriptive statistics of responses

Question 1

C1		
Mean	3.571429	
Median	4	
Standard Dev	1.15067	
Variance	1.324042	
Bin	1 <100	1
	2 101 to 500	9
	3 501 to 1000	7
	4 1001 to 5000	15
	5 Over 5000	10

Question 2

C2		
Mean	3.738095	
Median	3	
Standard Dev	2.767931	
Variance	7.66144	
Bin	1 Manufacturing	17
	2 Distribution	2
	3 Retail	3
	4 Mining	2
	5 Financial Services	6
	6 Computer & Associated Services	2
	7 Engineering & Construction	3
	8 Other	7

Question 3

C3		
Mean	3.095238	
Median	3	
Standard Dev	1.20587	
Variance	1.454123	
Bin	1 Have not	2
	2 <6 months	14
	3 <1 year	11
	4 <2 years	9
	5 <5 years	5
	6 >5 years	1

Question 4

C4		
Mean	3.609756	
Median	4	
Standard Dev	0.7706507	
Variance	0.5939025	
Bin	1 Disaster	0
	2 Failure	3
	3 Inadequate	14
	4 Success	20
	5 Resounding Success	4

Question 5

Initiative Type	C7 Value-stream reinvention	C5 Continuous improvement	C6 Procedure redesign	C9 Strategic visioning	C8 Enterprise redesign	C10 Financial optimisation	C11 Other	C12 Other
Observations	22	20	20	19	18	7	5	1
Total	41	41	41	41	41	41	41	41
%	54%	49%	49%	46%	44%	17%	12%	2%

Question 6

Question 6

Initiative	C21 Reduce Over-heads	C14 BPR	C22 Stream-lining	C27 Empower ment	C33 Strategic Manage-ment	C24 Outsour-cing	C23 Bench-marking	C17 Right sizing	C25 Increase sales	C20 Strategic Alliances	C31 Team work
Obser-vations	24	23	21	21	21	20	19	18	18	17	17
Total	41	41	41	41	41	41	41	41	41	41	41
%	59%	56%	51%	51%	51%	49%	46%	44%	44%	41%	41%

Question 6 continued

C13 TQM	C18 WCM	C32 Learning organi-sation	C26 ABC	C16 JIT	C30 MBWA	C28 Change in business direction	C19 TPM	C35 Other	C15 TOC	C29 Intrapre-neuring	C36 Other	C34 One-minute managing
13	12	12	11	10	10	9	5	5	3	2	1	0
41	41	41	41	41	41	41	41	41	41	41	41	41
32%	29%	29%	27%	24%	24%	22%	12%	12%	7%	5%	2%	0%

Question 7 - see appendices L, M, N

Question 8

C65

Mean	1.404762
Median	1
Standard Dev	0.4967958
Variance	0.246806
Bin	1 Yes 25
	2 No 17

Question 9

C66

Mean	1.470588
Median	1
Standard Dev	0.5144957
Variance	0.2647059
Bin	1 Yes 9
	2 No 8

Question 10

C67

Mean	1.44
Median	1
Standard Dev	0.5066228
Variance	0.2566667
Bin	1 Yes 14
	2 No 11

Question 11(A)

	C68 Need for improve-ment	C69 Generate alterna-tives	C70 Assess alterna-tives	C71 Select solution	C72 Develop solution	C73 Provide contin-gencies	C74 Implement solution	C75 Operate solution	C76 Phase-out
Yes	21	23	24	24	24	22	22	20	15
No	4	1		1	1	3	2	4	7
Should	4	1	1	0	1	3	2	4	7
Q11(B)	C77	C78	C79	C80	C81	C82	C83	C84	C85

Question 12(A)
Contingency Table

	(i)	(ii)	(iii)	(iv)	(v)	Total	Factor	Weight	Rank
C86	0	1	5	16	3	25	Risk analysis done in parallel with change analysis	96	3

Question 12(A)
Contingency Table

	(i)	(ii)	(iii)	(iv)	(v)	Total	Factor	Weight	Rank
C87	0	0	5	14	6	25	Use is made of appropriate qualitative and quantitative techniques	101	1
C88	0	0	3	18	4	25	Sufficient resources for implementation and contingencies	101	1
C89	1	4	9	10	1	25	Contingency plan(s) are accepted	81	7
C90	0	3	5	12	5	25	Regular review of benefits and risks during implementation	94	4
C91	1	4	5	11	4	25	Formal clear implementation plans are accepted	88	6
C92	1	0	9	13	2	25	Post implementation risk management plans	90	5
C93	4	2	13	4	2	25	Benefits and risks are known up-front	73	9
C94	2	2	11	8	2	25	Benefits and risks are clearly communicated	81	7
	9	16	65	106	29				

Question 12(B)
Contingency Table

	(i)	(ii)	(iii)	(iv)	(v)	Total	Factor	Weight	Rank
C95	0	0	0	15	10	25	Risk analysis done in parallel with change analysis	110	5
C96	0	0	0	12	13	25	Use is made of appropriate qualitative and quantitative techniques	113	1
C97	0	0	1	11	13	25	Sufficient resources for implementation and contingencies	112	2
C98	0	2	2	10	11	25	Contingency plan(s) are accepted	105	7
C99	0	0	1	11	13	25	Regular review of benefits and risks during implementation	112	2
C100	0	1	1	8	15	25	Formal clear implementation plans are accepted	112	2
C101	0	0	1	14	10	25	Post implementation risk management plans	109	6
C102	0	1	3	11	10	25	Benefits and risks are known up-front	105	7
C103	0	1	4	12	8	25	Benefits and risks are clearly communicated	102	9
	0	5	13	104	103				

