

## **INFORMATION TO USERS**

**This manuscript has been reproduced from the microfilm master. UMI films the text directly from the original or copy submitted. Thus, some thesis and dissertation copies are in typewriter face, while others may be from any type of computer printer.**

**The quality of this reproduction is dependent upon the quality of the copy submitted. Broken or indistinct print, colored or poor quality illustrations and photographs, print bleedthrough, substandard margins, and improper alignment can adversely affect reproduction.**

**In the unlikely event that the author did not send UMI a complete manuscript and there are missing pages, these will be noted. Also, if unauthorized copyright material had to be removed, a note will indicate the deletion.**

**Oversize materials (e.g., maps, drawings, charts) are reproduced by sectioning the original, beginning at the upper left-hand corner and continuing from left to right in equal sections with small overlaps. Each original is also photographed in one exposure and is included in reduced form at the back of the book.**

**Photographs included in the original manuscript have been reproduced xerographically in this copy. Higher quality 6" x 9" black and white photographic prints are available for any photographs or illustrations appearing in this copy for an additional charge. Contact UMI directly to order.**

# **U·M·I**

University Microfilms International  
A Bell & Howell Information Company  
300 North Zeeb Road, Ann Arbor, MI 48106-1346 USA  
313/761-4700 800/521-0600



**Order Number 9426558**

**Commercializing the university: The costs and benefits of the  
entrepreneurial exchange of knowledge and skills**

**Philpott, Rodger Frank, Ph.D.**

**The University of Arizona, 1994**

**Copyright ©1994 by Philpott, Rodger Frank. All rights reserved.**

**U·M·I**

**300 N. Zeeb Rd.  
Ann Arbor, MI 48106**



**COMMERCIALIZING THE UNIVERSITY:  
THE COSTS AND BENEFITS OF THE ENTREPRENEURIAL  
EXCHANGE OF KNOWLEDGE AND SKILLS**

by

Rodger Frank Philpott

Copyright © Rodger Frank Philpott 1994

A Dissertation Submitted to the Faculty of the

DEPARTMENT OF EDUCATIONAL ADMINISTRATION  
AND HIGHER EDUCATION

In Partial Fulfillment of the Requirements  
For the degree of

DOCTOR OF PHILOSOPHY

In the Graduate College

THE UNIVERSITY OF ARIZONA

1 9 9 4

THE UNIVERSITY OF ARIZONA  
GRADUATE COLLEGE

As members of the Final Examination Committee, we certify that we have read the dissertation prepared by Rodger Frank Philpott

entitled Commercializing the University: The Costs and Benefits of the Entrepreneurial Exchange of Knowledge and Skills

and recommend that it be accepted as fulfilling the dissertation requirement for the Degree of Doctor of Philosophy

Professor Larry Leslie

*Larry Leslie*

3/25/94  
Date

Professor Sheila Slaughter

*Sheila Slaughter*

3/25/94  
Date

Professor David King

*David King*

3/25/94  
Date

Dr. James Rusk

*James Rusk*

3/25/94  
Date

Associate Professor  
Gary Rhoades

*Gary Rhoades*

3/25/94  
Date

Final approval and acceptance of this dissertation is contingent upon the candidate's submission of the final copy of the dissertation to the Graduate College.

I hereby certify that I have read this dissertation prepared under my direction and recommend that it be accepted as fulfilling the dissertation requirement.

Professor Larry Leslie  
Dissertation Director

*Larry Leslie*

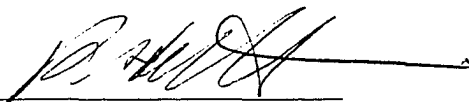
3/28/94  
Date

**STATEMENT BY AUTHOR**

This dissertation has been submitted in partial fulfillment of requirements for an advanced degree at The University of Arizona and is deposited in the University library to be made available to borrowers under rules of the Library.

Brief quotations from this dissertation are allowable without special permission, provided that accurate acknowledgment of source is made. Requests for permission for extended quotation from or reproduction of this manuscript in whole or in part may be granted by the copyright holder.

SIGNED: \_\_\_\_\_

A handwritten signature in dark ink, appearing to be 'R. W. H.', written over a horizontal line.

### ACKNOWLEDGMENTS

I acknowledge with gratitude the understanding and forbearance of my family, Susan and Nicholas Philpott, in helping me to achieve this long term ambition. Thank you for being there in the difficult times.

This research could not have been undertaken without the involvement, active support and cooperation of my colleagues at Curtin University of Technology. I am mindful of their generosity and encouragement and especially for the practical support of the University President and Vice-Chancellor, Professor John Maloney. Many Curtin University staff have contributed to the study as research respondents, suppliers of information and as the innovators and real models for the commercialization of Curtin University.

During my academic program (1991-1994) the staff of the Center for the Study of Higher Education, University of Arizona, and my fellow students have been challenging task masters, earnest colleagues and now I hope friends. My sincere thanks to Valerie Hyde, Karen Onstott, Amy Craddock, Paulette Catell, John Melvin, Ric Haan and Professors Larry Leslie (Committee Chair), Sheila Slaughter, Gary Rhoades, and Doug Woodard. Academic responsibility for this work is mine alone. If there is any credit due I thankfully share it with the many people who have contributed to this work. Thank you.

Rodger Philpott  
TUCSON Arizona,  
March 25, 1994.



## TABLE OF CONTENTS

<b>ACKNOWLEDGMENTS .....</b>	<b>4</b>
<b>TABLE OF CONTENTS .....</b>	<b>5</b>
<b>LIST OF TABLES .....</b>	<b>10</b>
<b>ABSTRACT .....</b>	<b>11</b>
<b>CHAPTER ONE</b>	
<b>CONTEXT OF THE PROBLEM .....</b>	<b>13</b>
<b>1. INTRODUCTION .....</b>	<b>13</b>
<b>2. STATEMENT OF THE PROBLEM .....</b>	<b>14</b>
<b>3. INSTITUTIONAL BACKGROUND .....</b>	<b>19</b>
<b>4. THE LESLIE STUDY .....</b>	<b>22</b>
<b>5. PURPOSE OF THE STUDY .....</b>	<b>23</b>
<b>CHAPTER TWO</b>	
<b>THEORETICAL FRAMEWORK AND LITERATURE SURVEY .....</b>	<b>25</b>
<b>1. THEORETICAL FRAMEWORK .....</b>	<b>25</b>
<b>2. RESEARCH FRAMEWORK .....</b>	<b>28</b>
2.1 REVENUE GENERATION.....	29
2.2 PRESTIGE AND RELATIONS WITH EXTERNAL BODIES .....	30
2.3 ACADEMIC RESOURCES CONSUMED .....	31
2.4 SPILLOVER ON RESEARCH AND TEACHING .....	32
2.5 FUTURE CONSULTING OPPORTUNITIES .....	3
2.6 FACULTY AND STUDENT RECRUITMENT, RETENTION AND LOSS .....	35
2.7 EXTERNAL EMPLOYMENT OF GRADUATE STUDENTS .....	36
2.8 EQUIPMENT UTILIZATION .....	36
2.9 REVENUE SUBSTITUTION .....	37
2.10 TIME OF HIGHER SUPPORT PERSONNEL .....	37
2.11 SECRETIVENESS AND CONFIDENTIALITY .....	38
2.12 LEGAL, PATENT, ROYALTY, PRODUCT LIABILITY, INTELLECTUAL PROPERTY AND BUREAUCRATIC FACTORS .....	39
2.13 PERSONAL SOCIAL COSTS .....	40
2.14 OTHER POTENTIAL BENEFITS AND COSTS .....	4
<b>3. LESLIE'S STUDY (1992) .....</b>	<b>42</b>
3.1 GENERAL INSIGHTS, STRATEGIES AND PRINCIPLES .....	45

## TABLE OF CONTENTS - *Continued*

<b>4. CONCLUDING COMMENTS .....</b>	<b>47</b>
<b>CHAPTER THREE</b>	
<b>METHOD .....</b>	<b>49</b>
<b>1. INTRODUCTION .....</b>	<b>49</b>
<b>2. RESEARCH DESIGN .....</b>	<b>50</b>
2.1 OVERVIEW .....	50
2.2 THE RESPONDENTS .....	51
2.3 FINANCIAL DATA .....	5
2.4 INTERVIEW SCHEDULE .....	54
2.5 VALUING NON-MONETARY COSTS AND BENEFITS .....	55
2.6 ENTREPRENEURIAL REVENUE IMPORTANCE .....	57
2.7 PILOT SURVEY .....	57
2.8 QUALITATIVE COMMENTARY .....	58
<b>3. STUDY LIMITATIONS .....</b>	<b>59</b>
3.1 VALUING NON-MONETARY COSTS AND BENEFITS .....	59
3.2 FINANCIAL DATA .....	59
3.2.1 EARNED INCOME .....	60
3.3 INTERVIEWER BIAS .....	61
3.4 RESPONDENT BIAS .....	62
3.5 ADDITIONAL RESPONSE DATA .....	63
<b>4. DATA ANALYSIS .....</b>	<b>63</b>
4.1 INTER-UNIVERSITY ANALYSIS .....	63
4.2 INTRA-UNIVERSITY ANALYSIS .....	6
4.3 SEPARATE COMPONENTS OF THE DATA ANALYSIS .....	64
4.4 UNIVARIATE DATA .....	65
4.5 THE SEPARATE UNIVERSITIES .....	65
<b>5. CONCLUDING COMMENTS .....</b>	<b>66</b>
<b>CHAPTER FOUR.</b>	
<b>DATA ANALYSIS AND RESEARCH RESULTS .....</b>	<b>67</b>
<b>1. REPORTING THE STUDY RESULTS .....</b>	<b>67</b>
<b>2. NON-MONETARY COST AND BENEFIT ITEMS .....</b>	<b>67</b>
2.1 BENEFITS .....	68
2.1.1 PRESTIGE .....	69
2.1.2 RELATIONS WITH EXTERNAL BODIES .....	70
2.1.3 FUTURE CONSULTING OPPORTUNITIES .....	71
2.1.4 SPILLOVER TO RESEARCH .....	73
2.1.5 SPILLOVER TO TEACHING .....	74
2.1.6 EQUIPMENT GAIN .....	75
2.1.7 SERVICES CONTRIBUTED BY PROJECT PERSONNEL .....	76
2.1.8 EMPLOYMENT OF GRADUATES .....	77
2.1.9 RECRUITMENT OF STUDENTS .....	77
2.1.10 RECRUITMENT OF STAFF .....	79
2.1.11 EMPLOYMENT OF STUDENTS .....	80

## TABLE OF CONTENTS - *Continued*

2.2 COSTS .....	80
2.2.1 PERSONAL SOCIAL COSTS .....	80
2.2.2 ACADEMIC RESOURCES CONSUMED .....	82
2.2.3 LOSS OF TEACHING AND PREPARATION TIME .....	83
2.2.4 LOSS OF TIME FOR BASIC RESEARCH .....	84
2.2.5 EQUIPMENT WEARING OUT .....	86
2.2.6 TIME FOR HIGHER SUPPORT PERSONNEL .....	87
2.2.7 MONETARY LOSS .....	88
2.2.8 LOSS OF ACADEMIC STAFF .....	89
2.2.9 SECRETIVENESS AND CONFIDENTIALITY .....	90
2.2.10 PRODUCT OR PROCESS LIABILITY .....	91
2.2.11 REVENUE SUBSTITUTION .....	91
2.2.12 PATENT COST .....	93
2.2.13 LEGAL FEES .....	93
2.3 COSTS AND BENEFITS IN TABULAR SUMMARY .....	94
<b>3. INTER-UNIVERSITY ANALYSIS .....</b>	<b>96</b>
3.1 GENERAL UNIVERSITY COST FACTOR .....	99
3.2 GENERAL UNIVERSITY BENEFITS FACTOR .....	100
3.3 EMPLOYABILITY FACTOR .....	101
3.4 LEGALISTIC FACTOR .....	102
3.5 GENERAL POSITIVE RESOURCES FACTOR .....	103
3.6 INTER-UNIVERSITY BY SPECIFIC COST AND BENEFIT .....	105
<b>4. INTRA-UNIVERSITY ANALYSIS .....</b>	<b>106</b>
4.1 GENDER VARIABLE .....	109
4.2 ACADEMIC DISCIPLINE VARIABLE .....	109
4.3 ACADEMIC STATUS VARIABLE .....	111
4.4 ENTREPRENEURIAL VARIABLE .....	111
<b>5. COMPONENT ANALYSIS .....</b>	<b>112</b>
5.2 REVENUE IMPORTANCE .....	112
5.2 MONETARY AND NON-MONETARY RELATIONSHIP .....	114
6.1 UNIVERSITY MONETARY INCOME .....	114
6.1.1 EARNED ENTREPRENEURIAL INCOME .....	115
6.2 NON-MONETARY COSTS AND BENEFITS .....	120
6.3 ADDITIONAL COSTS AND BENEFITS .CATEGORIES .....	121
6.4 ADDITIONAL COST AND BENEFIT .ITEMS .....	125
6.5 BENEFITS .....	125
6.4.1 ACADEMIC AND PROFESSIONAL DEVELOPMENT .....	125
6.4.2 MORALE AND MOTIVATION .....	126
6.4.3 OTHER ECONOMIC ITEMS .....	126
6.4.4 IMAGE AND PUBLIC RELATIONS .....	126
6.4.5 NETWORKING .....	127
6.4.6. OTHER SOCIAL ITEMS .....	127
6.6 COSTS .....	127
6.5.1 STRESS .....	127
6.5.2 PERFORMANCE WORRIES .....	128
6.5.3 OTHER ECONOMIC ITEMS .....	128

## **TABLE OF CONTENTS - *Continued***

6.5.4 ADMINISTRATION AND MANAGEMENT .....	128
6.5.5 TIME PRESSURES .....	129
6.5.6 TRADITIONAL UNIVERSITY ROLE .....	129
6.5.7 OTHER SOCIAL ITEMS .....	130
<b>7. GENERAL COMMENTS .....</b>	<b>130</b>
<b>CHAPTER FIVE</b>	
<b>DISCUSSION AND CONCLUSIONS .....</b>	<b>131</b>
<b>1. REVIEW OF THE STUDY PURPOSE .....</b>	<b>131</b>
<b>2. GENERAL DISCUSSION .....</b>	<b>137</b>
2.1 COST AND BENEFIT ITEMS .....	137
2.2 INTER UNIVERSITY ANALYSIS .....	143
2.3 THE FIVE FACTORS .....	144
2.4 INDEPENDENT VARIABLES .....	146
2.5 ADDITIONAL COSTS AND BENEFITS .....	147
<b>3 LESLIE'S PERCEPTIONS, STRATEGIES AND PRINCIPLES .....</b>	<b>148</b>
3.1 ADDITIONAL INSIGHTS .....	151
<b>4 CONCLUDING COMMENTS .....</b>	<b>152</b>
<b>APPENDIX A: COST BENEFIT TAXONOMY BY LESLIE AND HARROLD (1993) .....</b>	<b>154</b>
<b>APPENDIX B: THE SURVEY INTERVIEW .....</b>	<b>155</b>
<b>APPENDIX C: ABBRVIATION: CHAPTER FOUR DATA ANALYSIS TABLES .....</b>	<b>156</b>
<b>REFERENCES .....</b>	<b>159</b>

## LIST OF TABLES

TABLE	TITLE	PAGE
2.1	A TAXONOMY OF INDIRECT BENEFITS AND COSTS (After Leslie and Harrold, 1993) .....	44
3.1	DATA ANALYSIS COMPONENTS .....	64
4.1	LESLIE AND HARROLD'S (1993) TAXONOMY AND THE RESULTS OF THIS STUDY A COMPARISON OF INDIRECT BENEFITS .....	94
4.2	LESLIE AND HARROLD'S (1993) TAXONOMY AND THE RESULTS OF THIS STUDY A COMPARISON OF INDIRECT COSTS .....	95
4.3	ALL THE UNIVERSITIES COMBINED: FIVE FACTOR ANALYSIS .....	97
4.4	INTER-UNIVERSITY COMPARISONS: FIVE FACTOR ANALYSIS .....	98
4.5	INTER-UNIVERSITY COST AND BENEFIT ITEMS DIFFERENCES BY UNIVERSITY .....	105
4.6	CURTIN UNIVERSITY: FIVE FACTOR ANALYSIS .....	107
4.7	CURTIN UNIVERSITY: FIVE FACTOR ANALYSIS: BY INDEPENDENT VARIABLES .....	108
4.8	CURTIN UNIVERSITY: TOTAL TEACHING, RESEARCH AND PUBLIC SERVICE INCOME FOR RECURRENT AND CAPITAL DEVELOPMENT.....	115
4.9	CURTIN UNIVERSITY: ESTIMATED 1991 EARNED INCOME BY MAJOR ACADEMIC DIVISION .....	117
4.1	CURTIN UNIVERSITY: BENEFIT CATEGORIES: FOR THE ADDITIONAL BENEFIT ITEMS SUGGESTED BY RESPONDENTS .....	122
4.11	CURTIN UNIVERSITY: BENEFIT CATEGORIES: FOR THE ADDITIONAL COST ITEMS SUGGESTED BY RESPONDENTS .....	123
4.12	CURTIN UNIVERSITY: ADDITIONAL BENEFIT BY CATEGORY .....	124
4.13	CURTIN UNIVERSITY: ADDITIONAL COSTS BY CATEGORY .....	124
5.1	A REVISED TAXONOMY OF NON-MONETARY COSTS AND BENEFITS (After Leslie and Harrold, 1993) .....	148

## ABSTRACT

The emergence of the global economy has forced the Australian government to revise economic strategies and to seek institutional changes. Higher education's new roles in research and human resource development, have been manifested in university commercialization activities. Mindful that Universities are *prestige* rather than *profit* maximizers, this study applies Schumpeter's (1942) theoretical model for the survival of a firm under financial stress. The model's responses, extended to education by Leslie and Miller (1973), include new products, new markets, restructuring, increased productivity and new supply factors.

