Risk Appraisal and Venture Capital in High Technology New Ventures

Gavin C. Reid and Julia A. Smith

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This book is a 'crossover' treatment of quantitative and qualitative risk analysis within the setting of new high-technology ventures in the UK. Reid and Smith have based their research on extensive fieldwork in patent-intensive, high-technology firms. This has included face-to-face interviews with leading investors, and is illustrated by two chapters of case studies. Their aim is to advance the understanding of methods of risk assessment and to illuminate current policy concerns about stimulating innovative output and securing intellectual property.

This book is unique in being academic in intent and purpose, yet strongly grounded in practice, without becoming merely a practitioner volume. Reid and Smith find a considerable consensus in the venture capital industry on the spectrum of investments by risk, and on key commercial factors affecting risk. This book offers a useful and interdisciplinary approach to an increasingly popular field of study. It provides novel insights into valuing high-technology investments, and managing their risks.

This book will be of considerable interest to students of financial and industrial economics, and financial and management accounting, as well as practitioners in banking, private equity and business and management consultancies.

Gavin C. Reid is Director of CRIEFF and Professor in Economics and Finance at the University of St Andrews. **Julia A. Smith** is Reader in Accounting and Finance at Strathclyde Business School.

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GCR:
To my children Neil, Eilidh, Annabel and Kenneth

JAS:
To my parents John and Eileen

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Preface

This book examines how risk is handled in new high-technology ventures in the UK. Both investors (those allocating funds to ventures), typically venture capitalists, and investees or entrepreneurs (those receiving equity funding support for their ventures) are considered. The main evidence reported upon was gathered by face-to-face semi-structured interviews with key UK investors in high technology firms, and in addition by postal questionnaires. That is, our study is unique in being largely based on primary source data. The venture capital investors we examined have included those who have accounted for most of the funds allocated in this industry segment over the period of analysis of our research. The interview evidence covered risk premiums, investment time horizons, sensitivity analysis, expected values, cash flow, financial modelling, decision making, and qualitative appraisal. A set of ten case studies of patent-intensive, high-technology, investee firms has also been constructed, using evidence from face-to-face interviews supplemented by additional company evidence. The firms examined were operating in new technological areas like encrypting and enciphering for digital technologies, light emitting polymers for flexible screen displays, thermal imaging for security applications, and biopharmaceuticals for cancer therapies.

From the evidence gathered on venture capital investors and entrepreneurs, our principal findings are as follows:

- Standard determinants of company risk are a poor guide to an overall risk assessment of the high-technology firm.
- Business risk, agency risk, and innovation risk are crucial categories in high-technology contexts.
- Venture capital investors emphasise agency risk; investees emphasise business risk.
- Investors focus most on novelty in the marketplace and sales; while entrepreneurs focus most on getting to market and meeting innovation milestones.
- There is considerable consensus in the venture capital industry on the spectrum of investments by risk, and on key commercial factors affecting risk.
- There is little industry consensus on innovation risk.

- Investors prefer to rely on their own procedures and processes (rather than on those of entrepreneurs) when evaluating potential investments.
- Financial accounts seem to offer little to investors, in terms of risk disclosure, or the valuation of intangible assets like intellectual property.
- Investors generally would *not* welcome compulsory risk disclosure, as this would provide too much information to rival investors.
- Statistical models can explain levels of investment allocated by venture capitalists, using risk-based behavioural variables.

The authors should acknowledge, with gratitude, the support and advice about various aspects of this research which they have received from various quarters. We are especially grateful to the Research Foundation of the Chartered Institute of Management Accountants (CIMA), for providing funding for undertaking the first phase of the fieldwork, involving the venture capital investors. The Carnegie Trust for the Universities of Scotland subsequently provided valuable top-up funding, which allowed us to extend further our fieldwork on investees in high-technology areas. Further, funding by the Economic and Social Research Council (ESRC) has enabled us to develop the inter-disciplinary approach espoused in this book, which involves a synthesis of accounting, finance and economics methodologies. We have created a new ESRC research network arrangement, called Seminars in Accounting, Finance and Economics (SAFE) to promote further exactly this kind of approach. Finally, the dissemination of our principal results was facilitated by a travel grant from the British Academy. All of our sponsors have played a crucial role in facilitating the execution, development and dissemination of our research, and we record here our especial thanks for their involvement and support.