Question 13(A)

	C125	C104	C112	C120	C124	C108	C128	C121	C107
Use of techniqu e	Focus on delivering benefits to is	Ensure a vision	Strong committed leadership	Address employe es' needs	Put perfor- mance measures	Align initiatives with	Ensure high level of	Up- front cost	Train resources in the required

Question 13(A)

	C125 customers	C104 established	C112	C120	C124 in place	C108 business strategy	C128 communication	C121 benefit analysis	C107 skills
Observations	25	24	24	24	24	23	23	22	21
Total	25	25	25	25	25	25	25	25	25
%	100%	96%	96%	96%	96%	92%	92%	88%	84%

Question 13(A) continued

C109 Empower employees	C111 Plan for change management	C106 Ensure the technique is fully understood	C119 Use suitable implementation methods	C123 Change management paradigms to suit new	C122 Understand risks and develop contingencies	C126 Focus on changing behaviour	C130 Nurture and use leadership	C114 Use experienced consultants	C127 Articulate compelling need for change
21	21	20	20	20	19	19	19	18	18
25	25	25	25	25	25	25	25	25	25
84%	84%	80%	80%	80%	76%	76%	76%	72%	72%

Question 13(A) continued

C113 Encourage creativity	C105 Manage risks through the complete life-cycle	C115 Test solutions before implementation	C132 Institutionalise new approaches	C131 Plan for short term wins	C118 Use a holistic approach	C116 Plan for results in 1 year	C129 Use modelling and simulation tools	C110 Limit time spent on understanding current situation	C117 Prevent scope creep
17	16	16	15	14	13	12	12	11	8
25	25	25	25	25	25	25	25	25	25
68%	64%	64%	60%	56%	52%	48%	48%	44%	32%

Question 13(B)

Contingency Table

	(i)	(ii)	(iii)	(iv)	(v)	Total	Factor	Weight	Rank
C125	0	0	3	13	9	25	Focus on delivering benefits to customers	106	1
C112	1	0	1	10	12	24	Strong committed leadership	104	2
C104	0	0	4	12	8	24	Ensure a vision is established	100	3
C124	0	2	3	11	8	24	Put performance measures in place	97	4
C108	0	0	5	9	9	23	Align initiatives with business strategy	96	5
C128	0	3	3	7	10	23	Ensure high level of communication	93	6
C121	0	2	2	10	8	22	Up-front cost benefit analysis	90	7
C120	0	1	10	9	4	24	Address employees' needs	88	8
C107	0	2	4	10	5	21	Train resources in the required skills	81	9
C111	0	1	5	11	4	21	Plan for change management	81	9
C119	0	0	5	11	4	20	Use suitable	79	11

Question 13(B)

Contingency Table

	(i)	(ii)	(iii)	(iv)	(v)	Total	Factor	Weight	Rank
C123	0	3	3	7	7	20	Change management paradigms to suit new implementation methods	78	12
C130	0	2	2	8	7	19	Nurture and use leadership	77	13
C126	0	1	4	8	6	19	Focus on changing behaviour	76	14
C127	0	1	1	9	7	18	Articulate compelling need for change	76	14
C109	0	2	7	10	2	21	Empower employees	75	16
C122	0	4	3	6	6	19	Understand risks and develop contingencies	71	17
C106	0	3	6	9	2	20	Ensure the technique is fully understood	70	18
C114	1	0	6	4	7	18	Use experienced consultants	70	18
C113	0	1	2	9	5	17	Encourage creativity	69	20
C115	0	1	3	7	5	16	Test solutions before implementation	64	21
C105	0	3	3	7	3	16	Manage risks through the complete life-cycle	58	22
C132	0	0	5	7	3	15	Institutionalise new approaches	58	22
C118	0	1	0	5	7	13	Use a holistic approach	57	24
C131	0	0	7	5	2	14	Plan for short term wins	51	25
C116	0	0	5	5	2	12	Plan for results in 1 year	45	26
C129	0	2	6	1	3	12	Use modelling and simulation tools	41	27
C110	0	3	4	4	0	11	Limit time spent on understanding current situation	34	28
C117	1	1	3	3	0	8	Prevent scope creep	24	29
Total	3	39	115	227	155	539			

Question 14(A)

Tool Type	C135 Scenario planning	C136 NPV	C137 IRR	C138 EMV	C139 RONA	C140 ROI	C141 Mathematical process modelling	C142 Simulation	C143 Linear programming
Observations	17	14	12	8	15	17	6	12	4
Total	24	24	24	24	24	24	24	24	24
%	71%	58%	50%	33%	63%	71%	25%	50%	17%