University entrepreneurial activities have monetary and non-monetary impacts. The non-monetary costs and benefits of Australian university enterprise were studied by Leslie (1992) and Leslie and Harold (1993). In this study, academics at Curtin University of Technology (Perth, Western Australia) were selected as entrepreneurial or non-entrepreneurial subjects and surveyed on the non-monetary costs and benefits of entrepreneurial activities affecting Curtin's teaching, research and public service mission. This data were analyzed and subsequently compared with data obtained by Leslie (1992). Differences in academic perceptions were found among the Curtin respondents by gender, academic status, discipline area, entrepreneurship and non-entrepreneurship, and entrepreneurial revenue importance. Using the Leslie data inter-institutional differences were examined and an order of entrepreneurial institutional types proposed, with Curtin University described as a frontier entrepreneurial university.

The taxonomy of costs and benefits developed by Leslie (1992) was revised with the addition of personal social costs, stress, networking

and professional development. An estimate was made of the dollar value of non-monetary items; non-monetary benefits were three times the dollar value of monetary benefits; non-monetary costs were less than half the monetary cost levels. The ratio of non-monetary costs to benefits was 1:3.5. Academics in the disciplines of engineering and science had more favorable perceptions of entrepreneurial costs and benefits than respondents in business studies. Health science respondents were described as having pessimistic perceptions.

Future research may look at the levels of commercial revenue and investigate the effects of the amount of financial success or failure on the entrepreneurial efforts of academics. In university enterprise successes seem to foster success and the favorable perceptions of academics.

"Indeed, it is a fairly safe test; work that has a commercial value does not belong in the university."

(Veblen, 1917)

"The universities have demonstrated their willingness to do almost anything for money. Government and business are not wholly disinterested in their approaches to the universities; they are not seeking the truth, but are hiring universities to promote the ends they have in view. If the truth serves these ends, it is merely a coincidence."

(Hutchins, 1962: x-xi)

"Commercializing university intellectual property is more than a financial tactic. It is a strategic shift of considerable importance, and the policy implications of such a change must be considered carefully."

(Anderson and Sugarman, 1989:1)



## CHAPTER ONE

### CONTEXT OF THE PROBLEM

#### 1 INTRODUCTION

This study is undertaken in Australia where, until recently, all universities were government funded.<sup>1</sup> Historically, the Australian university system is seen as serving the public "interest" and the public "good." Commercial activities in, and private support for, universities were minimal. This situation has changed with the establishment of several small, privately funded universities and with some publicly funded universities now generating up to a third of total income from non-traditional funding sources. Teaching, research, advisory services, the renting of physical space and equipment, and the development of patentable intellectual property are considered to be activities that usually involve the transfer of knowledge and skills and that have now become saleable commercial products.<sup>2</sup> These far-reaching, commercially oriented activities are the focus of this study and are defined for the purposes of this study as the entrepreneurial exchange of knowledge and skills by university staff, or in abbreviated form, "entrepreneurial activities."

---

<sup>1</sup> This was true during most of the last decade although in the nineteenth and early twentieth centuries there was some private philanthropic support for Australian universities (e.g., The University of Western Australia).

<sup>2</sup> The adoption of commercial practices in general asset and resource management within universities needs to be considered in any study of university change and development (restructuring). Commercialization is not only affecting academic enterprise but also the institutional enterprise in which academic's function (the management and administration of the University itself -- the support services for the academic task).

The work of Thorsten Veblen, (1917); Hofstadter and Metzger, (1957); Furner, (1975); Skocpol, (1980); Silva and Slaughter, (1984); Martin, (1986); Barrow (1990); and others; although, often supporting commerce, indicate that until recently universities were, and were expected to be, somewhat superior to and insulated from economic activities. Indeed, many restrictions (legal and conventional, covert and overt) are placed on the commercial activities that universities could undertake. Certainly the idea of university activities making a profit is not countenanced by most governments, communities, and academic staff.

## 2 STATEMENT OF THE PROBLEM

Operationally, academic entrepreneurial exchange<sup>3</sup> may be defined as activities<sup>4</sup> that involve all the following listed points; they are

- 1) conducted or managed by academic staff,
- 2) in addition to recurrent budget<sup>5</sup> funded activities,
- 3) in keeping with a university's teaching, research and public service mandate,

---

<sup>3</sup> As distinct from an institutional perspective of entrepreneurial exchange involving all university staff (academic and administrative).

<sup>4</sup> Technology transfer activities in universities have been examined by other researchers under various entrepreneurial designations, for example, knowledge transfer (Fairweather, 1988), the commercialization of science (Leslie, 1992), the commercialization of scholarship (Leslie and Harrold, 1993), knowledge transfer and entrepreneurial scientists (Etzkowitz, 1983) and technology transfer defined by Rhoades and Slaughter (1991) along the lines of achieving a commercial product through the taking into the market place of an idea from the laboratory of a professor.

<sup>5</sup> Recurrent budget activities are those activities financially supported by, and required of, the university upon its acceptance of a financial grant from the federal Australian government. These funds are provided on an annual basis, within a three-year, rolling-plan, and against the anticipated "taught student load" for Australian domiciled students.

- 4) enterprising and commercial in nature,<sup>6</sup>
- 5) undertaken for a monetary return,
- 6) associated with the development or transmission of knowledge and skills,<sup>7</sup>
- 7) undertaken mainly for clients external to the university.

The term "entrepreneurial exchange" (for academic staff) is intended to incorporate "technology transfer"<sup>8</sup> as well as other commercially motivated academic activities.<sup>5</sup> Subject to a codicil, examples of academic entrepreneurial exchange include

- 1) selling degree courses to foreign students;
- 2) providing short, in-service training courses for government departments and private companies;
- 3) openly and competitively soliciting and winning government or corporate funds for contract research projects;
- 4) operating industrial parks for start-up companies;
- 5) selling patent rights;
- 6) contracting to provide analysis and testing services;
- 7) leasing university equipment; and
- 8) the setting up of university consulting companies.

A broader set of institution-wide entrepreneurial examples might include the management of investments and short term accumulated funds, the seeking of paid advertisements in university publications and public

---

<sup>6</sup> The inclusion of this factor is intended to indicate that there must be an element of economic risk and risk-taking in the activity and that entrepreneurial leadership is probably present.

<sup>7</sup> As previously indicated, this assumes that only academic enterprise is to be considered, a better definition for the university context might also include the application of commercial methods and practices in the general management of universities.

<sup>8</sup> Activities such as the operations of parking lots, student unions, bookstores and sporting teams are excluded from the definition. For an activity to be included, an underlying academic function and purpose must be present and university staff must be involved professionally.

donations for the support of university radio and television stations. The aforementioned activities are designed to recover operational costs and in most cases to provide a monetary surplus or some other form of material or "in-kind" benefit for the university. However, they also present individuals and groups within and without the academic community with the potential for conflicts of interest.

The internal repercussions of entrepreneurial activities within universities, especially financial ones, have not been as thoroughly documented or studied as have other aspects of economic relationships among universities and industry.<sup>9</sup> (For example, see Blumenthal, Epstein and Maxwell 1986; Leslie, 1992; Leslie and Harrold, 1993; Matkin, 1990; Rhoades and Slaughter, 1990; and Weiner, 1986, 1987). To date, the relationships investigated invariably distinguish between public and private funding of technology transfer, with private funding the more frequently researched.

The major research effort in university funding studies has been in the USA where a distinction is made between private and public research funding. The distinction between research funding sources might be less relevant for Australia because the private sector is much smaller, the national level of funding is substantially lower than in the USA, and the Australian government is the dominant research funding source. In Australia the government remains the main provider of research funds, and government and industry often align to provide funding packages.<sup>10</sup>

---

<sup>9</sup> See the discussion in the research framework in Chapter Two for comment on other areas of university-related entrepreneurial activities that have been subjected to recent investigation.

<sup>10</sup> For example with Cooperative Research Centers (CRCs); also see Hill, (1993), and Wood, (1992).

From 1982 to 1991 the average dollars (constant 1987 dollars) per student place<sup>11</sup> provided by government to Australian universities dropped by over 25 percent. Beginning in 1988, this funding decrease is largely achieved by requiring universities to take more students for the existing level of funds (insignificant additional funds are provided for additional students). However, because of the high rate of inflation, current dollars per student place increased each year. Universities enrolled more students in high cost fields or areas for the same share of national income as provided previously. Not only did the purchasing power of the money per place decline, but many of the new places are in engineering and sciences rather than arts and humanities and are, in real terms, more expensive to maintain. Over this period many items purchased by Australian universities (e.g., books, equipment) are affected by currency devaluation. Furthermore, almost 10 years of restricted capital programs (maintenance and new) had taken its toll. Ensuing capital funding difficulties included

- 1) increased costs in maintaining deteriorating facilities,
- 2) forced use of expensive alternative and temporary facilities (portable offices, leased accommodation, temporary office partitions),
- 3) stresses and strains of being overcrowded in ill-maintained premises,
- 4) meeting additional cleaning, heating, cooling, security and other building operating costs,
- 5) an insufficient recurrent budget capacity (building commissioning funds) to put into proper operation the facilities gained under a \$200 million dollars annual building program (that commenced in 1987), and
- 6) insufficient funds to furnish and fit out new facilities.

---

<sup>11</sup> The term "per student place" means the place a full-time student would take up in a course of study. Theoretically the place may be filled by a number of part-time students, each with a percentage share of the full-time student place.

Throughout the 1980s, Australian universities experienced clearly period of considerable stress manifest in increased and changing work-loads, deteriorating physical conditions, general overcrowding, financial difficulties and increased competition for all resources.

Simultaneously, governments<sup>12</sup> in Australia and in other countries began to require universities to develop funding sources alternative to government budgets, and to become more directly associated with industry and commerce.<sup>13</sup> Some of the reasons that these requests have proliferated (not shared by all researchers)<sup>14</sup> have been examined by Collins, 1979; the Business-Higher Education Forum, 1983, 1986; Leslie and Brinkman, 1988; Layzell and Lyddon, 1990; Smith, 1990; Wells and Bradshaw, 1992). The issues raised included

- 1) expensive and incessant demands for more higher education opportunities,
- 2) increasing populations,

---

<sup>12</sup> This might occur at the federal, state and local levels, as appropriate. The main source of pressure is invariably the prime funding authority, usually at federal (the country-wide authority) or state level. The underlying philosophy is that the economy of an area can be enhanced through the collaborative efforts of universities (government) and industry.

<sup>13</sup> For example, ASTEC, 1989 (Australia); Declerq, 1979 (Belgium); Buchbinder and Newson, 1985 (Canada); Bernstein, 1986 (China, France, United Kingdom); US Department of Commerce, 1980 (Japan, Germany); MacKenzie and Jones, 1985 (United Kingdom) OECD, 1984, 1989, 1990 (OECD Countries); Praeger and Omenn, 1980 (USA); National Research Council, 1985b (USA); National Science Board, 1986 (USA).

Works by Bok, 1982; Boyer, 1987; NSF, 1985, 1985d; Peters and Fusfeld, 1983; and others support the 'economic good' argument for university, government, and industry partnerships. In essence the government argument is that universities should do more than simply providing human capital for the economy. Universities should direct their research and industry liaison efforts to promoting economic development through discoveries and applications that in the hands of industry or business will create local jobs, give international (global) competitive advantage and promote economic and political stability (in a steadily increasing rather than gyrating manner).

<sup>14</sup> For example, see a recent paper by Slaughter (1993) wherein the ramifications of mass education, seen as a social welfare function, is discussed.

- 3) social expectation and social change,
- 4) popularly-perceived linkages between education and jobs,
- 5) the belief that education can lead to a more effective participation in the global economy,
- 6) the belief that education can lead to more national competitiveness and productivity.

The relative costs and benefits accruing to universities from entrepreneurial activities are debated within the academy. One concern is that entrepreneurial activities might, at best, be marginally profitable in financial terms. The debate has been extended to question the general propriety and appropriateness of the emerging range of university commercial activities (Feller, 1989; Gibbons and Wittrock, 1987; Weiner, 1986).

### **3 INSTITUTIONAL BACKGROUND**

In its Australian context, Curtin University of Technology, Perth, Western Australia, stands as a success in increasing and diversifying its revenue sources. In 1991 approximately 35 percent of Curtin University revenue is obtained outside the federal-government funded recurrent budget. (The calculation of recurrent budget funding is primarily based on "taught student load."<sup>15</sup> In Australia, the government funded recurrent budget is applied largely to the instruction and academic support of undergraduate and postgraduate Australian resident students).

Conditions of employment for academic staff at Curtin are very supportive of staff involvement in entrepreneurial activities. For example, with minimal regulation, an academic has the right to spend the

---

<sup>15</sup> Taught student load is an established standard of full time equivalent student undertaking an agreed number of hours of instruction in a given program, and against which funding is provided to the university. Funding levels vary on a discipline and academic level basis.

equivalent of one day per week on consulting activities without affecting his or her university salary and without regard for the level of consulting income. For taxation, public liability, administrative, and ethical reasons many staff members choose to arrange their consulting activities through the university rather than to act independently. The consulting and other activities have led to increased resources for the university and have significantly benefited some academic professionals in financial terms.

The pressure to find alternative resources to support university programs requires increased attention and time commitment by university administrators. In practice and in the research literature, the additional work demand on academic staff, who already carry increased teaching and research workloads,<sup>16</sup> has been largely ignored. The debate over the nature, purpose, and function of entrepreneurial activities encompasses academic developments such as contracted research work and fee-paying overseas students but might also extend to issues such as the establishment of a university hotel or the provision of charges for the development of a multi-level car-parking facility (that is to be revenue generating). At Curtin particular staff concern is expressed over the level of resources (that many staff consider are) being diverted from instruction and academic support to new entrepreneurial exchange activities. At other universities, a prime concern is the nature of the growing dependency on and the influence of (public and private) external funding authorities (Geiger, 1988; Hutchins, 1962; NSF, 1982b; Price, 1965).

---

<sup>16</sup> Increased workloads have come about due to a deteriorating real-dollar financial provision per effective full time student place; a change in work priorities and promotional requirements, giving greater emphasis to research activities; and higher numbers of students per available teaching hour (bigger classes).