Continuous development of our work has also been assisted by its exposure to the welcome intellectual feedback received from participants at numerous seminars, workshops and conferences. The latter have included the British Accounting Association (BAA), the European Accounting Association (EAA), the Financial Reporting and Business Communication (FRBC) conference (at Cardiff Business School), the Babson/Kauffman Entrepreneurship Research Conference (both in Europe and the USA) and the annual meeting of the Academy of Management, USA. We have benefited enormously from that feedback down the years. It is hard to single out specific individuals, and there are many more that we have no space to acknowledge (for which apologies), but the following should be specifically mentioned: Zoltan Acs, John Ashworth, David Audretsch, Andrew Burke, John Butler, Bill Bygrave, Gavin Cassar, Robert Cressy, Marc Epstein, Lynne Evans, Sharon Gifford, Paul Gompers, Graham Hall, Richard Harrison, Peter Johnson, Tom Jones, Josh Lerner, Graham Loomes, Sophie Manigart, Neil Marriott, Colin Mason, Falconer Mitchell, Gordon Murray, Mike Nolan, Paul Pacter, Simon Parker, Werner Ploberger, Paul Reynolds, Steve Spinelli, Andy Stark, David Storey, Nicholas Terry, Roy Thurik, Martin Walker, Mike Wright.

A presentation of our preliminary results to a specialist gathering (the EIASM

Workshop on Performance Measurement and Management Control, EDHEC, Nice) was made possible by travel grants from the British Academy. When our work was close to completion, it was useful to have its full range of ideas, as developed in this book, set out and 'bench tested' before members of the Faculty of Economic Science, Development and Business Administration, and of the CNRS research unit MRSH, of the University of Caen. Our particular thanks go to Jean Bonnet and Vincent Merlin, for their creating the sponsorship that made possible this invigorating research engagement.

We should also extend our warmest gratitude to the venture capital investors and the entrepreneurs who gave so willingly of their time, often within the context of extreme commercial pressure, to answer our questions, and also provided us with additional material from which we could construct our ten case studies. Without their active and enthusiastic participation, the completion of this book would not have been possible. The initial contacts we made with key players in the UK venture capital industry were greatly facilitated by introductions from two past Chairmen of the British Venture Capital Association (BVCA), Michael Denny and Robert Drummond, for which our thanks, for opening up to us a persistently fascinating field of enquiry.

A number of academic and practitioner referees have provided valuable critical feedback on several earlier drafts of this book, from which we have learnt much, and to which the text has been adapted, to the best of our powers. The authors remain responsible for the views expressed within this monograph, including any such errors of omission or commission that it may contain, despite our most assiduous efforts to obtain perfection in drafting.

As regards the final product that you see before your eyes, we should particularly thank Terry Clague of Routledge, who has been a most positive force in encouraging us to bring this project to conclusion, and Rob Langham, also of Routledge, who played a vital early role in the commissioning of this volume. Thanks too, on the production side, to Tom Sutton, also of Routledge.

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Abbreviations

AIS	accounting information system
BVCA	British Venture Capital Association
DCF	discounted cash flow
DTI	Department of Trade and Industry
EV	expected value
ICFC	Industrial and Commercial Finance Corporation
IP	intellectual property
IRR	internal rate of return
IS	information system
LCD	liquid crystal display
LEP	light emitting polymer
MAS	management accounting system
MBI	management buy-in
MBO	management buy-out
NPV	net present value
R&D	research and development
ROCE	return of capital employed
ROSF	return of shareholders' funds
SME	small- to medium-sized enterprise
SPSS	statistical package for the social sciences
SWOT	strengths, weaknesses, opportunities and threats: a form of company evaluation
VaR	value at risk
VC	venture capital
VCR	venture capital report

Part I

Conceptual framework

1 Background

Introduction

The aim of this book is to analyse methods of risk appraisal in new high-technology ventures (compare Reid and Smith, 2001; Norman, 2004). The objectives of the research upon which this book reports were threefold. First, to advance best practice in supporting high-technology ventures (compare Hsu and Kenny, 2005). Second, to suggest new methodologies, drawing on accounting, finance and economics, for risk handling (compare Cumming *et al.*, 2005). Third, to increase awareness of the utility of accounting, finance and economics methods in a combined sense, for improving our understanding and management of uncertainty. Such methods are explored from both the venture capitalist's (investor's) and the entrepreneur's (investee's) perspective.