Question 14(A) continued

C144 Forecasting	C145 Utility theory	C146 CAPM	C147 APT	C148 OPT	C149 Burke-Litwin	C150 OPT	C151 Unwritten rules	C152 McDonald	C153 Insurance
22	0	5	2	2	3	2	1	1	11
24	24	24	24	24	24	24	24	24	24
92%	0%	21%	8%	8%	13%	8%	4%	4%	46%

Question 14(A) continued

C154 Hedging	C155 Systems reliability analysis	C156 Portfolio management	C157 Excess liquid assets	C158 Contingency management	C159 LCA	C160 Market research	C161 Value engineering	C162 Ring-fencing	C163 Contracting	C164 Outsourcing
8	4	11	1	8	2	21	7	1	12	14
24	24	24	24	24	24	24	24	24	24	24
33%	17%	46%	4%	33%	8%	88%	29%	4%	50%	58%

Question 14(B)

Contingency Table   (Refitted)

	(i)	(ii)	(iii)	(iv)	(v)	Total	Tool	Weight	Rank
C160	0	1	2	5	13	21	Market research	93	1
C144	0	0	5	10	7	22	Forecasting	90	2
C135	0	0	4	7	6	17	Scenario planning	70	3
C140	0	4	1	3	9	17	ROI	68	4
C139	0	0	1	12	2	15	RONA	61	5
C136	0	2	1	8	3	14	NPV	54	6
C164	0	1	5	6	2	14	Outsourcing	51	7
C163	0	0	2	8	2	12	Contracting	48	8
C137	0	2	1	5	4	12	IRR	47	9
C156	0	0	1	6	4	11	Portfolio management	47	9
C142	0	0	4	8	0	12	Simulation	44	11
C153	0	0	3	5	3	11	Insurance	44	11
C138	0	0	0	6	2	8	EMV	34	13
C158	0	0	2	5	1	8	Contingency management	31	14
C154	0	0	3	4	1	8	Hedging	30	15
C161	0	0	1	4	2	7	Value engineering	29	16
C141	0	0	2	3	1	6	Mathematical process modelling	23	17
C146	1	0	0	3	1	5	CAPM	18	18
C155	0	0	2	1	1	4	Systems reliability analysis	15	19
C143	0	1	2	0	1	4	Linear programming	13	20
C149	0	0	1	1	1	3	Burke-Litwin	12	21
C159	0	0	0	0	2	2	LCA	10	22
C148	0	0	0	1	1	2	OPT	9	23
C147	1	0	0	1	0	2	APT	5	24
C151	0	0	0	0	1	1	Unwritten rules	5	24
C152	0	0	0	1	0	1	McDonald	4	26
C157	0	0	0	1	0	1	Excess liquid assets	4	26
C162	0	0	1	0	0	1	Ring-fencing	3	28
C145	0	0	0	0	0	0	Utility theory	0	29
	2	11	44	114	70				

Question 15 - See appendix N

Question 16	
C167	
Mean	1.619048
Median	1
Standard Dev	0.7635725

Question 17	
C168	
Mean	1.571429
Median	1
Standard Dev	0.8006966

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</table>

Question 18

Contingency Table

	(i)	(ii)	(iii)	(iv)	(v)	Total	Benefit	Weight	Rank
C171	1	3	6	14	18	42	Facilitates change management	171	1
C169	1	1	7	20	13	42	Problems identified and contingencies put in place	169	2
C174	1	0	5	29	7	42	Provides longer term focus	167	3
C175	2	2	12	9	17	42	Minimises exposure to failure	163	4
C170	1	2	11	23	5	42	Facilitates understanding of complexity	155	5
C173	1	5	9	20	7	42	Develops responsible culture	153	6
C172	1	3	19	13	6	42	Provides unbiased holistic evaluation	146	7
C176	3	9	12	12	6	42	Audit trail for decision-making	135	8
C177	3	7	14	16	2	42	Encourages higher level of risk taking	133	9
	14	32	95	156	81				

Question 19

Contingency Table

	(i)	(ii)	(iii)	(iv)	(v)	Total	Problems	Weight	Rank
C181	0	2	8	29	3	42	Lost solutions due to high risk	159	1
C182	0	2	14	18	8	42	Additional effort, skills, time	158	2
C180	0	3	17	20	2	42	Limit creativity	147	3
C184	2	5	13	16	6	42	No suitable integrated methods and tools	145	4
C183 ·	1	7	11	21	2	42	Another dimension of complexity	142	5
	3	19	63	104	21				

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<tr><td></td><td>2 No</td><td>13</td></tr>
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18. Appendix K - Question 7 - Contingency table

	(i)	(ii)	(iii)	(iv)	(v)	Total (n)
C37	1	3	9	25	4	42
C38	1	8	13	18	2	42
C39	0	0	2	5	35	42
C40	0	2	8	24	8	42
C41	0	0	10	22	10	42
C42	0	2	6	13	21	42
C43	1	2	11	23	5	42
C44	0	0	9	19	14	42
C45	0	1	7	19	15	42
C46	0	1	9	24	8	42
C47	0	0	4	15	23	42
C48	0	1	3	11	27	42
C49	0	2	1	14	25	42
C50	0	1	4	20	17	42
C51	0	1	4	10	27	42
C52	2	3	15	15	7	42
C53	1	3	22	15	1	42
C54	0	2	3	21	16	42
C55	0	0	6	22	14	42
C56	0	2	11	24	5	42
C57	0	0	0	15	27	42
C58	0	0	3	17	22	42
C59	0	1	4	25	12	42
C60	1	1	14	20	6	42
C61	1	7	19	11	4	42
C62	0	0	4	23	15	42
Total	8	43	201	470	370	