Studies of the social and economic rates of return of technology transfer for individuals, industries, and communities generally are well documented. Many of these studies looked at activities in which university academic staff have been involved (Griliches, 1980; Mansfield, 1980, 1989; Minasian, 1962, 1969; Terleckyj, 1974). Many academics have advocated that universities should be active participants in the task of addressing the economic problems that besiege society (David, 1982; Bach and Thornton, 1983; Peters and Fusfeld, 1983; Dickson, 1984; Johnson, 1984; Feller, 1986; and Kenney, 1986). Dickson (1984) and Kenney (1986) support these propositions with a caveat that the activities also support "social" agenda. A number of compelling, mainly resource-based reasons for the support of entrepreneurial linkages between universities and industry have been advanced by Fife<sup>17</sup> in the foreword to Fairweather's 1988 study, *Entrepreneurship and Higher Education*.

Slaughter (1990) in *The Higher Learning and High Technology* emphasizes the importance of political considerations in the motivation of university action and inaction in technology transfer. The advocacy of university and industry linkages for mutual profit might remain, to some extent one-sided, in favor of industry, until the benefits for the university (as a body corporate) are shown to be "sufficiently profitable" (Slaughter, 1990, p.139) for the institution as well as for the other participants. Slaughter's viewpoint has been extended in her recent work *Professionals in a Global Economy: Differentiation, Market Relations and Reward Structures, Australian Cases* (to be published in 1994). In this work Slaughter has illustrated the organizational

---

<sup>17</sup> Compelling reasons advanced by Fife include increasing faculty awareness of the real world, improving access to the forefront of technology, the potential for augmenting university personnel, increasing institutional revenue' and presumed improved stature and funding.

changes (restructuring) that Australian academics are making as they adapt to the global economy and the competition for scarce national resources within and among universities.

#### **4 THE LESLIE STUDY**

Professor Larry Leslie of the Center for the Study of Higher Education at the University of Arizona conducted research highly-related to this study in Australia in 1990 - 1991 as part of a Fulbright Scholarship Program. The results of the study have been reported in two papers, *Commercialization of Scholarship in Australian Universities*, with Ross Harrold, and in an unpublished working paper (1992) for the Center for the Study of Higher Education, titled, *Commercialization of Science in Australian Universities*.

The above papers report on what Leslie (1992, p.1) "believed to be the first broad attempt to examine the economic consequences to universities of their attempts to commercialize science." In Leslie's study the present and future *direct* benefits and costs of commercialization are separated from the present and future *indirect* benefits and costs. The latter are further classified as monetary or non-monetary and the non-monetary are held to be quantifiable and non-quantifiable (Leslie and Harrold 1993, p.102).

Leslie and Harrold (1993, p.105) suggested a taxonomy of non-monetary costs and benefits based on a review of research literature and Leslie's Australian investigations. The Leslie study is an initial broad investigation of the non-monetary side of university commercialization (entrepreneurial activities). The study acknowledges many unresolved issues in the area of non-monetary benefits and costs in university commercialization, for example

- 1) How do universities differ in their entrepreneurial behavior?
- 2) What are the entrepreneurial differences within universities in terms of vested interest or representative groups?
- 3) What is the relative importance of identified benefit and cost factors?
- 4) Have all significant benefit and cost factors been identified?
- 5) What priority, if any, exists among benefit and cost factors?
- 6) What is the relationship of monetary and non-monetary benefits and costs (the possible imputed value of non-monetary benefits and costs)?

The present study extends Leslie's work and looks in greater depth at some of the issues raised. (Professor Leslie kindly agreed to make his research survey data available for use in this study). Further details of the Leslie study are provided in Chapter Two.

## **5 PURPOSE OF THE STUDY**

The purpose of the present study is twofold (1) to investigate and establish, for (1991), the nature and level of non-monetary costs and benefits<sup>18</sup> that accrued to Curtin university from university staff involvement in entrepreneurial activities, and (2) to examine the proposition that Curtin is a frontier entrepreneurial institution. Monetary costs and benefits for Curtin's entrepreneurial activity are identified in the study and used as a point of reference for the consideration of non-monetary costs and benefits.

The research on which the present study is based investigates

- 1) the range and extent of items that might constitute individual perceptions of non-monetary costs and benefits;

---

<sup>18</sup> In entrepreneurial activity the costs and benefits are often cited by academics as extending beyond the money earned to what Feller (1988a, p.248) refers to as "second order consequences" of technology transfer, or in this case the indirect or non-monetary costs and benefits.

- 2) the differences, if any, within universities in the perception of non-monetary costs and benefits;
- 3) the differences, if any, among several universities in the perception of non-monetary costs and benefits;
- 4) the overall relationship of non-monetary costs and benefits to monetary costs and benefits;
- 5) the interrelationship of non-monetary costs and benefits, if any;
- 6) insight arising by coincidence or through the exercise of the research process, into the nature of university enterprise (entrepreneurship in academic staff); and
- 7) factors that might be of assistance to university entrepreneurs and the managers of university entrepreneurs in understanding the processes of change that are affecting universities.

## CHAPTER TWO

### THEORETICAL FRAMEWORK AND LITERATURE SURVEY

#### 1 THEORETICAL FRAMEWORK

In the introduction to this study it was suggested that the decade of the 1980s was a period of considerable financial stress for Australian universities. A market-economy, theoretical model for the survival of a firm under financial stress was proposed by the economist Joseph Schumpeter, in his book *Capitalism, Socialism and Democracy* (1942, 3rd Edition 1950). The then prevailing Keynesian model of economic change had been argued on the basis of "the marginal propensity to consume," in a situation where change in investment led to change in income. Schumpeter's work substantially modified the Keynesian paradigm. He argued that change came about as a result of successive waves of "creative-destructive" technology. The new model underscored the social (if not cultural) and professional aspects of evolutionary technical change. The role of political (or controlling) forces that also act to shape markets and a firm's position in those markets are not covered in Schumpeter's model. The model assumed a competitive market place, and a profit motive that underpins the efforts of the firm to change.<sup>1</sup>

---

<sup>1</sup> The economic survival responses of universities might be similar to those of a "firm," but universities are clearly not free-standing enterprises in the same sense as commercial firms. In Australia and in many other countries, a university is part of a private, state, or federal government system with public responsibilities (in their charter of establishment or founding legislation) and therefore do not have all the freedoms of a firm (e.g., to file for bankruptcy, borrow funds without limits, other than the market place limits). Nevertheless, most universities tend to act as if they were or would like to be firms and exhibit many of the characteristics of firms.

Schumpeter's ideas were extended to the field of higher education by Leslie and Miller (1973). Writing in 1982 with Sidney Winter; with Levine, et alii in 1984; and in 1986, and again in 1989, Richard Nelson advocates the on-going relevancy of the economic model advocated by Schumpeter and his modern followers.

In Schumpeter's model positive response by economic enterprise to financial stress (involving technological change) might utilize all the responses delineated below or a combination thereof

- developing new products,
- looking for new markets,
- restructuring and or reorganizing,
- seeking to increase productivity (efficiency and effectiveness),
- looking for new sources of supply for the factors of production.

It has been suggested by Leslie and Miller (1973), Miller (1976) and Leslie (1992) that the modern university is an economic enterprise similar to that of the "firm" in Schumpeter's paradigm. During an earlier period of financial stringency in American higher education, Miller (1976) successfully tested for the presence of the five Schumpeter responses options in the American university setting. The periods of (world-wide) university financial stress of the early 1980s and early 1990s are appropriate time frames in which to observe universities operating under the Schumpeter response options.<sup>2</sup>

---

<sup>2</sup> Studies by DiMaggio and Powell (1983) and Feller (1988b) indicate that universities are likely to engage in "mimicking" behavior rather than in seeking differentiation (Feller, 1988b:33). This behavior might make the universities isomorphic. Universities might copy successful behavior (mimetic isomorphism) but not necessarily be efficient or effective because they have not properly adapted to the behavior mimicked (DiMaggio and Powell, 1983:151). Thus, when prestigious universities engage in specific activities, (e.g., establishing research parks, research and development vice presidents, industry endowed research programs) other universities are likely to follow and

Schumpeter-like adaptations at Curtin University have been verified by the official minutes and meeting records of Curtin University. Curtin operations have been subjected to increasing workloads, accommodation shortages, comparative disadvantage in academic facilities, and more students for the same funding resource levels. In response to these pressures the university

- 1) acted to provide its staff with training in entrepreneurial processes,
- 2) noticeably rewarded successful entrepreneurs,
- 3) sought new sources of students,
- 4) developed new programs,
- 5) changed teaching practices, and
- 6) generally became more competitive and aggressive in the pursuit of resources, objectives and its mission.

Usually, a university's goals are seen as differing from those of a profit-driven organization, with the latter focused on profit maximization, the former on optimizing revenue, ostensibly for the public good (Aslanian and Brickell, 1981; Bowen and Schuster, 1986; Carley, 1988; Douglass, 1984; Haddad, 1986; Kenney, 1986; Weiner, 1982). Public and private universities, as providers of public services and benefits are largely restricted to returning "profits" or "surpluses" back into

---

follow and refine them principally for prestige driven reasons (Bok, 1982; David, 1982; DiMaggio and Powell, 1983; Fairweather, 1988, 1989; Leslie, 1992; Peters and Fusfield, 1983; Praeger and Omenn, 1980; Weiner, 1986).

University staff and administrators are very conscious of the relative status (or lack thereof) of their respective institutions. In most cases the publicly-acknowledged level of institutional status is often higher than the reality (as privately recognized); therefore, there is an acute awareness of the points of institutional similarity. It might be possible to rank order universities in terms of their perceived prestige levels; if this was achieved, then some monetary value might also be placed on prestige (normally a non-monetary benefit or value). Institutional deviations from university "norms" or "ideals" are not easily embraced by the general community or the academic community.

their enterprises. This practice partially fulfills Nelson's (1989:240) assertion that "... technology is a public good as well as a private one. It is important to preserve both aspects." Most universities uphold goals that are beyond any "bottom line" profits such as the enhancement of institutional prestige, the pursuit of excellence in teaching and research, concern for the environment, public service, equity and social justice.

## **2 RESEARCH FRAMEWORK**

The impact of entrepreneurial activities on University operations (but not of intra-university impact) has been documented by many researchers (Barrow, 1990; Constable and Webster, 1990; Etzkowitz, 1993; Fairweather, 1988; Peters and Furfield, 1987; Peters and Etzkowitz, 1991; Stankiewicz, 1986). A non-monetary cost-benefit taxonomy of the impact of the commercialization of science has been suggested by Leslie (1992), and by Leslie and Harrold, (1993). The potential areas (items that might constitute non-monetary costs and benefits) of non-monetary costs and benefits are addressed in the research interview questions of this study and are described in the next section of this chapter. For the purposes of this study a benefit has been defined (by Weisbrod, 1968, p.158) as any factor that extends an institution's utility; a cost is defined as anything that diminishes an institution's utility.

In the following section, a total of thirteen areas are addressed under topical headings, amalgamating over twenty-three separate, potential benefit and cost items. Comments on costs and benefits are combined under topical headings. Combining costs and benefits where relevant (and associated) served to reduce the complexity of topics and reminded the researcher to explore the meaning and importance of items



(e.g., the common theme of employment, be it for staff, clients or students), and to look for potential research inter-relationships.

## **2.1 REVENUE GENERATION, A BENEFIT<sup>3</sup>**

Who generates the revenue for universities? Why and how is revenue generation accomplished (see Feller and Seshadri, 1990)?<sup>4</sup> In the case of universities it is assumed that all revenue is ultimately spent since there is no dividend or profit paid or any individual entitled to the residual (dollar) value of a university. Hence expenditure is taken to be the opposite factor to revenue or income. This research is focused on university income, rather than university expenditure.

Fairweather (1988); Levine, Klevovick and Nelson (1987); Leslie and Harrold (1993), observe that the applied sciences (e.g., engineering and agriculture) rather than the basic sciences (chemistry, physics, zoology) have been most successful in attracting additional resources to universities. Levine, Klevovick and Nelson (1987), also report a concentration of commercialized research activities in the applied science areas and substantially fewer resources from commercial (private) funding sources in the humanities and social sciences.

Leslie (1992), Leslie and Harrold (1993), and others have established that revenues from entrepreneurial activities are important to universities. They have implied also that there might be a relationship

---

<sup>3</sup> The references shown within each of the following sections on the costs and benefits of entrepreneurial activities indicate sources that have either used or identified in some way the costs or benefits addressed.

<sup>4</sup> Feller and Seshadri (1990, p7-8) suggest a list of reasons that have a common concern in the revenue generation needs of universities but also involve the pursuit of publicity, meeting legal requirements, exploiting university discoveries, fear of losing staff and desirable academic opportunities, developing administrative capacity with the responsibility to promote discoveries, innovations and developments, filling budgetary expenditure-revenue gaps, and the comparative ready availability of venture capital.

between the revenue generating "value" of an academic entrepreneurial activity and the perceived importance of the research work of individual academicians. The perceived value might be different from (greater or smaller) than the relative monetary value of the additional resources generated. Entrepreneurial revenue might provide the marginal financial difference needed to offer an academic program against the alternative of not offering the academic program.<sup>5</sup> The question thus arises, do academic staff see these new resources in terms of their monetary value or in terms of their "value to," and importance for, the immediate academic operation? A person, thing, item or idea might be important not because it has high monetary value but because it is essential to survival or continuing operations. The important item might be small in value but vital to some larger entity (e.g., an electric toaster is of little use if it has no plug). Entrepreneurial revenue might be small in a given academic department but it might mean the difference between employing a full-time staff member instead of a part-time staff member, where the former is needed.

## **2.2 PRESTIGE AND RELATIONS WITH EXTERNAL BODIES, BENEFITS**

Research results have suggested that many academic and administrative staffs share the belief that entrepreneurial exchange increases private and public appreciation of the university. This belief, also held by important external organizations and individuals, is purported to be intimately linked to the raising of or maintaining of the status of the university relative to other social organizations and

---

<sup>5</sup> For example, if it cost \$20,000 to employ a staff member to teach a year long course and only \$15,000 is available in the recurrent budget, then the course might not be run, but if \$5,000 is available from other sources to supplement the \$15,000 then the course can be run. The amount of \$5,000 is only a quarter of the total cost, but it is essential if the programs is to operate.

other institutions of higher education (Blumenthal, et al., 1986; Feller, 1989). Attaining and maintaining status and prestige are considered by some researchers as "central" activities for universities (Alpert, 1985; Bowen and Schuster, 1986, P.150; Schuh, 1986, P.6). It has been suggested that the quality (level of excellence) and the overall contributions of university activities are not necessarily measured in financial terms. Rather, universities respond by "maximizing prestige" for the academic area concerned and for the university as a whole (Fairweather, 1988; Weiner, 1986). Bowen (1983) likens university prestige maximization to the profit maximization of firms. Increased prestige and the strengthening of external relationships might be two of the non-monetary benefits arising from entrepreneurial exchange. For Curtin University the best way to increase institutional prestige might be to build on existing strengths and relationships.

### **2.3 ACADEMIC RESOURCES CONSUMED, A COST.**

It is often difficult to identify and separate the specific cost factors that contribute to a given activity. Conceptually, as well as in practice, a "total academic resource consumed," non-monetary cost item (factor) might lead to the identification of an encompassing item (i.e., one capable of embracing all or most of the other cost factors). This item might cover the totality of resources that are used in entrepreneurial exchange, physical space, academic and support staff time, library, computer and equipment use, minor consumables, and general support services.

All the individual cost items identified by other researchers (e.g., use of equipment, staff time) encountered in a given situation might be expected to contribute towards this composite measure. The

extent to which the composite measure, academic resources consumed, subsumes other individual cost measures (e.g., academic support services, the time of academics) was investigated by Leslie (1992). Knowledge of this item (as an independent measure) was enhanced through the further investigation of the item, in the course of this study.