A principal tool of this book is the notion of a risk class. Three classes of risk are considered: agency risk, arising from incomplete alignment of the interests of investor and investee (Hyytinen and Toivanen, 2003); innovation risk, arising from the use of an entirely new technology (Lerner. 2002; Moore and Wüstenhagen, 2004; Cumming *et al.*, 2005); and business risk, arising from unpredictable competitor and customer reactions (Goodman, 2003; Frigo and Sweeny, 2005). The research project on which this book reports sought to enquire into attitudes to risk and skills at risk management, in the relationship between high-technology firms and their venture capital backers. The basic idea, building on earlier work by the authors and various co-workers (Reid, 1996; Reid *et al.*, 1997), and related developments (e.g. Fiet, 1995a, 1995b), is as follows. It is that as the venture capital industry matures, so should the techniques which high-technology firms and their venture capital backers use for risk management (compare Dauterive and Fok (2004) in a Chinese context; Liu and Chen (2006) in a Taiwanese context; Robnik (2006) in a Slovenian context; Smolarski *et al.* (2005) in an Indian context; and Salehizadeh (2005) for a general emerging economies context).

Finally, the book explores the usefulness of financial reporting, risk reporting and disclosure in the context of high-technology firms (Hand, 2005). This lays the basis for an analysis of how investors' attitudes to risk affect the level of funding they are willing to provide to entrepreneurs who have started (and run) high-technology firms (compare Cumming, 2006).

If total risk is split up into innovation risk, business risk and agency risk, we note that the main category of risk which the venture capitalist seems to have sought to attenuate is agency risk. They have done this by improved management accounting systems, post-investment, and by pre-commitment to the installation of such systems, pre-investment. However, success in this area has been incomplete, and attention to business and innovation risk has been severely limited. Lack of overall success in risk handling has, as a consequence, been a major cause of failure to provide adequate levels of outside finance for high-technology ventures, compared to appropriate yardstick comparisons in the USA. This book reports on research which aims to investigate the spectrum of methods used for managing innovation, business and agency risks in investors and investees. It thereby seeks routes to better practice in risk handling.

The investigation was fieldwork based (Glaser and Strauss, 1967; Sekaran, 1992, Ch. 4). It drew on our extensive experience in the application of this methodology, both in the venture-capital area (Reid, 1998), and in the investigation of information (e.g. management accounting) system implementation and development (Mitchell *et al.*, 2000). In coping with the high-technology dimension of the study, our previous experience in the intellectual property area, especially as applied to patent-intensive regimes, was also drawn upon. This extended to detailed knowledge of patenting protocols, including the generation of patent 'families' (Reid *et al.*, 1994, 1996; Reid and Roberts, 1996).

In this book, we provide a detailed account of our recent and current research into risk appraisal in UK based high-technology ventures. A comparative US component has also been incorporated into our work, as reflected in fieldwork and two case studies (see Case I and Case J of Chapter 8). As our work is fieldwork based (compare Fried and Hisrich, 1995), it is sharply focused on the reality, and efficacy, of contemporary methods of risk assessment. Over a period of a year we engaged in face-to-face interviews (Oppenheim, 2000) with venture capital investors, and with entrepreneurs in whose firms venture capital had been committed (compare Sapienza, 1989). Our sample consisted of twenty leading UK investors who had engaged in the support of high-technology ventures, and ten entrepreneurs (investees), who were involved in bringing to market some of the most exciting high-technology products being developed in the world today (e.g. encrypting and enciphering, quantum cascade lasers, animal robotics, light emitting polymers, thermal imaging). The meetings with venture capital investors and entrepreneurs were conducted using a administered questionnaire schedule (Sekaran, 1992, Ch. 7) (see Appendix 2). This schedule was constructed in a slightly different variant for the investor and investee case, but each used a standardised approach to the following eight-point agenda: risk premia, investment time horizon, sensitivity analysis, expected values, predicted cash flows, financial modelling, decision making, and qualitative risk appraisal. A specimen interview schedule (which contains this eight-point agenda) is contained in Appendix 2. Further sample data were obtained by a postal questionnaire, as reflected in the analysis of Chapters 9 and 10, which is based on the instrumentation detailed in Appendix 4.