19. Appendix L - Question 7 - Correspondence analysis

Eigenvalue Report

Coord	Eigenvalue	Percent Individual	Cumulative	Histogram
Variables: #1:#5				
1	0.25094	73.12	73.12	▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓
2	0.06003	17.49	90.61	▓▓▓▓
3	0.024132	7.03	97.65	▓▓
4	0.008078	2.35	100	▓
Total	0.34318			
Root	0.585816			

Detail Report - Rows

Variables: #1:#5

Label	Wght	Co-ordinate F1	Co-ordinate F2	Contribution CTR1	Contribution CTR2	Sq. Correl. COR1	Sq. Correl. COR2
Row 1	38	473	184	34	22	731	110
Row 2	38	810	-324	100	67	688	110
Row 3	38	-944	-431	136	119	813	169
Row 4	38	220	238	7	36	401	469
Row 5	38	133	243	3	38	158	525
Row 6	38	-286	-202	13	26	635	318
Row 7	38	455	145	32	13	841	85
Row 8	38	-32	124	0	10	19	290
Row 9	38	-84	82	1	4	409	390
Row 10	38	212	281	7	50	346	608
Row 11	38	-473	-31	34	1	969	4
Row 12	38	-605	-235	56	35	869	131
Row 13	38	-552	-156	47	16	835	67
Row 14	38	-229	126	8	10	710	214
Row 15	38	-580	-276	52	49	810	184
Row 16	38	574	-275	50	48	645	148
Row 17	38	904	-235	125	35	822	55
Row 18	38	-186	123	5	10	367	160
Row 19	38	-107	248	2	39	150	807
Row 20	38	400	234	25	35	694	237
Row 21	38	-713	-26	78	0	986	1
Row 22	38	-463	51	33	2	982	12
Row 23	38	-54	327	0	69	23	837
Row 24	38	462	65	33	3	756	15
Row 25	38	857	-569	113	208	679	300
Row 26	38	-192	291	6	54	302	691

Note: All numbers were multiplied by 1000 .

Detailed Report - Columns

Variables: #1:#5

Label	Wght	Co-ordinate G1	Co-ordinate G2	Contribution CTR1	Contribution CTR2	Sq. Correl. COR1	Sq. Correl. COR2
C1	7	1275	-655	47	52	531	140
C2	39	815	-610	104	244	473	265
C3	184	644	-167	305	86	846	57

Variables:	#1:#5	Co-ordinate		Contribution		Sq. Correl.		
Label	Wght	G1	G2	CTR1	CTR2	COR1	COR2	
C4		430	117	260	23	484	162	801
C5		339	-621	-154	520	134	941	58
Note: All numbers were multiplied by 1000 .								

20. Appendix M - Question 7 - Transformed data: Descriptive statistics and factor analysis

Descriptive Statistics

Variable	Mean	Standard Deviation	Communality
C37	3.189619	0.864007	0.38492
C38	2.834214	0.836421	0.39859
C39	4.687547	0.736969	0.56789
C40	3.457619	0.905496	0.10426
C41	3.548953	0.938817	0.44337
C42	3.9925	1.104161	0.53791
C43	3.20881	0.906984	0.54036
C44	3.723714	1.009211	0.47729
C45	3.778667	1.017614	0.63913
C46	3.466214	0.892653	0.67851
C47	4.189738	0.953606	0.49794
C48	4.329429	0.966921	0.43533
C49	4.273167	0.953003	0.5539
C50	3.932238	0.9662	0.56374
C51	4.302953	1.006211	0.54657
C52	3.282738	1.184644	0.39808
C53	2.734215	0.715777	0.30183
C54	3.886572	0.969955	0.65381
C55	3.803143	0.935887	0.42333
C56	3.266976	0.837554	0.25687
C57	4.443928	0.755092	0.44413
C58	4.179142	0.914424	0.47362
C59	3.746881	0.887975	0.7631
C60	3.201523	0.956952	0.45597
C61	2.784571	0.938856	0.4176
C62	3.893167	0.894408	0.57514

Eigen Value Summary

No.	Eigenvalue	Percent	Cumulative Percent
1	6.107	23.49	23.49
2	2.7612	10.62	34.11
3	1.9932	7.67	41.77
4	1.6719	6.43	48.2
5	1.5598	6	54.2
6	1.3417	5.16	59.36
7	1.3165	5.06	64.43
8	1.1976	4.61	69.03
9	1.0337	3.98	73.01
10	0.9143	3.52	76.53
11	0.85	3.27	79.8
12	0.8303	3.19	82.99
13	0.7646	2.94	85.93
14	0.6043	2.32	88.25
15	0.5313	2.04	90.3
16	0.5198	2	92.3
17	0.4002	1.54	93.84