#### **2.4 SPILLOVER ON RESEARCH AND TEACHING, COST AND BENEFIT**

The satisfaction that academic staff derive from engaging in entrepreneurial activities is believed to have the added benefit of enhancing, enlivening, and supporting teaching and research endeavors (Blumenthal, et alii, 1986a; 1986c; Crean, 1990; Fairweather, 1989; Geiger, 1989). Nevertheless, research evidence is equivocal on the impact of entrepreneurial exchange on teaching time, including preparation time. Some researchers (Fairweather, 1988; Slaughter, 1988) suggest that teaching has suffered as a result of academic staff involvement in entrepreneurial exchange. Leslie (1992) and Leslie and Harrold (1993) present contrary research findings. Regardless of research findings, the academic community is concerned about the potential demands of such activities on teaching time (Anderson and Sugarman, 1989; Blumenthal, et alii, 1986a; 1986c; Fairweather, 1989).

It has been suggested that often external personnel engaged in university entrepreneurial exchange activities (whether as clients, full-time employees or interested parties) can be induced to contribute to the wider departmental or university teaching and research program. If such contributions arise, they might provide students and staff with access to high-level expertise not normally available or afforded at most universities (Fairweather, 1989). For example, a collaborative research project with an esteemed external research laboratory might

enable personnel from that laboratory to work in the university's laboratories. This might give university staff opportunity to observe, associate with, and possibly collaborate with the visiting personnel. Students also might have the opportunity to observe, perhaps assist in research and to discuss the work being undertaken (e.g., ad hoc seminars, informal discussions, special lectures). The operation of a joint program might realize opportunities for staff and students to interact with an eminent visitor.

The potential for entrepreneurial university activities to spillover into teaching and research and to facilitate access to knowledgeable and skillful persons might occur as a net cost or benefit. The spillover<sup>6</sup> might detract from the teaching and research role or enhance and encourage the teaching and research role.<sup>7</sup>

In universities with a strong tradition in basic or fundamental<sup>8</sup> research, the loss of staff time to entrepreneurial activities usually requiring *applied* research skills might be a major drawback to engaging in entrepreneurial activities. Entrepreneurial activities tend to be

---

<sup>6</sup> The term "spillover" is use in this document in the sense that one activity has an impact on another activity that is not necessarily premeditated, intended or called for, but is to some extent inevitable because of their proximity, association or similar function. Leslie and Harrold (1993, Footnote 8) use the term "spillover" (synonym "spin-off") in reference to interactions among activities undertaken by the same person. Spillover is not used by them in the same conventional sense as the term is use by economists.

<sup>7</sup> In this research spillover into teaching and research will be treated as a positive factor, benefiting the academic activity.

<sup>8</sup> In keeping with Leslie (1992), the distinction adopted in this paper between basic and applied research is the distinction provided by the United States National Science Foundation (NSF, 1959:124). In basic research situations the NSF distinction removes any commercial objectives from the original investigations for the advancement of scientific knowledge. Slaughter 1990, 1993 and 1994(p65-66), argues that "The differences between basic or fundamental research and applied or entrepreneurial sciences were probably never hard and fast ... At best the boundaries between basic and applied were always highly permeable, at worst distinctions were ideological rather than substantive."

more applied than fundamental, but this possibility is still under debate.

It might be that factors such as the availability of alternative funds are important determinants of the nature of overall research efforts (for basic and applied research). Although this cost has not been quantified, the research literature frequently mentions this potential drawback area. In literature germane to this topic, the views of staff working in applied discipline areas and staff working in discipline areas with greater opportunities for basic research are usually dichotomized (Anderson and Sugarman, 1989; Blumenthal, et alii, 1986a, 1986b; Geiger, 1989; Fairweather, 1989; Matkin, 1990). The mission of a university might determine the eventual impact of the cost or benefit of fundamental and applied research efforts. Some institutions deliberately maintain a strong, applied research profile while others emphasize the quality of their fundamental research.

## **2.5 FUTURE CONSULTING OPPORTUNITIES, BENEFITS.**

Successful academic entrepreneurs might use their reputations and activities to attract more consulting opportunities. Academic staff with proven track records usually find it easier to compete for new resources to fund their own chosen research activities. In contrast, the whole process might be self-fulfilling and restrictive for new entrants or competitors. The questions asked might include (1) Are academic staff members, who are already successful, likely to continue to be successful in entrepreneurial exchange? (2) Do they use that success to attain consulting opportunities? (3) Does previous success in consulting have an impact on the financing of entrepreneurial activities? Work by Fairweather (1988), Omenn (1982), Slaughter and Rhoades (1990)

would seem to suggest that from a primarily American perspective a positive answer can be given to the above questions.

## **2.6 FACULTY AND STUDENT RECRUITMENT, RETENTION AND LOSS, COST AND BENEFIT**

It might be possible to attract staff and students to a university more readily if the institution is involved in entrepreneurial activities since activities might heighten the visibility and prestige of a given university or academic department. This "prestige factor" might be useful for recruiting and retaining staff and for attracting post-graduate and other students (Blumenthal, et alii, 1986b; Fairweather, 1989; Feller and Seshadri, 1990; Stauffer, 1986). Similarly, the potential for loss of personnel might be dependent on the nature of an academic department's work and the prominence of individuals in that work.

Present research does not indicate a high level of staff or student attrition or attraction through entrepreneurial activities. The most common cause of attrition for a given university is the lure of more prestigious universities. However, it must be noted that these more prestigious universities often exhibit a high level of entrepreneurial activity (Dimancescu and Botkin, 1986; Matkin, 1990).

Nevertheless, the loss of highly trained staff might lead to costly consequences for an academic unit (recruitment costs, work transition time, skill replacement). Similarly, the gaining of eminent staff as a result of contacts made during entrepreneurial exchange activities might bring benefits to the unit, such as very capable research students, more funds, prestige, people with exceptional knowledge, factors which have a strong tendency to inter-actively build up and to increase the overall enterprise (i.e., Harvard University).

## **2.7 THE EXTERNAL EMPLOYMENT OF GRADUATES AND STUDENTS, A BENEFIT**

Historically, academic units with solid linkages to influential external public and private organizations have been able to facilitate the employment prospects of their students. However, today, in conditions of economic recession, equal opportunity, affirmative action, and increased access to higher education, the employment process might be more difficult. All academic disciplines cannot be expected to experience the same level of competition for their staff, students or graduates (Feller, 1988a; Geiger, 1989; Gilley, 1986). Over time, opportunities for employment might be an attractive proposition for students, but the opportunities might increase slowly and might have little direct institutional benefit, except for an initial appeal to students and the retention of students for the duration of their course.

## **2.8 EQUIPMENT UTILIZATION, COST AND BENEFIT**

At the completion of most entrepreneurial exchange projects, the residual ownership of equipment and facilities usually reverts to the university. In some cases the equipment might be purchased specifically for a project, but might be used widely within the university prior to, or on completion of the project. In many universities the financial proceeds of entrepreneurial activities are used to acquire equipment and facilities not readily available under university funding programs (Fairweather, 1989; Stauffer, 1986). Just as there might be equipment gains (benefits), there might be disadvantages (costs) such as equipment wear and tear and periods of non-availability during the span of the entrepreneurial contract. One of the big problems faced by universities is the un-recompensed use of university equipment and facilities in the process of seeking (bidding for) and carrying out entrepreneurial



activities. It might be considered by some academic staff that the cost of the cumulative use of general university facilities for entrepreneurial activities might far outweigh any additional facilities acquired or the benefit of entrepreneurial activity as a whole.

## **2.9 REVENUE SUBSTITUTION, A COST**

Does success in resource acquisition lead to greater or lesser success in internal and external budgetary negotiations for academic units? Revenue substitution might be defined operationally as the replacement of traditionally-acquired budget funds with funds acquired through entrepreneurial activity. Some academics fear that success in entrepreneurial activities might lead to a reduction in resources from other, more traditional, venues (the university central budget, special development funds, government budget). To date, there is little evidence to suggest that this is the case. Indeed, the reverse might be true (Blumenthal, et alii, 1986b; Fairweather, 1988; Feller, 1989). Jaschik, (1988) found some evidence of revenue substitution in a number of US situations, but Feller (1989) found no such evidence in USA state-government support expenditure. The potential relationship, if any exists, of success in entrepreneurial activity and *internal* university budget substitution has not been studied.

## **2.10 TIME OF HIGHER SUPPORT PERSONNEL, COST AND BENEFIT.**

In many higher education institutions academic staff members are seen as indifferent if not outright hostile towards the work and contribution of senior university administrators such as presidents, vice-presidents, directors of consulting companies, business managers. Is this the case in university entrepreneurial activities?

Alternatively, are the contributions of administrative staff recognized by the academic staff they are employed to support? Is recognition accorded to senior administrators for the part they play in attaining entrepreneurial contracts? The research literature suggests that senior staff and university administrators do play roles in entrepreneurial activity, but that their roles are not held in high regard (indeed possibly with great derision and suspicion) by entrepreneurial academic staff (Feller, 1988b; Rhoades and Slaughter, 1991; Rosenthal and Fung, 1990). If there are positive responses to the roles of administrators, then both costs and benefits might be expected; if responses are negative, net costs might be involved.

## **2.11 SECRETIVENESS AND CONFIDENTIALITY, A COST**

There appear to have been few reports of academic work difficulties due to the presence of contractual secretiveness or confidentiality work requirements, probably since secretiveness and confidentiality are a routine reality in many entrepreneurial activities. However, after several publicized instances in the 1960s and 1970s, efforts have been made by the academic community to reduce the overall effect of confidentiality and secretiveness on academic freedoms (Anderson and Sugarman, 1989; Blumenthal, et alii, 1986c; Fairweather, 1989; Johnson, 1984).

In many discipline areas (e.g., social sciences, psychology, medicine) the protection of individual identity or organizational identity (as confidentiality restraints) are accepted as a normal component of research activity. Nevertheless, Rhoades and Slaughter (1991), suggest that, in the American university, confidentiality and secretiveness are still unresolved issues.

Minuscule Australian military research programs and the virtual lack of interest in research by Australian or multinational corporations operating in Australia have kept the secretiveness and confidentiality issue low on the agenda of Australian academics. Nevertheless, as a result of worldwide interest it should be included as a potential issue for further study. The particular businesses which Curtin chooses to associate with are possibly a matter of greater importance to Curtin academic staff than the issue of research confidentiality. For example, the academic community at Curtin will not accept money from tobacco companies.

## **2.12 LEGAL, PATENT, ROYALTY, PRODUCT LIABILITY, INTELLECTUAL PROPERTY AND BUREAUCRATIC FACTORS IN BENEFITS AND COSTS**

Many researchers have reported specific instances where legal, patent, copyright, royalty payment, business registration, intellectual property rights, product liability and liability insurance matters have been of concern to the academic community (Anderson and Sugarman, 1989; Blumenthal, et alii, 1986a; Feller, 1988b; Feller and Seshadri, 1990; Geiger, 1989; Kolm, 1990; Slaughter and Rhoades, 1990; Rosenthal and Fung, 1990; Weiner, 1986). Chew (1992), and Olivas (1992) have found that many American universities are putting into place policies and procedures that increase the university's claim on the intellectual property developed by their academic staff. Leslie (1992, p.4) notes that in Australia "generally, universities are unable to separate out their intellectual property costs and revenues from other (revenue) categories."

The "legal-bureaucratic" element in entrepreneurial activity might only be of direct concern where there are specific entrepreneurial activity needs.<sup>9</sup> This often applies where there are, actual or

potential, large sums of money involved. Leslie (1992) reports senior university management in Australia as suffering legal processes and practices not so much for the immediate gains but in the hope of a "big hit" one day.

It is suspected that these legal matters directly affect very few academic staffs and that staff in engineering, science, medical and pharmaceutical fields might be most affected because they are the most active raisers of additional revenue. Although problem cases (e.g., legal disputes, compensation payments, contractual challenges) are rare, academic staff are concerned that such situations can pose problems. They are concerned that they themselves be protected (e.g., by insurance, the university, legal provisions) in case there is a problem, although very few individual academics might have had need for such protection and fewer still might anticipate a real need.

A recent report in the *Chronicle of Higher Education* (February 7, 1994) suggested that only a few American universities actually made money when substantial legal processing of entrepreneurial items took place in the university, and that in the pursuit of legal matters most universities spent more money on administration costs and the fees of legal personnel than they received in income from this source.

## **2.13 PERSONAL SOCIAL COSTS**

Leslie (1992) observed that the social costs and personal health care costs for individual staff were a cause for concern to academic staff. The need for concern arises out of the pressure on academics to

---

<sup>9</sup> The need to engage in these activities might have to be specific and real for the individual academic before it becomes an issue. University administrators might worry about this issue but there is often little that they can do other than to take "risk avoidance" steps, steps that might be limited by the cost of such action.

carry out traditional work activities and to take on of additional entrepreneurial roles under commercial contracting time limits.

Traditionally academic staff have worked long hours and have claimed to do more than they are paid to do. This time commitment comes at the expense of personal and family time, recreation, professional pursuits, and leisure. If entrepreneurial activities increase the time demands on academic staff, the staffs' personal time constraints are likely to increase. Can the "cost" of this real contribution<sup>10</sup> by individual staff be accounted for in entrepreneurial activities, if not in all academic work activities? In this study only costs and benefits that contribute to the mission of the university were considered, hence, some personal costs and benefits were not applicable.

## 2.14 OTHER POTENTIAL BENEFITS AND COSTS

Other *benefits* that might arise as a result of engaging in entrepreneurial activities include

- enhanced morale, intellectual stimulation, and excitement in the pursuit of problems facing clients;

- the use of financial resources generated to improve the comfort level of the workplace;

- the removal of workplace irritations (broken equipment, support staff shortages);

- opportunities for students to gain "hands on experience" in field or workplace situations;

- the building of an ongoing research infrastructure; and

- enabling the pursuit of less fundable research, of interest to individual academics.

Other possible costs that might be considered include

---

<sup>10</sup> This contribution can be considered as a non-monetary benefit for the university and the client entrepreneurial contractor and as a non-monetary cost for the individual; however, both situations might be costed against the staff member's income foregone and opportunity costs.

- 1) the direct monetary loss to the organization incurred through underbidding, cost overruns, deliberate money-losing contracts (loss-leaders--for future access to funders), strong academic desire to perform specific work, and technical difficulties;
- 2) the impact of internal conflicts; feuding and anger over perceived advantages and disadvantages (e.g., between the university "haves" and "have nots" in terms of their access to financial resources);
- 3) the disaffection caused in the wider community by the perception of universities as competitors with the private sector for consulting, advisory and other services (including competitive bidding for research and development contracts);
- 4) the organizational stress caused when no additional provision is made for the additional burden on the university committee agenda, the number of administrative actions required, external approvals that need to be sought (from partners and clients) and the influx of external visitors to the university.

### **3 LESLIE'S STUDY (1992)**

The following is a brief summary of research work, seminal to this study, supported by the Australian -- American Educational Foundation, and documented by Leslie (1992) and Leslie and Harrold (1993). In 1991 Leslie interviewed 111 academic and senior administrative staff in seven Australian universities and examined institutional financial records. Entrepreneurial academic staff<sup>11</sup> in two universities were asked to respond to a series of questions regarding the non-monetary costs and benefits of entrepreneurial exchange and on the revenue importance of such activities and their comparison with total monetary costs and benefits.

Leslie limited the scope of his study to entrepreneurial exchange (technology transfer) in the context of the commercialization of scientific scholarship. The researchers used the terms "direct" and "indirect costs" and benefits and provided a classification of indirect costs and benefits as follows

---

<sup>11</sup> Deemed to be in academic departments with noteworthy commercial revenues.

Monetary / pecuniary / financial

Present  
Future

Non-monetary / non-pecuniary / non-financial

Present	{	[quantifiable
		[non-quantifiable
Future	{	[quantifiable
		[non-quantifiable

The financial significance of direct benefits was established as 10 per cent to 12 per cent of total university operating revenues in 1989 or 1990 representing A\$16.3 million<sup>12</sup> (University A) and A\$12.3 million (University B). Total commercial revenue represented 18 to 19 per cent of recurrent budgets, respectively for those departments engaged in significant entrepreneurial activities, such revenue represented an average of 22 per cent, with ranges up to 50 per cent and in a few cases 100 per cent for some entirely commercial centers.