No.	Eigenvalue	Percent	Cumulative Percent
18	0.3669	1.41	95.25
19	0.2995	1.15	96.4
20	0.2489	0.96	97.36
21	0.231	0.89	98.24
22	0.1398	0.54	98.78
23	0.1106	0.43	99.21
24	0.0957	0.37	99.58
25	0.0699	0.27	99.84
26	0.0404	0.16	100

Rotated Factor Loadings

Variable	Factor 1	Factor 2	Factor 3	Factor 4	Communality
C37	0.3518	0.1261	0.393	-0.3013	0.3849
C38	0.0924	0.1176	-0.1744	0.5881	0.3986
C39	0.099	0.2315	0.6827	-0.1962	0.5679
C40	0.0115	-0.054	0.3178	0.0151	0.1043
C41	-0.221	0.3992	0.3404	0.3454	0.4434
C42	0.6785	0.19	0.1452	0.1429	0.5379
C43	-0.0334	0.6715	-0.0244	0.2962	0.5404
C44	0.1152	0.4138	0.2256	0.4919	0.4773
C45	0.7792	0.1179	0.09	0.0999	0.6391
C46	0.7443	0.1748	-0.2595	-0.1633	0.6785
C47	0.1771	0.4167	0.3322	0.4273	0.4979
C48	0.4777	0.1055	0.4059	0.1769	0.4353
C49	0.1638	0.0892	0.7075	0.1362	0.5539
C50	0.5154	-0.2696	0.3325	0.339	0.5637
C51	0.1285	0.0667	0.3449	0.6377	0.5466
C52	0.5542	0.1292	0.2641	0.0675	0.3981
C53	0.278	-0.0125	0.3604	0.3074	0.3018
C54	0.7535	-0.1115	0.2702	0.0259	0.6538
C55	0.4499	0.1781	-0.16	0.4044	0.4233
C56	0.0871	0.0548	-0.0569	0.493	0.2569
C57	0.3467	0.5187	0.23	0.0442	0.4441
C58	0.4365	0.0121	0.5316	-0.0208	0.4736
C59	0.0925	0.8618	0.0453	-0.0993	0.7631
C60	0.1882	0.6053	0.0384	0.2295	0.456
C61	-0.2467	0.1523	0.2611	0.5152	0.4176
C62	0.0694	0.2395	0.6962	0.168	0.5751

21. Appendix N - Products used in risk management practice

The following is a list of products that respondents indicated were used in support of their risk management practices:

Product[1]	Tools/methods[2]
• Internally developed • SAP • Lotus • Sims, Soprano • Use consultants • MS Excel • Rochade Repository • Super Project • MS Project • IAA • Various software packages	• Source co. • McKinsey methods • Forecasting • Market research • Outsourcing • Value engineering • NPV/RONA • Simulation • Market research (Perry & Associates) • Scenario planning (Pierce & Robertson) • IRR • ROI • Insurance (Ratio: internal to external) • Portfolio management (BCG) • Linear modelling • Financial modelling • Proudfoot methods and tools • Delloite and Touche methods and tools • Strategic planning • Hedging • Business modelling

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[1] Many respondents indicated that supporting systems were internally developed. These have not been repeated.

[2] This list is the union of all methods and tools provided by respondents. Similar replies have not been repeated.

22. Appendix O - Tables for randomised block design on question 7

The following table summarises the cross tabulation of the risks per sector. The values have been averaged to do a sector on sector comparison.

RISK	SECTOR								
Norm:	Manufacturing	Distribution	Retail	Mining	Financial	Computers	Engineering	Other	Totals
Mis-use of technique	3.6	3.5	2.7	4.0	3.8	4.0	4.0	3.9	29.4
Too much time analysing current	3.2	2.0	3.7	2.0	3.7	3.0	4.3	3.4	25.3
Lack of top management commitment	4.9	4.5	4.3	4.5	5.0	5.0	4.3	4.9	37.4
Mis-alignment of technique and paradigm	3.8	3.5	4.0	4.5	3.8	3.5	4.3	4.1	31.6
Poor attention to innovation	4.0	4.0	3.7	3.5	4.5	3.5	3.7	4.1	31.0
Implement without testing	4.4	3.5	4.7	4.5	4.2	5.0	3.7	4.1	34.0
Initiative too slow	3.9	3.5	3.0	2.5	4.0	3.0	3.7	3.9	27.4
Not consider holistic issues	4.1	3.5	4.0	3.5	4.7	3.5	4.0	4.3	31.6
Inappropriate implementation method	4.4	3.5	4.0	4.0	4.0	4.5	3.3	4.0	31.7
Inappropriate tools	3.9	3.5	4.3	4.0	3.7	4.0	4.3	4.3	32.1
Ignore employee concerns	4.4	4.5	4.7	4.0	4.8	4.5	3.7	4.7	35.2
No focus on financial implications	4.6	3.5	4.7	4.0	4.7	5.0	3.7	4.7	34.9
Poor vision	4.5	3.5	3.7	4.5	4.8	4.5	4.3	4.9	34.7
Mis-alignment with strategy	4.3	4.0	5.0	3.5	4.3	5.0	3.3	4.3	33.7
Lack of customer focus	4.5	3.5	5.0	3.5	4.8	5.0	4.3	4.6	35.2
No use of experienced specialists	3.7	3.0	3.3	4.0	3.5	4.5	3.0	3.1	28.2
Aim for minimal gains	3.1	2.5	3.3	3.0	4.0	3.5	3.3	3.6	26.3
Failure to appreciate risks	4.2	3.5	4.7	3.5	4.3	5.0	3.7	4.3	33.2
Not anticipating effort and energy	4.2	4.0	4.3	3.5	4.8	3.5	3.7	4.1	32.2
Take on too much	4.0	3.0	3.7	3.5	4.0	3.5	3.0	3.7	28.4
Poor communication	4.6	4.5	4.7	4.5	4.8	4.0	4.0	5.0	36.1
Poor change management attention	4.4	4.0	4.7	4.0	4.5	5.0	4.3	4.6	35.5
No sense of urgency	4.2	4.5	4.0	3.5	4.2	3.5	4.0	4.3	32.2
No plan for short term success	3.8	4.0	3.7	2.5	3.7	3.0	3.0	3.9	27.5
Declaring success too soon	3.1	4.0	3.3	2.5	4.3	2.5	2.3	3.1	25.3
Not anchoring changes in culture	4.2	4.5	3.7	3.5	5.0	4.5	4.0	4.1	33.5
	106.1	95.5	104.7	94.5	112.0	105.5	97.3	108.0	823.6

The following table summarises the cross tabulation of the risks per business change. The values have been averaged to do a business change on business change comparison.

Norm:	SECTOR						
	Continuous improvement	Procedure redesign	Value-stream reinvention	Enterprise redesign	Strategic visioning	Financial optimisation	Totals
Mis-use of technique	4.0	4.1	3.9	3.7	3.5	3.7	22.9
Too much time analysing current	3.2	3.4	3.3	3.6	3.4	3.9	20.7
Lack of top management commitment	4.9	5.0	4.9	4.7	4.8	4.6	28.8
Mis-alignment of technique and paradigm	4.0	3.3	3.9	3.8	3.9	3.9	22.6
Poor attention to innovation	4.1	4.0	3.9	4.2	4.1	4.1	24.4
Implement without testing	4.1	4.5	4.5	4.4	4.2	4.9	26.6
Initiative too slow	3.8	3.7	3.7	3.6	3.5	3.4	21.6
Not consider holistic issues	4.2	4.1	4.2	4.3	4.1	4.6	25.4
Inappropriate implementation method	4.1	4.4	4.4	4.3	4.0	4.4	25.6
Inappropriate tools	3.9	4.1	3.0	3.8	3.8	4.0	22.5
Ignore employee concerns	4.6	4.5	4.5	4.5	4.6	4.7	27.3
No focus on financial implications	4.3	4.6	4.7	4.9	4.7	4.9	28.1
Poor vision	4.4	4.7	4.5	4.7	4.6	4.6	27.4
Mis-alignment with strategy	4.1	4.4	4.4	4.3	4.5	4.6	26.2
Lack of customer focus	4.2	4.6	4.7	4.6	4.7	4.7	27.4
No use of experienced specialists	3.2	4.0	3.8	3.1	3.3	3.9	21.2
Aim for minimal gains	3.3	3.6	3.5	3.3	3.5	3.7	20.8
Failure to appreciate risks	4.1	4.4	4.6	4.2	4.4	4.6	26.3
Not anticipating effort and energy	4.3	4.3	4.2	4.4	4.4	4.9	26.3
Take on too much	3.9	3.7	3.7	4.1	3.9	4.0	23.1
Poor communication	4.7	4.7	4.7	4.7	4.7	4.7	28.1
Poor change management attention	4.4	4.6	4.5	4.5	4.6	4.6	27.2
No sense of urgency	4.3	4.2	4.2	3.9	3.9	3.9	24.4
No plan for short term success	3.5	3.8	3.7	3.6	3.5	3.7	21.7
Declaring success too soon	3.1	3.3	3.3	3.4	3.3	3.4	19.9
Not anchoring changes in culture	4.3	4.4	4.3	4.4	4.3	4.3	26.0
	104.4	107.9	106.8	107.2	106.2	110.4	642.8

23. Appendix P - Software

The research has put forward a framework for the management of risk in business change. As this theory has new requirements it is important to understand what support is available regarding the successful implementation of the framework. This thesis provides the method, but computer support is required to accelerate the process as well as provide the appropriate level of information management assistance.

This appendix aims to disseminate the information system requirements of the purported framework, evaluate software products commercially available and put forward the ideal software profile.