When interviewees made comparisons of direct and indirect benefits, the average indirect benefit was put by respondents at 1.83 times as high as the direct benefit (University A = 1.66; University B = 1.98). For indirect costs, the average ratio of direct to indirect costs was approximately 3:1, (University A = 3.7:1; University B = 2.9:1) with a total indirect dollar cost level of A\$16.7 million. Net indirect benefits amounted to A\$64.2 million. A distinction was made among the greater revenue-earning capacity of applied sciences (e.g., engineering) and lower revenue-earning capacity of the basic sciences (e.g., Physics, chemistry), the humanities and arts.

---

<sup>12</sup> A single university center produced \$6.8 million of this revenue, thus the researchers regard a more comparable figure as A\$9.5 million.

Interviewees completing the survey numbered 62 in total, including 29 from university A (the standard, more traditional, broadly based university), and 33 from university B (the more modest, peripheral university, heavily engaged in agriculture, and minimally involved in engineering). The majority of interviewees were from the engineering and science disciplines, home to most university entrepreneurial activity. Leslie interviewed an additional 49 university informants (e.g., Vice-Chancellors, Business Managers, Deputy Vice-Chancellors Research and Development), but did not necessarily seek the same information from each informant.

<b>TABLE 2.1</b> <b>A TAXONOMY OF INDIRECT BENEFITS AND COSTS</b> <b>(After Leslie and Harrold, 1993)</b>	
<u>Indirect Benefits</u>	<u>Indirect costs</u>
Relations with external bodies	Academic resources consumed
Prestige	Loss of time for basic research
Spillover to research	Time of higher support personnel
Future consulting opportunities	Revenue substitution
Employment of graduates	Equipment
Student recruitment	Loss of teaching and preparation time
Services contributed by project personnel	Secretiveness, confidentiality
Equipment gains	Departure of faculty and staff to client organizations
Employment of students	Monetary loss
Recruitment of faculty from clients	Legal fees
	Patent and copyright application fees
	Product of process liability

A key objective of Leslie's study was to develop a taxonomy of indirect costs and benefits (listed in full in Appendix A), and in summary form in Table 2.1 (other areas such as personal social costs were also indicated as potential taxonomy items).



A number of general insights, strategies and principles were also suggested in the Leslie study. These items were useful matters to explore during the Curtin data collection, analysis and discussion. Curtin University is considered to be one of the more entrepreneurial Australian universities and was for a time almost entirely dependent on external funds for all research activities. Given that the research instrument for this study was almost identical to Leslie's and that the research context is an Australian university, the application of these insights, strategies and principles should be closely observed.

### **3.1 GENERAL PERCEPTIONS, STRATEGIES AND PRINCIPLES (AFTER LESLIE)**

- 1) Net direct and indirect revenues attracted by entrepreneurial activities<sup>13</sup> are substantial and important to overall university survival.
- 2) High indirect benefits might contribute significantly to the job satisfaction of academics.<sup>14</sup>
- 3) There might be considerable scope for expansion of university commercial activities since less than half of all academic departments surveyed were involved in major commercialization activities.
- 4) The promotion of jobs is the primary, economic development test (for technology transfer activities).
- 5) Entrepreneurial activities make crucial resource contributions to academic departments.
- 6) Universities are preoccupied with intellectual property (even if it is not of immediate application).

---

<sup>13</sup> Leslie (1992) used the term commercialization of science (COS); Leslie and Harrold (1993) used the term commercialization of scholarship (COS).

<sup>14</sup> One of the reasons' academics might pursue entrepreneurial activity is not so much for the financial rewards but the personal satisfaction gained. Leslie and Harrold (1993) suggest that "while academics would undoubtedly protest against their share of the monetary rewards of COS being reduced, they are unlikely to cut back on their involvement in these activities" if monetary rewards were cut.

- 7) The immediate interests in and need for patents are minimal and limited in scope, since attention is focused on the "big hit" at some future date. Australian academics are less concerned than American academics on this matter.
- 8) Australian university administration and management fees are low (in comparison to American levels).
- 9) In some cases the interest on up-front payments for commercial contracts has been a lucrative source of revenue.<sup>15</sup>
- 10) Personal entrepreneurial "earning accounts" for academic staff are an effective incentive (for both the university and the staff member).
- 11) Organizational structures (of departments and research centers) might have important implications for promoting entrepreneurial activities.<sup>16</sup>
- 12) Relatively minor market activities by a university might shape university ethos, priorities and behaviors.
- 13) The (leadership) role of the entrepreneurial academic in university enterprise is surprisingly powerful.
- 14) Basic sciences (e.g., physics, chemistry, zoology) appear not to be in as strong a position as applied sciences (e.g., engineering, plant science, animal science) in the raising of entrepreneurial revenue.
- 15) The revenue obtained from overseas fee-paying students is an important element in Australian university entrepreneurial activity. revenue from student fee-payers might have even greater impact when the issue of Australian fee paying students is fully addressed by the Australian Government.<sup>17</sup>
- 16) The role of the campus entrepreneur (the entrepreneurial academic) was noted as an important emerging development.<sup>18</sup>

---

<sup>15</sup> This situation might be ending in Australia as the historically high levels of interest rates have now fallen to a level closer to the rates in other OECD countries. The fixed percentage interest point deductions (rather than a percentage of the interest income) charged by many university administrations will take a substantially higher proportion of the total amount of any interest payment.

<sup>16</sup> Similar conclusions (in different contexts) regarding the importance of organizational structure in technology transfer have been arrived at by Fairweather, 1988:v; Whiston, 1988; the OECD, 1990; and Ziman, 1988.

<sup>17</sup> Students undertaking postgraduate programs that are not required for first entry to professions and similarly students taking a second or third undergraduate degree program might be charged the full cost of their programs by the University. Federally funded universities are prohibited from charging first degree undergraduates full cost program fees.

<sup>18</sup> Leslie (1992, p54) states that nothing was encountered on this

#### 4 CONCLUDING COMMENTS

In response to external pressures (global and national; economic and political) and in line with Schumpeter's (1942) theoretical model for institutional responses to financial pressures, Curtin University of Technology has steadily and progressively increased its entrepreneurial academic enterprise and shows no sign of abating in its progress. Indeed, it might be suggested that since Curtin is at the very forefront of entrepreneurial academic enterprises, it is a frontier institution.

Curtin was an early entrepreneur in the Australian context, it has been remarkably successful in increasing revenue from all sources, it has a broad range of entrepreneurial activities and involves a large number (high percentage) of academic units and staff in such activities.

The Leslie study confirmed the awareness of Australian academics to the indirect (non-monetary) costs and benefits of entrepreneurial activity. Furthermore, his study suggested (Leslie, 1992, p107) that because direct (monetary) university revenue is fully expended "in non-profit universities, only the indirect benefit to cost ratio has a clear implication for policy affecting academic behavior." Questions then arise as to the differences (if any) in entrepreneurial behavior between and within universities. Most studies of university enterprise to date, have looked at specific cases of enterprise (e.g., biotechnology) and have concentrated on matters external to the university, monetary aspects rather than inter-university and intra-university non-monetary aspects.

---

topic in the literature, nor was it a focus for his research (although Leslie notes the presence of "strong leadership," individual drivers (champions), "key persons," good science and enterprise interaction, a large ego, scarce talent, potentially unmanageable, and institutional threatening, safety risk people). However, a forthcoming paper by Sheila Slaughter (1994) deals, in part with this issue.

Some researchers have suggested that the very nature of universities changes as a result of increasing liaison with government and industry and in response to entrepreneurial exchange opportunities. Whether such opinions are unique to the development of intellectual property or are common to broader areas is yet to be resolved.

Aslanian and Brickell (1981:18) suggest that

"The current patterns, and certainly the trend-setting innovations, go far beyond cooperative partnerships between business and colleges: They reflect the adoption of similar objectives; the overlapping functions; the copying of organizational structures; the appointment of counterpart personnel; the emergence of colleges as companies; companies as colleges; and the proliferation of academic corporations and corporate colleges."

How deep and lasting the change in universities will be might depend on the extent to which the underlying ideals, beliefs, practices, cultures, myths, ethos and values are affected. Certainly, much of the pressure driving change within universities results from financial need. If long-term survival depends on solving immediate financial problems, then the changes in universities might be permanent and far reaching. How universities are restructuring to accommodate these changes is already the focus of academic attention (Slaughter and Leslie forthcoming).

## CHAPTER THREE

### METHOD

#### 1 INTRODUCTION

This study was conducted at Curtin University of Technology, Perth, Western Australia, between 1991 and 1993. Data were obtained through interviews with selected Curtin University academic staff. Interview questions were based on the cost and benefit areas identified in the Chapter Two literature review. The research survey followed the general format and method of presentation devised by Leslie (1992) and Leslie and Harrold (1993).

A pilot study of the survey instrument for the present research was conducted, resulting in a number of additions and changes to the Leslie (1992) instrument: the changes are described in detail in this chapter. This study, in contrast to the Leslie study, looks at entrepreneurial activity

- 1) at Curtin University, reputedly one of the frontier, entrepreneurial universities in the Australian context;
- 2) in depth within one university (Leslie looked at 7 institutions, 2 in greater depth, but limited primarily to the most successful entrepreneurs);
- 3) in a broad ranging and extensive manner covering most traditional disciplines (except lawyer and medical doctor training);
- 4) from the viewpoint of entrepreneurs and non-entrepreneurs (obtained through the same interview instrument as used for entrepreneurs) from within the one institution;
- 5) under various variables of potential relevance to university operations (e.g., academic status, discipline area);

- 6) with the intention of validating and rounding out (extending and improving) the cost benefit taxonomy devised by Leslie;
- 7) in the totality of opportunities for university enterprise and commercialization (e.g., not just technology transfer or the commercialization of science).

## **2 RESEARCH DESIGN**

### **2.1 OVERVIEW**

Respondents' perceptions of the value of the non-monetary costs and benefits of entrepreneurial activities were elicited through personal interview. For part of the analysis, the responses from this study were combined with Leslie's data. The data were then subjected to factor analysis, analysis of variance, and multiple regression statistical techniques, and the issues of inter-institutional response similarities and differences were examined.

Respondents were categorized according to a number of variables, such as level of entrepreneurship, gender, academic status, discipline area, and revenue valuation. Based on the above variables, intra-institutional similarities and differences for Curtin University (only) were examined.

Open-ended and structured questions provided information as to additional areas of costs and benefits. These data were tabulated, analyzed and placed in the context of Leslie's cost-benefit taxonomy. The relationships of non-monetary to monetary costs and benefits indicated by respondents were examined and compared with Leslie's findings. The distinguishing characteristics of a frontier entrepreneurial university were examined.

## 2.2 THE RESPONDENTS

One hundred and twelve respondents were selected from full-time academic and senior management staff at Curtin University (total full time equivalent staff (FTE) = 2,500+; FTE academic staff = 1,200). A sub-sample of seventy-four respondents was selected by the researcher, in consultation with university administrators, on the basis of their high level of involvement in university entrepreneurial activities, as judged by the respondents' having had a substantial record of achievement in raising university revenue through entrepreneurial activities.<sup>1</sup> In addition, despite difficulty in identifying such respondents at Curtin, thirty-eight subjects were included due to their minimal involvement in entrepreneurial activities.<sup>2</sup> Minimal involvement was based on choice (opposed to such activities), or occurred (in the opinion of both informants and respondents) because the respondents' were not in an academic area conducive to entrepreneurial endeavor. Alternatively, lack of entrepreneurial participation was necessitated by excessive teaching and administrative workloads. "Non-entrepreneurial" respondents were identified in consultation with university administrators and entrepreneurial respondents.

Gender, age, discipline group and academic status were not taken into account in the selection of respondents. The distribution of respondent characteristics other than level of entrepreneurship was governed by the availability of appropriate respondents and the actual population of Curtin entrepreneurs and non-entrepreneurs.

---

<sup>1</sup> The terms entrepreneurial, and commercial are used interchangeably in this study.

<sup>2</sup> Leslie (1992, p.7) indicates for his study "the sample being stratified by level of faculty involvement in generating commercial revenues."

In preliminary studies conducted by Leslie (private communication, February, 1994) academic staff not involved in technology transfer often were found to be insufficiently informed. Leslie suspects that the knowledge level of these non-entrepreneurial staff members was deficient. Nevertheless these staff often had strong opinions on the efficacy of technology transfer activities for their university. For the present study the issue remained open. Non-entrepreneurial respondents were asked to rate a potential set of non-monetary costs and benefits on a scale related to the accomplishment of the university's overall mission, and not the respondents' personal views. Interviewees with limited knowledge of the ramifications of entrepreneurial activity were expected to experience some difficulty in assigning values to the non-monetary costs and benefits.

After the 112 respondents had been selected it was found that 90 were male and 22 were female. Differentiation of the 112 respondents by academic status was achieved by using the formal professional title of the respondents. This provided five academic status categories of respondents

- 1) *University Administrators* consisting of Deputy Vice-Chancellors, Executive Officers, and other Senior Management Staff (5 respondents, 4.4%),
- 2) *Professors* (26 respondents, 23.2%),
- 3) *Associate Professors* (35 respondents, 31.2%),
- 4) *Senior Lecturers* (26 respondents, 23.2%), and
- 5) *Junior Staff* consisting of Lecturers and below (20 respondents, 17.8%).

The number of respondents in the university administrators group was very small at 5, but represented 50 per cent of the total potential population of 10.



Curtin University is divided organizationally into four teaching divisions, two (teaching) branch campuses and three administrative divisions. The four teaching divisions are listed below. It was to these divisions that respondents were linked after they had been drawn for the sample of entrepreneurs and non-entrepreneurs.

- 1) Health Sciences (26 respondents, 23.2%),
- 2) Engineering and Science (35 respondents, 31.2%),
- 3) Arts, Education, and Social Sciences (AESS) (33 respondents, 29.4%), and
- 4) Business Studies (18 respondents, 16.1%).

One of the Curtin branch campuses the Western Australian School of Mines (WASM, and incorporating the Collie, Federated School of Mines) specializes in mining education and was classified with engineering and science. The other branch campus, the Muresk Institute of Agriculture (Muresk), teaches agricultural subjects with an emphasis on agribusiness; hence, for the purposes of this research, respondents from Muresk were included in business studies. It should be noted that the financial analysis excludes branch-campus financial details (unless otherwise stated). Respondents from the three administrative divisions and from senior management were assigned to an academic discipline area according to their previous academic affiliation at Curtin.

With the exceptions of architecture and design in the arts education and social sciences division, and possibly psychology in health sciences (they all remain in their respective divisions for the purposes of this research), the four discipline areas suggested above are consistent with international practice in grouping academic disciplines.

### **2.3 FINANCIAL DATA**

University accounting records provided information on the monetary costs and benefits arising from Curtin's entrepreneurial activities. Data were extracted by divisional unit. Details of expenditures relating to entrepreneurial activities were devised only after considerable re-working of budgetary figures. The intention was to identify complete income-expenditure generation figures; rather than the depleted budget allocation figures, for example, money allocated from entrepreneurial activities to administration activities was re-incorporated with the budget for the academic area earning the revenue.

### **2.4 THE INTERVIEW SCHEDULE**

All respondents were asked the same survey questions by the same interviewer, invariably in their own university offices at a time of their choosing. The average interview time was one hour, the range being 40 minutes to 2 hours. The interviewer was well known to all respondents. On only two occasions did respondents fail to complete the entire survey. No potential respondent refused to participate. The interviews were conducted in periods when internal university budgetary discussions were not in progress. The Schumpeter framework formed the conceptual basis for the interview schedule (Schumpeter, 1942). Essentially, all entrepreneurial activities are aimed at Schumpeters' fifth element, "increasing sources of supply of factors of production," which in a word translates to "money." Yet, the "coin of the realm" in universities is "prestige," the variable of first importance in the interview list. The interview items which are non-monetary items are expansions of the notion of factors of production; i.e., as benefits (or

costs) of a non-monetary nature. Four types of questions were asked in the research interview:

thirteen questions on costs and eleven questions on benefits, with responses based on the items importance in achieving the university's mission;

two open ended opportunities for respondents to add, respectively, new benefit and cost items;

one question on the importance of entrepreneurial revenue to the survival of the respondents academic unit; and

two questions requiring respondents to relate overall non-monetary cost and benefits to monetary costs and benefits.

## 2.5 VALUING NON-MONETARY COSTS AND BENEFITS

Respondents were asked to place a value on a scale of zero (lowest) to ten (highest) for the "set" cost and benefits<sup>3</sup> questions (items 1 and 2 immediately above). A copy of the interview record sheet and question guideline is provided in Appendix B.

Respondents were given opportunity and encouragement to elaborate on their answers and to provide qualitative comments. Note that the term "value" was intended to relate to monetary values and not necessarily to culturally determined preferences.<sup>4</sup> It was the financial

---

<sup>3</sup> The term "set" costs and benefits (non-monetary) are used to distinguish the costs and benefits presented in Leslie and Harrold's (1993) taxonomy (Appendix A). The term 'modified set' describes the set costs and benefits plus the non-monetary cost factor "personal social costs." Additional costs and benefits were added as a result of this study; these are referred to as the 'additional' non-monetary costs and benefits. The 'revised taxonomy' combines the set, modified set and additional non-monetary cost and benefit items.

<sup>4</sup> Kerlinger (1986:456) suggests that "values are culturally weighted preferences for things, ideas, people, institutions, and behaviors." Value as defined differs from attitude or "the organization of beliefs about things 'out there'." The "values" in this study implicitly relate to the informed individual's monetary values, as attributed to costs and benefits in entrepreneurial activities. The values were scaled both on the research instrument items and the systematized numerals (zero to ten) of the instrument. The latter continuum represents no costs at zero and the highest level of costs at minus ten (0 to minus 10). For benefits the continuum represents no benefit at zero and the highest level of benefits at ten (0 to 10).

reality (even though respondents were not asked to specify the actual 1991 dollars) that formed the monetary frame of reference for the respondents' value scaling of non-monetary cost and benefit. No claim is made that respondents' scaled values<sup>5</sup> are directly equivalent to dollar measures. However, discussions using dollar-equivalent non-monetary cost and benefit figures were undertaken on a "what if" basis: that is, it was assumed for discussion purposes, that the normally non-dollar-denominated-non-monetary values have a dollar value.

There is no known absolute measure for non-monetary cost and benefits because the value of such items is dependent on the perceptions, beliefs and broad value systems held by individuals.<sup>6</sup> Therefore, a respondents' assigned value was only indicative of an absolute monetary figure.

Attempts to associate monetary and non-monetary costs and benefits, must also be subject caution and limitations. Even monetary benefits and costs are not necessarily fully reflected in the dollar values placed on some items (an item can be subject to a government subsidy and sold at a lower price; an item can be sold at a company bankruptcy sale at a cost less than its manufacturing cost). However, because there is general acceptance of items in dollar values, such "absolute" values find legitimacy and are readily used.

Admittedly, such linkages as suggested above are tenuous, but they may provide the best, most readily-available approximations of the comparative value of non-monetary costs. Similar techniques have been used by, amongst others, McMahon (1982) and Haveman and Wolfe (1984). The

---

<sup>5</sup> Alternatively, the collective means of the respondents' values.

<sup>6</sup> The term "heuristic" cost (or benefits) is sometimes used in the discipline of economics to impute monetary value to non-pecuniary costs (or benefits), as in this research.

technique was used in both studies to impute a dollar value for non-monetary benefits arising from participation in higher education<sup>7</sup>. Haveman and Wolfe's (1984) study examined the non-monetary components of the overall rates of return on higher education. Dunn (1977), in a study of factory workers' fringe benefits, including non-monetary benefits, used similar techniques to link workers' perceptions of value to a number of possible fringe benefits.

## **2.6 ENTREPRENEURIAL REVENUE IMPORTANCE**

The interviewees' perceptions of the importance of entrepreneurial activities to the survival of the organizational, academic unit to which they belonged, were also examined (item (3) in the above list). The potential relationships of the actual revenue, as reported in the accounting records, and the scaled value of non-monetary costs and benefits were explored.

## **2.7 PILOT SURVEY**

Pilot interviews were conducted prior to the main survey, resulting in a number of modifications to the instrument, including

- 1) the addition a cost factor question on *personal social costs*,
- 2) the modification of the "services provided" question,
- 3) the modification of the staff loss question, and
- 4) the modification of the staff and student recruitment questions.

---

<sup>7</sup> In the words of Leslie (1992, p12) "The process was first to gain the interviewee's scaled estimate of the direct benefit of the revenues themselves and then using this estimate as a reference point, to gain a similarly scaled estimate of the indirect benefits associated with each item on the indirect benefits list." The process was repeated for cost factors.

The modifications to the above latter two questions permitted consideration of all staff and student recruitment situations and all staff loss situations influenced by entrepreneurial activities rather than just staff loss or recruitment to and from commercial clients. Similarly, any additional services provided to the university due to entrepreneurial activity were accepted and not limited to clients.

During the pilot study it was made clear by respondents that they did not necessarily conceive of Curtin University's entrepreneurial activities to be akin to the academic enterprise presented in American research literature (e.g., technology transfer, commercialization of science, intellectual property). Rather, the Curtin respondents' viewed the university enterprise (corporate) and academic enterprise (individual) as the means of obtaining significant additional resources from any source outside the government-funding grant. They viewed entrepreneurial activity as a method of resource generation to facilitate and improve the total program of the university: teaching, research and public service.

## **2.8 QUALITATIVE COMMENTARY.**

Qualitative commentaries were integrated with other analytical information to extend and enhance the quantitative data. Elaborations or side comments made by respondents were recorded during interviews, and information from university records (e.g., newsletter, public relations material, memos and internal correspondence, formal meeting minutes) and publications were collected and used to supplement the interview data, especially for field verification purposes. (Yin, 1982).

## **4 STUDY LIMITATIONS**

The study contained a number of design, analytical, and operational limitations.

### **4.1 VALUING NON-MONETARY COSTS AND BENEFITS**

One of the most difficult tasks undertaken in this study was the reduction to a generally acceptable common measure of the value of non-monetary costs and benefits, as discussed earlier in this chapter. After respondents gave a value to individual benefit factors (prestige, research spillover, etc.), respondents were asked to compare quantitatively the overall relationship of the monetary benefits, first to the non-monetary benefits and subsequently and similarly to monetary and non-monetary costs. Respondents were asked to take as their monetary benchmark the actual monetary income of the academic unit with which they were most familiar. The scale suggested was non-monetary benefits equal to, greater than, or less than the monetary benefits (costs), and then by an order of magnitude, in percentage terms, for example 10%, 30%, 70%, 100%, 150%, 200%, 300%.

### **4.2 FINANCIAL DATA**

University financial information was used to establish the level of total recurrent funds available to Curtin University in 1991. Total funds included all earned money (entrepreneurial funds) and the annual government grant of funds for recurrent and capital purposes. Government recurrent funds were defined as the government grant for recurrent expenditure, based on achieving target student enrollments. The residual (remaining) recurrent funds were regarded (conditionally) as being

earned by the university through regulatory, commercial or entrepreneurial initiatives.

Income and expenditure records in university financial systems have been shown to be inconsistent and erroneous due to changes in definitions, clerical errors, and revised accounting requirements. Such sources of errors are frequently encountered by those using university accounting information. Fortunately, accounting errors tend not to be systematic, and thus should not lead to biased conclusions. For the purposes of this study, the official financial records were accepted as representing a "true" record of monetary transactions.

Fairweather (1988), Levine (1987), Leslie (1992), and Leslie and Harrold (1993), have commented on the patterns of commercial revenues commonly found in universities. They have identified substantial revenue flows in applied science (agriculture, business, medical care and engineering) versus those in basic sciences (physics, chemistry, zoology) and those in the substantially lower funded social science, non-science areas.

#### **4.2.1 EARNED INCOME**

Earned funds at Curtin include donations, fees and charges of different kinds (excluding HECS<sup>a</sup>), income from investments, service and trading income, fees from full-fee paying students and funds from any other entrepreneurial activity.

As far as possible, money for capital development, funds transferred from previous years, and accumulated financial reserves were excluded. Funds earned in 1990 but not paid until 1991 were included but funds earned in 1991 and not paid until 1992 were excluded. Adjustments

---

<sup>a</sup> HECS = The Federal Government's Higher Education Charge paid by most Australian Students (approximately 20 per cent of the national average full time undergraduate annual course cost).



were made to federal and state recurrent grants to include in the study federal and state funds won under competitive conditions but included for payment in the recurrent grant.

Money earned by individual academic staff in non-university associated academic activities was not included because it was not processed through University accounts. The external (to the university) earnings of academics were a substantial amount of money of unknown total magnitude. Funds earned by teaching areas but apportioned to administrative expenditures, overheads and academic support were re-allocated to the academic areas originally earning the funds.

Additional funds that were taken into account in assessing the earned funds included the federally required allocation of 15 per cent of the fees paid by overseas full-fee-paying students (OFPS) to the capital program<sup>9</sup> and money donated for buildings and major equipment items. Charges and fee income relating to parking fines and other penalties were excluded from the earned money figures.

#### **4.3 INTERVIEWER BIAS**

In the course of their work on grounded theory, Glaser and Strauss (1968), Glaser (1978) and Strauss and Corbin (1990) demonstrated the importance of recognizing the researcher's personal biases. Also to be taken into account was the potential bias associated with role relationships between interviewer and interviewee. The interviewer, the author of this study, was well known to all interviewees. On the one hand, interviewees are accustomed to explaining and discussing (positive and negative aspects of) their work activities with the interviewer, a circumstance that facilitated interview rapport. On the other hand,

---

<sup>9</sup> If this fee component is not spent on capital projects the federal government can require the money to be paid to the government.

the interviewer was known within the institution to be a strong supporter of entrepreneurial activities and this may have had impact on respondents' comments.

#### **4.4 RESPONDENT BIAS**

Self-reporting by respondents has been subject to research examination (e.g., Rossi and Freeman, 1985; Yin, 1982). Not only was there a strong possibility that self interested answers may be provided, but that due to a lack of timely and precise information, the respondents may unconsciously amalgamate data or mentally reinterpret situations under investigation (Schon, 1983).

Efforts were made to minimize interviewee contamination<sup>10</sup> and as suggested by Yin (1982), respondents' self-reported data were validated, where possible. For example, every effort was made to insure that the divisional financial information was of the same order of magnitude as the costs and benefits suggested by respondents. Data obtained from different respondents working in the same activity area were expected to be comparable since it was presumed that these individuals were using the same frame of reference. Both cross-checking of data and repeated questioning of respondents were undertaken; no unacceptable data disparities were indicated or presented: data obtained from different respondents working in the same area were generally comparable.

There may have been some reluctance by respondents to provide information that may have placed an operational unit's entrepreneurial activities in a negative light. Judging from experience it was anticipated that this possibility would be minimal, given the positive, wider relationship that existed between the interviewer and interviewees.

---

<sup>10</sup>See further discussion in the section on research limitations.

#### **4.5 ADDITIONAL RESPONSE DATA**

The collection of "thick descriptions" (Geertz, 1973) was not undertaken in this study due to time and focus constraints. "Thick descriptions" are the extensive, recorded responses or observations on or from a single person or situation that are extensive, detailed, elaborate and comprehensive in nature. They provide in-depth information on the target of inquiry. For example, if a scaled value was given to a particular activity, to obtain a "thick" description, the respondent might explain the reason and thoughts behind the response and some details of his or her personal background. It is acknowledged that to some extent "thick" descriptions, as described by Geertz (1973), form a part of the Leslie (1992) study. "Thick" descriptions provide a clearer and more comprehensive insight into interviewee reasoning, beliefs and preferences, the sum of which may form or influence the perceptions that determine any offered scaled values.

### **5 DATA ANALYSIS**

Before carrying out factor analyses for inter-university and intra-university cost and benefit comparisons, values were converted to standardized scores (Z scores). This was required because the two response categories of monetary and non-monetary costs and benefits had raw scores expressed in percentage terms, whereas all other survey instrument items had raw scores scaled from zero to plus or minus ten.

#### **5.1 INTER-UNIVERSITY ANALYSIS**

A factor analysis was performed on the combined data from Universities A, B and C, and then a comparison of the results among universities was undertaken.

## 5.2 INTRA-UNIVERSITY ANALYSIS

Data from University C, the frontier entrepreneurial university (Curtin) were separately subjected to a factor analysis and then using multiple regression techniques, internal University differences were examined in terms of the variables previously identified (e.g., gender).

## 5.3 SEPARATE COMPONENTS OF THE DATA ANALYSIS

The separate items of information (data components) of interest for the results and data analysis are listed in Table 3.1.

**TABLE 3.1**

### **DATA ANALYSIS COMPONENTS**

- 1) **REVENUE IMPORTANCE.** The weighting of the importance to operating revenue of commercial activities.
- 2) **MONETARY -- NON-MONETARY.** Non-monetary costs and benefits relative to monetary costs and benefits.
- 3) **COSTS AND BENEFITS.** Individual components of non-monetary costs and benefits.
- 4) **ADDITIONAL COSTS AND BENEFITS.** Open ended responses on non-monetary costs and benefits.
- 5) **DIFFERENT POPULATIONS DESCRIPTORS.** Research population differences on the basis of gender, academic status, discipline area, entrepreneurship and revenue importance.
- 6) **RESEARCH COMPARISONS.** A comparison of results with Leslie's 1992, and 1993 research findings.
- 7) **DOLLAR RELATIONSHIP IN MONETARY AND NON-MONETARY COST AND BENEFITS.** An examination of some aspects of the relationship of the actual dollars raised through commercialization and the non-monetary costs and benefits examined in this research.
- 8) **INTER UNIVERSITY COMPARISONS.** Curtin as a frontier university.

Eight components are included in the data analysis and results chapter. Discussion of two of the components, population variables and research comparisons, are integrated, with five of the other component reports. Curtin University financial information is provided in conjunction with the discussion of monetary and non-monetary relationships. Where appropriate, in each of the result sections a brief summary of results from Leslie's research (1992, 1993) is provided.

#### **5.4 UNIVARIATE DATA**

To facilitate discussion of individual aspects of the data, the means, frequencies, ranges and standard deviations of the responses (and other univariate information) were calculated. Data from the Leslie (1992) study were compared to data from the present study. As the process of collecting and analyzing the data proceeded, further analytical opportunities and alternatives presented themselves. To some extent the data themselves determined the final form of analysis. There were many significant interactions and differences for the more than forty dependent and independent variables occurring in the study.

#### **5.5 THE INDIVIDUAL UNIVERSITIES**

References to Universities A, B, C, and Sub-Universities D, and E are, respectively

- 1) Leslie's two Universities, A and B;
- 2) Curtin University as University C;
- 3) Engineering and Science respondents at Curtin University as a separate analysis group, Sub-University D, or Science/Engineering; and
- 4) Curtin University less its Engineering and Science respondents as a separate analysis group, Sub-University E, or Residual Curtin.

## 6 CONCLUDING COMMENTS

This study builds on the work of Leslie by seeking and extending insight into the

- 1) range of non-monetary costs and benefits,
- 2) inter-institutional elements that may distinguish entrepreneurial universities,
- 3) intra-institutional elements that may help to increase understanding of university enterprise.

The use of the general linear model and multiple regression statistical techniques may have helped reduce some of the potential complexity and the diffusion of the data. It is recognized that such techniques often deal with conceptual or hypothetical constructs that are difficult to express in precise terms and difficult to observe in isolation.