23.1 Overview design

The ideal software environment for a risk management system is shown in Figure 102.
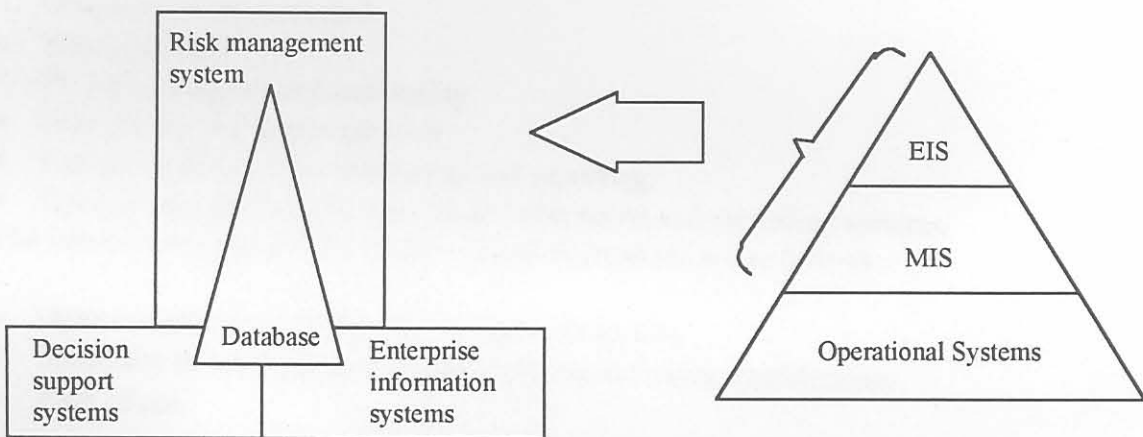
Figure 102 - Ideal Software Architecture for Risk Management System

From Figure 102 the enterprise information systems provide the management information from the various areas internally and externally to the organisation. These represent the management information systems (MIS) and the executive information systems (EIS). Modelling for decision support is achieved by the decision support systems (DSS) which integrate with the enterprise information systems. Integration is typically achieved via a database or other form of sophisticated data warehouse. This provides the "bus" for integration sharing with a range of specialised systems, such as a risk management system.

The risk management system in itself is constituent of a management information system and a set of decision support systems. In terms of the framework requirements as set out in this study, the risk architecture of the risk management system should be comprised as shown in Figure 103.
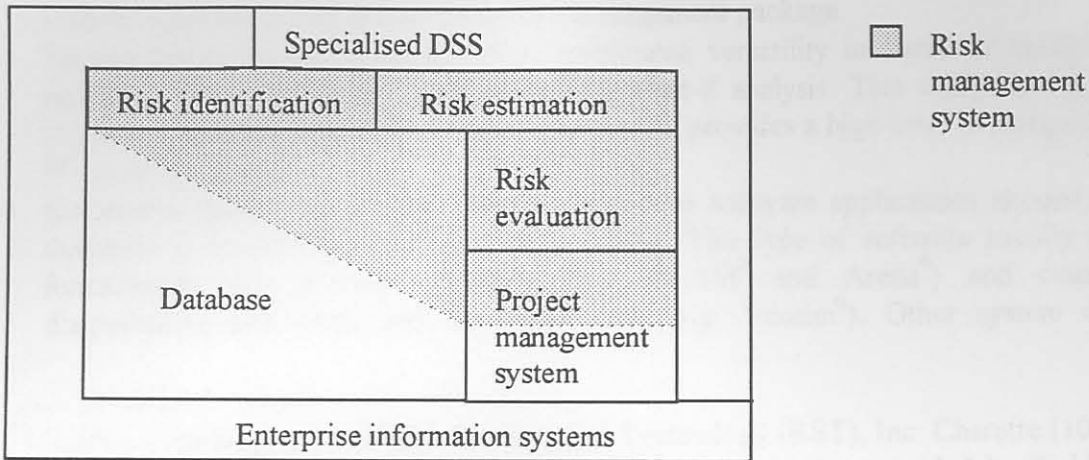
Figure 103 - Composition of the Risk Management System

The core of the risk management system is shown in Figure 103. In general, the core system includes the framework components as described in chapter 4, while the more specialist components e.g. simulation modelling should be left to specialist software packages.

23.2 Criteria

The major areas of functionality required by the risk management system are:

- Documentation of strategic architecture.
- Stakeholder analysis.
- Scenario documentation.
- Business driver analysis.
- Causal loop analysis.
- Stock and flow analysis.
- Listing of risks.
- Problem/opportunity definition.
- Project definition.
- Risk estimation scorecard.
- Life cycle analysis.
- Rating functions.
- Risk management action descriptions.
- Risk evaluation scorecard.
- Risk portfolios
- Project management functionality.
- Risk philosophy documentation
- Executive information monitoring and reporting.
- Open to integration with specialised information and modelling systems.

The functionality requirements of the auxiliary modules are as follows:

- Open integration with the risk management system.
- Suitability of tool/system to model the situation under consideration.
- Ease of use.

23.3 Available software

As the framework presented in chapter 4 has not been put forward previously, it follows that it is unlikely that an appropriate integrated system exists which will support this framework. This section therefore aims to describe the types of available software and highlight examples where appropriate. These types are listed and described as follows:

- **Risk management software**: During this study very few risk management software offerings were found. Risk management software refers to software that caters for the full compliment of management actions from analysis through to monitoring and control. RiskPro[1] is the only comprehensive package that was found during this study. RiskMetrics[2] is specialist software that focuses on global market risk. It is therefore an analysis application and not an integrated management package.
- **Spreadsheets**: Spreadsheets provide considerable versatility in terms of modelling and reporting. It is also powerful in performing what-if analysis. This study used Excel[3] to model the estimation and evaluation scorecards. It provides a high-level of integration with PC based products.
- **Simulation software**: A wide range of simulation software applications abound. System dynamics software is included in this grouping. This type of software usually provides functionality like process modelling (e.g. SLAM[4] and Arena[5]) and causal loop diagramming and stock and flow modelling (e.g. Vensim[6]). Other system dynamics