## **CHAPTER FOUR**

### **DATA ANALYSIS AND RESEARCH RESULTS**

#### **1 REPORTING THE STUDY RESULTS**

This chapter is divided into four sections: (1) Non-monetary Cost and Benefit Items, (2) Inter-University Analysis, (3) Intra-University Analysis, and (4) Component Analysis. The component analysis is divided into subsections on (a) revenue importance, (b) monetary and non-monetary comparisons, and (c) additional costs and benefits.

#### **2 NON-MONETARY COST AND BENEFIT ITEMS**

This first section presents, evaluates, and comments on the survey responses of selected Curtin University academic staff. The responses are collected on 11 benefit and 12 + 1 cost items identified by Leslie.<sup>1</sup> as present in university entrepreneurial activity (the additional cost item is "personal social costs" specifically included in this study).

The responses of Curtin University respondents are reported as a whole, according to variable groupings, and in comparison with data from the Leslie study. The two universities in Leslie's study are University A and University B. The cost and benefit items reported here are the fundamental building blocks for the factor analysis, that is, they are items that are important in assessing the impact of entrepreneurial activity within the university.

---

<sup>1</sup>. All references to Leslie in this chapter refer to the research work he carried out in Australia in 1991, and reported in the two papers previously cited, Leslie (1992) and Leslie and Harrold (1993).

Each benefit item is reported in a similar manner: as a listing of the item's priority among other benefit items (as determined by respondents), a reporting of the mean,<sup>2</sup> standard deviation (STD), and response range, followed by similar data from the Leslie study (in the following order, University A, University B, and Universities A and B combined). Statistically significant differences are reported as "significant." The respondent classification variables used in the analysis and described in Chapter Three, are academic status, gender, entrepreneurial and non-entrepreneurial academic staff, and academic disciplines. All references to study results should be read as referring only to the respondents who participated in the study and not to the institutions to which they belong. In some data presentation situations the word "respondent" has been omitted from the response category description due to the excessive length of category name. Information on non-monetary cost items are presented in a manner identical to the benefit results as outlined above.

## **2.1 BENEFITS**

Schumpeter's notion of the firm in distress is manifest in universities, currently, where revenue shortfalls have resulted in expansion of pursuits of additional revenue--additional sources of supply of factors of production, in Schumpeter's terms. Universities as non-profit organizations are revenue maximizers. Money is used to enhance prestige and to serve clients better. The following benefit items reflect how money is employed to satisfy the university's mission, how university visibility is maintained, in short how the university survives financial difficulties in a manner analogous to the firm.

---

<sup>2</sup> The statistical means of all respondent valuations of research items are reported in the text, in brackets close to the name of the relevant respondent group.



### 2.1.1 PRESTIGE

First (highest) priority benefit Mean =7.6, STD =1.7, Range = 1-10. Leslie Universities A/B/A+B, N =29/33/62, Mean =6.5/7.4/7.0, STD =2.5/1.9/2.2).

Curtin University respondents value prestige as the highest priority item over all the other entrepreneurial, non-monetary benefit items considered in this study. In terms of academic status, university administrators (8.6) and professorial staff (8.0) value prestige more highly than respondents identified as associate professors (7.0), senior lecturers (7.8), and junior staff (7.7). With the exception of the responses of the associate professors, there is a pattern of high to low responses for prestige, with the highest level reported by university administrators and the lowest level by the junior staff. As academic status increases, academics appear increasingly to value prestige.

Respondents from one of the most financially successful entrepreneurial discipline areas at Curtin, business studies (6.6), report the benefits of prestige at a significantly lower level than respondents from engineering and science (8.0) and AESS<sup>3</sup> (7.9). Furthermore, they report prestige at a lower level than do health sciences respondents (7.5). Respondents' comments and elaborations do not indicate why Curtin's business studies respondents perceived lesser prestige benefits than do respondents from other discipline areas.

Respondents who highly value the importance of entrepreneurial revenue to their academic units' operations also value prestige significantly higher ( $p = 0.0003$ ) than do low revenue valuers. Possibly, without the *crucially-important* entrepreneurial revenue, academic respondents consider that prestige (theirs and the University's) may be

---

<sup>3</sup>. AESS stands for arts, education and social science disciplines at Curtin University.

threatened, should the academic product not be of a sufficiently high quality due to a lack of resources (revenue).

Leslie suggests that respondents from University B (7.4) are more heavily engaged in commercial activities than respondents from University A (6.5); thus, they may be expected to value prestige more highly. This line of reasoning may also apply to respondents at Curtin University (7.6) as compared to those at University A (6.5), where prestige receives a lower value. Leslie's data on prestige may be better compared to the 35 Curtin engineering and science respondents (8.0) who value prestige higher than Curtin respondents as a whole, and higher than the respondents from Universities A and B. A possible explanation of this phenomenon is that Curtin respondents may be a little insecure in their academic status, since Curtin only recently has been designated a "University." Before 1987 Curtin was an "Institute of Technology." The respondents who worked at the "Institute" and then continued to work at the newly designated "University," may value the attainment of university status and prestige more highly than newly-appointed Curtin University staff.

### **2.1.2 RELATIONS WITH EXTERNAL BODIES**

Second priority benefit. Mean =7.5, STD =1.9, Range = 2-10.  
 Leslie Universities A/B/A+B, N =29/33/62, Mean =7.0/6.8/6.9,  
 STD =2.0/2.0/2.0).

The function of entrepreneurial activities in promoting external relations is recognized by most Curtin respondents as an important function, placed second in the priority of non-monetary benefits. Relations with external bodies are valued by Curtin's respondents (7.5) almost as highly as is prestige. The strengthening of Curtin's external relations is considered by many respondents as a factor that increases

the university's credibility with the general community and with politicians, which facilitates future inter-organizational relationships and which keeps staff in direct contact with key community members.

Consistent with their response to prestige, respondents in business studies (6.2) value external relation benefits at a significantly lower level than do health sciences (7.7), engineering and science (7.7), and AESS (8.0). Business studies, in practice, has attained a high level of interaction with the local, national and international-regional commercial community. Business studies respondents' consistent low valuing of entrepreneurial benefits, which will become evident as other individual items are discussed, requires explanation.

Despite slight differences in magnitude and excepting Curtin business studies' respondents, the overall respondent reaction to the importance of external relations as a benefit of entrepreneurial activities is roughly the same for all respondents from the three universities. In essence, entrepreneurial activity helps to keep open a university's lines of external communication and allows the university to maintain visible involvement in the community.

### **2.1.3 FUTURE CONSULTING OPPORTUNITIES**

Third priority benefit. Mean =7.3, STD =2.0, Range = 1-10.  
 Leslie Universities A/B/A+B, N =29/33/62, Mean =5.3/5.5/5.7,  
 STD =2.5/1.9/2.2).

Respondents are acutely aware of additional opportunities that may arise as a result of successful university commercial ventures. The developments of performance records, access, know-how, and know-who, are thought by respondents to lead to better prospects in future consulting and contractual situations. Curtin respondents highly value future consulting opportunities (7.3), perhaps as a way of keeping "visible."

They regard consultancy opportunities as a third priority among all the benefits from entrepreneurial activities. This may not be simply because they desire to establish some work prospect for future enterprise; it may indicate a desire to maintain external relations, further increase prestige and obtain additional revenue. Respondents may have been considering future consulting opportunities as an avenue through which they are able to keep active and available for entrepreneurial opportunities.

There appears to be a significant circular relationship for responses among Curtin's discipline area respondents on the matter of the benefit of entrepreneurial activities and future consulting opportunities. Engineering and science (7.9) and AESS (7.8) respondents are significantly different from health science (6.5) and business studies (6.2). In the Curtin context, the registering of significantly lower future consulting benefit values by business studies and health science respondents is an unexpected research outcome. What element in future consultancy opportunities brings to a similarly high value level the relatively low revenue raising AESS respondents and the relatively high revenue-raising engineering and science respondents?

Interviewee responses in Leslie's University B (5.5), are significantly below the level of all Curtin responses on the matter of future consulting opportunities. Curtin respondents place this item as the third highest benefit priority, and higher than the fifth priority accorded by Leslie's respondents. University B (5.5) is considered by Leslie to be the more commercial (entrepreneurial) university; thus, higher values may have been expected from this university on the matter of future consulting opportunities than from University A (5.3). Possibly the same considerations that brought Curtin's AESS respondents

to the fore on this item may also be present in respondents from University A in comparison to respondents from University B.

#### 2.1.4 SPILLOVER TO RESEARCH

Fourth priority benefit. Mean =6.8, STD =2.4, Range = 0-10.  
 Leslie Universities A/B/A+B, N =29/33/62, Mean =5.3/5.5/5.7,  
 STD =2.5/1.9/2.2).

Curtin respondents (6.8) value the benefits of the spillover into research from entrepreneurial activities highly, placing it fourth in the Curtin respondents priorities. As a group, Curtin university administrators (8.2) value the benefit of entrepreneurial activity spillover to research significantly higher than respondents in other academic status groups (range, 7.0 to 6.3), except for the senior lecturer group (7.0) (where the difference is higher but not significantly higher). From their vantage point, university administrators may see more clearly the overall impact of entrepreneurial activity on the university's research program. Initially, funds from entrepreneurial activities made a research program possible at Curtin; it is not until the late 1980s that Curtin became eligible for federal government research funds.

Engineering and science respondents (7.6) value the spillover into research significantly higher than respondents in business studies (5.5). This is understandable in the Curtin situation since the major portion of business studies income is derived from overseas fee-paying students, not from research contracts and Cooperative Research Centers (CRCs), as is the case for the engineering and science disciplines.

Respondents from Leslie's University A (7.2) value research spillover more than respondents from University B (5.3). The overall value for research spillover (6.6) in Leslie's study is close to the value

placed on it by Curtin respondents (6.8). Leslie suggests that the respondent perception gap on this item, between Universities A and B may be a reflection of the greater emphasis on basic research at University A. This suggestion can be extended to propose that Curtin's R&D effort lies somewhere between Leslie's two universities. The respondent value gaps (the absolute difference between the mean scores) that separates the overall lower levels of responses in Leslie's data and the levels provided by this study's respondents are uncharacteristically small on this particular item.

#### **2.1.5 SPILLOVER TO TEACHING**

**Fifth priority benefit. Mean =6.2, STD =2.5, Range = 0-10.  
Leslie Universities A/B/A+B, N =23/33/56, Mean =6.4/5.3/5.8,  
STD =2.7/2.6/2.7).**

Not all commercialization activities are seen by Curtin respondents as being beneficial to teaching activities; however, most Curtin academic staff indicate that they are able to draw on their commercialization activities when seeking examples for teaching purposes, practical exercises, and case studies. The spillover benefit to teaching from commercialization (6.2) is placed fifth in Curtin's list of benefit priorities. The respondents in all of Curtin's academic discipline groups appear to hold this benefit in relative high regard (range, 5.4 to 6.8).

University A respondents (6.4) and Curtin respondents (6.2) are closer together in their valuations of the spillover to teaching than are the respondents from University B (5.3). On this item Curtin respondents are similar to the traditional University A, possibly because they are well able to use entrepreneurial activity to improve the Curtin teaching programs. Leslie expounds the idea that University A has a

better (greater) integration of commercialization and academic units than does University B. Such integration is certainly the situation at Curtin. This item is placed fourth in Leslie's overall priority.

#### **2.1.6 EQUIPMENT GAIN**

Equal sixth-seventh priority benefit. Mean =5.5, STD =3.0, Range = 0-10. Leslie Universities A/B/A+B, N =29/33/62, Mean =5.7/3.5/4.5, STD =3.3/3.0/3.3).

The next highest non-monetary benefit of entrepreneurial activity identified by Curtin respondents (5.5) is equipment gains. Although, the equipment gained is usually without any cost, some university costs are often incurred in the maintenance, operation, and servicing of this "free" equipment.

Again, engineering and science respondents (6.6) value the benefits of equipment gained higher than other discipline areas. This is not unexpected at Curtin, since engineering and science, followed by health sciences (5.0), have the highest need for equipment. Yet, responses from these two disciplines areas show a significant disparity in perceptions on the value of equipment gains through entrepreneurial activity. From an equipment standpoint, are the health sciences tackling the "most advantageous" entrepreneurial activities? The lower levels of real equipment needs in business studies and AESS may, in this case, explain respondents lower values for the benefit item. University administrators place a significantly higher value on equipment gains (6.8) than do other academic respondents (range, 5.0 to 5.8).

In the Leslie study respondents from University A (5.7) are significantly higher in their values for equipment benefits than respondents from University B (3.5). Curtin values are closer to University A responses than University B responses. If a university is successful,

prominent, and prestigious, it may gain more equipment through entrepreneurial activities than a less prominent university.

### **2.1.7 SERVICES CONTRIBUTED BY PROJECT PERSONNEL**

Equal sixth-seventh priority benefit. Mean =5.5, STD =2.3, Range = 0-10. Leslie, Universities A/B/A+B, N =29/33/62, Mean =5.3/3.8/4.5, STD =2.5/2.9/2.8)

The services contributed by personnel associated with entrepreneurial activities are defined broadly and include any type of service facilitated by past and present project personnel. This benefit item is valued equally with equipment gains (5.5).

University administrators (7.6) place a significantly higher value on the services contributed to the university by entrepreneurial project personnel than do other academic staff (range, 5.0 to 6.0). Again, from their management vantage point, many university administrators may be more aware of the total level of services contributed to the university than are other academic staff. There is also a legitimate argument advanced by many academic staff, that academics as the people most directly involved in entrepreneurial activity may have more valid perceptions of costs and benefits than do many administrators.

Leslie (1992, p.21) notes that "In larger projects and in units where commercial activity is substantial, it is fairly common for the added personnel to work with one or two postgraduate or honors students in their research, in one instance to the extent of noticeably reducing the workload of faculty." Such relationships are uncommon at Curtin: Service support is made available by project personnel; it is relatively modest and ancillary, but highly regarded and desired by respondents (the sixth-seventh priority benefit).



### 2.1.8 EMPLOYMENT OF GRADUATES

**Eighth priority benefit. Mean =5.2, STD =2.9, Range = 0-10.  
Leslie Universities A/B/A+B, N =28/33/61, Mean =5.0/5.2/5.1,  
STD =2.9/2.8/2.9).**

Opportunities for the employment of higher degree graduates through entrepreneurial activity are regarded by respondents as substantially higher than the level of opportunities for bachelor degree graduating students. In Australian universities, in general, concern with employment as an integral component of university programs seem to be less a focus issue than it is in the USA (but it is still important).

Associate professors (4.9) and junior staff (4.9) value graduate employment at a slightly lower level than other academic staff groups (range, 5.4 to 5.8), possibly because these levels of academic staff do not directly encounter the employment situation in the same manner as other staff. A higher valuation is placed on this benefit by Curtin's engineering and science respondents (6.2), compared to respondents from other disciplines (range, 4.5 to 5.0). Findings for Curtin University respondents compare similarly to those of Leslie (5.0 and 5.2), but this is not so for the Curtin engineering and science respondents, who are again the highest valuers of this benefit item.

### 2.1.9 RECRUITMENT OF STUDENTS

**Ninth priority benefit. Mean =5.17, STD =2.65, Range = 0  
--10. Leslie Universities A/B/A+B, N =27/33/60, Mean  
=4.5/5.3/5.0, STD =3.3/2.6/2.9).**

Many respondents suggested that the question on the recruitment of students should have been divided into two categories, one for undergraduate and the other for postgraduate student recruitment. The responses are acknowledged by many respondents as a composite value. The valuations of the benefit of entrepreneurial activity for postgraduate

recruitment would have been higher than for valuations for undergraduates recruitment, if the question had been appropriately categorized.

Business studies attracts the highest number of fee-paying students to Curtin (4.3). Respondents in business studies value the benefit to student recruitment of entrepreneurial activities lower than do respondents from other discipline areas (range, 4.7 to 5.9). The reason for business studies respondents lower valuation are difficult to understand. The recruitment of fee-paying students is important to this discipline area; fee-paying students are the main source of additional revenue; recruiting fee-paying students is the main entrepreneurial activity of business studies. In part, by being entrepreneurial prominent, business studies at Curtin has been able to capture fee-paying student clients. An alternative explanation for the above situation is that the academic staff may not see "overseas fee-paying" students as entrepreneurial activity in the same sense as obtaining research grants or other university commercialization activities.