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[1] RiskPro is the trademark of Risk Services and Technology (RST), Inc. Charette [10, 65, 66] is a specialist consultant associated with RST. The functionality provided by RiskPro is as follows:
- Analysis:
  - Identify potential risks through a knowledgebase of risk factors
  - Estimate risks and their magnitude
  - Evaluate the consequence of risk, including prioritisation
- Reports:
  - Root cause analysis
  - Cost benefit analysis
  - Risk alternatives reporting
  - Risk management planning
  - Schedule impacts
  - Risk breakdowns by phase, organisation and severity
- Managing:
  - Standards against which performance can be measured
  - Information to monitor actual performance
  - A database of risk aversion strategies and tactics

[2] © JP Morgan

[3] © Microsoft corporation.

[4] © Pritsker and Associates.

[5] © Systems Modelling Corporation.

[6] © Ventana Systems, Inc.

modelling packages include Stella[1], Ithink[2], Dynamo[3] and Powersim[4]. A spreadsheet add-in package @Risk[5] specialises in risk analysis and limited simulation.

- **Mathematical modelling**: Some advanced analysis can be undertaken using mathematical modelling packages like Mathematica[6]. An example is the use of Markovian modelling where partial differential equations need to be resolved.
- **Statistical packages**: Statistical packages are used extensively in the analysis of risks. They are applied primarily for forecasting, market research and the derivation of probabilities for analysis like decision trees. NCSS[7] is an example of a functionally rich statistical package.
- **Cultural assessment software**: In recent times a range of cultural assessment packages have emerged. These are typically aimed at analysing the organisation in order to facilitate the change management process. Examples of these analyses include organisational readiness assessments for change. They tend to have a human resources slant[8].
- **Process modelling software**: A very broad range of business process modelling software exists. The primary reason behind this is that business process models form the core of many types of analysis. This includes activities as diverse as BPR, simulation modelling, information systems modelling, embedded systems modelling, business analysis, etc. The format of the models are usually dependent on the use of the models. A typical format could be based on IDEF rules. An example of process modelling is BDF[9].
- **Project management software**: Project management systems range significantly in complexity. In the risk management environment only elementary project management functionality is required and a software package like MS-Project[10] would be suitable.
- **Programming languages**: Programming languages are always a last option of ensuring an application suits the needs of the method. This as an intermediate measure is undesirable. It may however, be feasible if developed for long term and recursive use applications.
- **Database management systems** (DBMS): These systems are strong in the database intensive environment, but usually provide a limited account of functional capability. An example of this is Access[11].
- **Management information systems**: These are the enterprise information systems that accumulate corporate information in order to provide for management monitoring and reporting as shown in Figure 102. SAP[12] is an example of an enterprise requirements planning (ERP) system used by a respondent (see market research) to help manage risk.
- **Executive information systems**: EIS is the high level information system that provides for executive level information both [67] internally and externally to the organisation. It is

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[1] © High Performance Systems.

[2] © High Performance Systems.

[3] © Pugh-Roberts Associates.

[4] © Powersim AS (Norway).

[5] © Palisade Corporation (@Risk is a spreadsheet add-in).

[6] © Wolfram Research.

[7] © Dr Jerry L Hintze.

[8] Wizdom Systems, Inc.

[9] BDF from James Martin and Company not only models processes, but does elementary simulations as well.

[10] © Microsoft Corporation.

[11] © Microsoft Corporation.

[12] © SAP AG.

typically the system ideal for the monitoring of the risk management portfolio, its exposure and its progress against targets and objectives.

- **Diagramming software**: While having no or very limited intelligence, diagramming software allows for the visual representation of mindsets and logic. An example of this is the use of PowerPoint[1] to represent cause-effect relationships.

The above list reveals the wide range of software that could be utilised. While it is possible to use software in isolation, this will be sub-optimal. The ideal situation will be the development of software better suited to the framework purported in the study.

23.4 Software development

Since the development of the framework, it has been applied in another consulting engagement. In order to facilitate its execution, the development of some supporting software was required. This was achieved using a combination of Access[2], Visual Basic (VB)[2], Excel[2] and Word[2]. The database and key risk management components (see Figure 102) were developed with the aide of Access and VB. Reporting and data manipulation for summary purposes is done via Excel. The detailed risk profiles are maintained in Word. Vensim is used for modelling the relationships between risks, but this is not integrated.

The system currently provides key support but is not robust enough for commercial purposes or to provide advanced levels of assistance. A need for a more advanced development is still therefore required. It is recommended that specialist analysis software should be employed, but this must also seamlessly integrate with the risk management software.

23.5 Conclusion

This appendix identified the overview requirements of a supporting computer system that will address the information management and advanced analysis needs of the integrated risk management framework. Current commercial offerings were reviewed and assessed against these requirements. It was found that no single package is able to provide a solution, but that a combination of packages and system development is required.

The researcher has developed a system that supports the required functionality. It is not sufficiently robust for commercial purposes and some work in this regard would therefore be required.

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[1] © Microsoft Corporation.
[2] © Microsoft Corporation.