Engineering and science respondents maintain their higher value pattern by placing a high value on student recruitment (5.9), a value significantly different from respondents in business studies. There is strong competition among Perth's five universities (of which Curtin is one) to attract "high quality" students to their programs, this is particularly the case for the two universities offering professional engineering programs. University administrators (6.2) also value the benefit of student recruitment arising from entrepreneurial activities higher than do other academic staff respondents (range, 4.4 to 5.5).

The valuations on this benefit by the Leslie study respondents (0.1 and 1.7) are significantly different from the Curtin respondent valuations (5.2). Leslie (1992, p.20) suggests that entrepreneurial projects give "departments the visibility, the perceived quality, that

is instrumental to the attraction of postgraduate students." Generally, for benefit items of lower priority, Curtin respondents place much higher numerical values on these benefits than do the respondents in the Leslie study. Hence, most low-priority benefit items show a significant difference in respondent values between the Curtin and Leslie studies. Curtin may be gaining good value (and hence high value) from entrepreneurial activities; alternatively, respondents at Curtin may be generous with their valuation of benefits. The recruitment of "quality" students is considered by Curtin respondents to be important for maintaining institutional prestige associated with the government funded, undergraduate activity of the university. Although, student recruitment as a spin-off of entrepreneurial activity may not be directly in evidence, almost anything that may contribute to competitive advantage in this area is valued by academic staff.

#### **2.1.10 RECRUITMENT OF STAFF**

Tenth priority benefit. Mean =4.7, STD =2.8, Range = 0 --10.  
 Leslie Universities A/B/A+B, N =29/33/62, Mean =1.7/0.1/0.9,  
 STD =2.2/0.5/1.8).

The facilitation of the recruitment of staff as a result of university involvement in entrepreneurial activities is valued as the tenth priority by Curtin respondents (4.7). Respondents indicate that not only are entrepreneurial activities in themselves attractive, the reputation of being entrepreneurial is also of assistance in recruiting staff.

Engineering and science respondents (5.6) attach higher values for this benefit item than respondents in other discipline areas (range, 3.4 to 4.7). There is a statistically significant difference between business studies respondent values and engineering and science values.

Similar significant results are observed between this study's university administrators (6.2) and the respondents in other academic groups (range, 4.5 to 4.9).

### **2.1.11 EMPLOYMENT OF STUDENTS**

Eleventh priority benefit. Mean =5.17, STD =2.6, Range = 0-10. Leslie Universities A/B/A+B, N =28/33/61, Mean = 4.2/4.3/4.2, STD =3.0/2.8/2.9).

Junior academic staff respondents (3.8) value the employment of students lower than other levels of academic respondents (range, 5.8 to 4.2) and significantly lower than the response values of university administrators (5.8). Not unexpectedly, respondents in engineering and science disciplines (5.2) value the employment of students significantly higher than respondents in health sciences (3.7) and business studies (3.4), and higher than AESS respondents (4.1).

There is very little difference in the priority and respondent valuation of student employment benefits among Curtin University and Leslie's Universities A and B (4.5/5.3/5.0). In Australia there is a more controlled supply and market for university graduates than there is in the USA, 90-95 per cent of Australian university graduates are placed in jobs within 6 months of graduating (some not in their position of choice). Curtin University has a high percentage of successful student work-placements.

## **2.2 COSTS**

### **2.2.1 PERSONAL SOCIAL COSTS**

First (highest) priority costs. Mean =-5.7, STD =2.6, Range = 0-10.

Personal social costs are clearly matters that need to be taken into account by universities intending to maximize the entrepreneurial activities of their academic staff. Personal social costs items are considered by respondents at Curtin to be the most substantial and important cost issue for university entrepreneurial activity encountered by the researcher.

In the survey the interview question on personal social cost is asked after respondents complete the questions on the set non-monetary costs. Personal social costs (5.7) are identified by many Curtin respondents as those costs, usually but not always, without dollar value, borne by the individual staff member. Personal social costs include less time for personal and professional reading, less time with colleagues in friendly professional discussion and social discourse, less time with family, less personal activity time, less sport and recreation. Other personal social cost items are being tired out for scheduled family or private activities, having to spend more time on business travel, and having to meet small out-of-pocket expenses which are not re-claimable from the University (e.g., a meal out instead of at home, the extra gift for a child for being away on a birthday, a cup of coffee for a client, a gift for a spouse due to the staff member's guilt at working extra long hours).

Associate professors (-5.8) and junior staff (-7.0) respondents value their personal social costs in carrying out entrepreneurial activity significantly higher than do other academic respondents (-4.8 to -5.3). Junior staff and female academic respondents, respectively, rate the personal social costs of entrepreneurial activity statistically higher than other groups of academic respondents and males respondents.

Personal social costs (-5.7) are valued highest of all costs by all Curtin respondents. Leslie (1992, p.31) mentions that several

respondents complain of their loss of leisure time, one of the factors which constitutes personal social costs. However, the respondents in Leslie's study were not asked to value this entrepreneurial activity cost item. The issue of personal social costs in entrepreneurial activity is one of high importance current issues for academic staff.

### 2.2.2 ACADEMIC RESOURCES CONSUMED

Second priority costs. Mean = -4.6, STD = 2.5, Range = 0 --10.  
 Leslie Universities A/B/A+B, N = 28/33/61, Mean =  
 -3.0/-3.3/-3.1, STD = 2.5/2.5/2.5).

The second highest cost value indicated by Curtin respondents is a broad ranging summary cost factor, the total academic resources consumed (-4.6). This is one of the few cost items that overlaps the numerical values given by respondents to benefit items; most benefit items are valued substantially higher. Academic resources consumed cover all those aspects of non-monetary costs which are unlikely to be covered by direct costs, for example, time at departmental meetings discussing a project proposal, the incidental photocopying and secretarial services due to the project but paid for under the recurrent budget, staff time spent communicating (phone, letters, meetings) on a project, the overheads of unsuccessful bids for projects and contracts, the "free" use of physical space, and the time of colleagues spent helping with project problems.

Curtin respondents (-4.6) are significantly higher in their valuations of the total academic resources consumed, than Leslie's respondents (-3.1). *Indeed, all the average Curtin respondent valuations of non-monetary costs are numerically much higher than the costs valuations reported in the Leslie study.*

On the above basis, it could have been anticipated that the overall non-monetary cost responses at Curtin would be much higher than the responses for Universities A and B; yet, the average level of Curtin cost reported by Curtin respondents is fairly close to that of the Leslie study (Curtin =46%, University A =27%, University B =50%, A+B =40%).<sup>4</sup> Responses on the issue of academic resources consumed do not correlate highly with other (taxonomy) cost responses. The benefit items that correlate ( $p < 0.05$ ) with academic resources consumed are service and graduate employment, and the cost correlations with academic resources consumed are staff loss, loss of teaching time, and equipment wear and tear. If this item had shown a high correlation with most costs item, then it may have been a good substitute item for all those other items.

### 2.2.3 LOSS OF TEACHING AND PREPARATION TIME

Third priority costs. Mean =-3.8, STD =2.7, Range = 0-10. Leslie, Universities A/B/A+B, N =28/33/61, Mean = -1.6/-2.2/-1.9, STD =2.3/2.1/2.2).

The loss (and potential or feared loss) of teaching and teaching preparation time is a matter of concern to Curtin academic staff. Some staff insist that they have given the highest priority to their teaching responsibility and have not let teaching suffer because they are involved in entrepreneurial activities (19 respondents place this cost at zero). The frequency distribution of the loss of teaching time responses is slightly bi-modal, however, with 46 responses at values two, three, and four and 31 responses at values six, seven, and eight. The results indicate that 83 per cent of Curtin academic staff are concerned

---

<sup>4</sup>Note that this issue is determined on the basis of separate research questions, and not on the individual cost and benefit questions.

about the pressure on teaching time and that almost one third of respondents see it as a prominent issue.

Junior staff respondents (-5.9) value the loss of teaching and preparation time significantly higher than the other levels of academic staff respondents. On the other hand, respondents in engineering and science disciplines (-2.9) and female respondents (-3.6) respectively rate the loss of teaching time significantly lower than respondents in other disciplines (-3.8 to -4.4) and against all male respondents (-4.6). The most financially successful entrepreneurial discipline group, the engineering and science respondents, place a lower value on teaching time lost. Possibly, financial success eases the demand of entrepreneurial activity on teaching time by providing more resources (human and physical) to support the teaching program and thus, the program does not suffer as much from the pressures on academic staff time.

#### **2.2.4 LOSS OF TIME FOR BASIC RESEARCH**

Fourth/fifth priority costs. Mean = -3.5, STD = 2.6, Range = 0-9. Leslie Universities A/B/A+B, N = 28/33/61, Mean = -2.1/-2.0/-2.0, STD = 1.9/2.0/2.0).

The next priority non-monetary cost identified by Curtin respondents is the loss of time for basic research. The loss of time for basic research is seen in the research literature as a major issue for universities engaged in entrepreneurial activities, and this concern is moderately born out (with reservations) in this study. Some observers consider that basic research has not been a significant feature of academic life at Curtin. Until the late 1980s Curtin was not eligible for government research funding and had to obtain all research funds through competitive contracts. Although, a major Western Australian center for research, Curtin is probably not a leading center for basic research.



Given Curtin's past low level of basic research involvement these survey results should be considered in light of the respondents' desire (as academic staff) to be involved in basic research, rather than a feeling of deprivation stemming from the respondents earlier level of involvement in basic research. Some respondents told how their applied research leads them to consider basic research issues.

Respondents in AESS (-2.9) and engineering and sciences (-3.0), the latter working largely in applied science areas, value the loss of time for basic research at a lower level than respondents in health science (-4.8). This may suggest that the health sciences have been traditionally involved in more basic research than other discipline areas at Curtin.

University administrators (-5.0) and junior staff (-4.4) reported higher values on this cost item than do other levels of academic respondents (-2.9 to -3.8). Most Curtin administrators are university-research oriented and their higher valuations could be anticipated. Junior staff still have their careers before them. They indicate that they are under pressure to publish their research, and yet they feel that they are bearing much of the increased workload due to the restructuring of the university. Many Curtin respondents may have biased responses on this item, in part, due to the growing pressure at Curtin to publish research, rather than to the specific issue of the loss of basic research opportunities.

Respondents at Leslie's University A (-2.5) and University B (-3.2) value the loss of basic research time at a lower level than do Curtin respondents, suggesting that respondents at these universities may be less affected by loss of time for basic research than are respondents at Curtin (despite the previously mentioned caveat that research at Curtin usually has not been basic research). This cost is

accorded the third highest priority by Curtin respondents. In the Leslie study the loss of teaching time is accorded sixth priority by the respondents.

### 2.2.5 EQUIPMENT WEARING OUT

Fourth/fifth priority costs. Mean = -3.5, STD = 2.9, Range = 0 --10. Leslie Universities A/B/A+B, N = 28/33/61, Mean = -2.5/-3.2/-2.9, STD = 2.5/2.9/2.7).

The use of university equipment by staff engaged in entrepreneurial activities is wide-spread, often considerable, and difficult to monitor. Equipment used for "private purposes" is often indistinguishable from uses for other routine activities. The use of university equipment and wear and tear on university equipment in the course of entrepreneurial activities ranges from using a university word processor and library resources to holding up access to or use of equipment by others. Certainly, some of the university's equipment may not be otherwise used. The equipment may also become surplus before wearing out, due to any extra use called for by entrepreneurial activities.

Male respondents (-4.23) see wear and tear on equipment as a heavier cost than do female respondents (-3.34). This, in part, may be a function of male dominance in research at Curtin, and in particular of the almost exclusively male presence in engineering and science disciplines, which are among the heaviest users of university equipment.

In comparison with the Leslie study, Curtin respondents (-3.5) value the cost of equipment wear due to entrepreneurial activities as significantly higher than both University A (-2.1) and University B respondents (-2.0). This perception may arise because entrepreneurial activities that are more demanding on equipment are being carried out at Curtin. Although, in comparison with many Australian universities, the

equipment situation is improving, equipment at Curtin is generally considered to be in short supply.

#### 2.2.6 TIME OF HIGHER SUPPORT PERSONNEL

Sixth priority costs. Mean = -2.7, STD = 2.1, Range = 0 --8.  
 Leslie Universities A/B/A+B, N = 28/31/59, Mean =  
 -1.9/-2.0/-1.9, STD = 1.9/1.9/1.9).

When asked to value the contribution of higher support personnel to entrepreneurial activity, many academic staff laugh. They imply that the prospects of higher support personnel spending useful time on *their* entrepreneurial projects is laughable. This critical response may reflect a lack of understanding of the support and assistance that many higher personnel provide for entrepreneurial efforts. University administrators' (-3.6) rate this cost higher than the value recorded for all respondents (-2.7). Fifteen percent of all respondents view higher support personnel as contributing medium-to-high levels of support time. Many of these respondents are involved in large, multi-million dollar entrepreneurial projects. Similar comments and reactions are recorded by Leslie from respondents at Universities A and B.

There are a number of areas of university enterprise at Curtin where the contribution of university administrators is widely acknowledged (e.g., in the development of CRCs), although this is not noticeably reflected in respondents cost item valuations. One respondent suggested that very big projects are to some extent more impersonal and distant from the individual academic because of the very size of the activity. Hence, the contribution of higher support personnel to the project is not necessarily well known. Some observers would argue that the academic entrepreneur at the work-face has a good idea of the real

contribution of higher support personnel to entrepreneurial activity and has valued such contributions accordingly.

### 2.2.7 MONETARY LOSS

Seventh priority costs. Mean = -2.6, STD = 2.2, Range = 0-9.  
 Leslie Universities A/B/A+B, N = 22/33/55, Mean =  
 -0.5/-0.1/-0.3, STD = 1.2/0.2/0.3).

Many respondents indicate that some monetary loss occurs in their entrepreneurial activities and many are also aware of a number of major money-losing entrepreneurial activities at Curtin. Comments on monetary loss, however, must be seen in perspective by noting that 87.5 percent of respondents rate the monetary loss as low, including 33 percent who indicate the monetary loss as zero. Some respondents suggest that losses usually are *masked* by the overall financial activity and thus, are not often subject to wide scrutiny. It is this *masking* that makes it difficult to calculate the monetary cost of loss-making activities and explains in part, why *monetary loss* is counted as a *non-monetary cost*.

The most common type of monetary loss occurs when the time and effort required to complete a contract exceeds the budgeted time. In effect, academic staff members are often faced with completing a contract by drawing on their own personal time, by taking from the time allocated to other university activities or the time of other university workers, and by employing additional workers to complete the task (or to enable the staff member to complete the task unfettered by routine duties).

Curtin female respondents (-3.4), perceive a higher loss than do male respondents (-2.4). Monetary losses also are a matter of significantly higher concern for university administrators' (-5.2) compared to

other staff (range, -2.3 to 3.1). This difference in perception may occur because the work responsibilities of university administrators eventually bring them into direct contact with all Curtin loss-making situations. Similarly, there is greater concern for this issue by respondents in business studies (-3.5) than in other discipline areas (range, -2.3 to -2.7). Some respondents in business studies indicate that for some time they have felt threatened by ventures undertaken in other discipline areas which they deem "riskier" compared to their own (dominating), safe entrepreneurial activity which is fee-paying overseas students. The respondents in business studies disciplines know that they will most likely experience serious financial difficulty in their academic operations if for any reason fee-paying student activities are curtailed or reduced.

Judging from the respondent valuation levels, the monetary losses for respondents at University A (-0.5) and University B (-0.1), (A+B = -0.3) are minor and significantly lower than at Curtin. Given that Curtin is an entrepreneurial institution (risk taking and venturesome), a higher level of monetary losses (and potential monetary losses) due to entrepreneurial activity can be anticipated. It is emphasized that for many respondents the fear of potential monetary loss is much greater than the experience of actual monetary loss. This fear may govern responses to many new entrepreneurial activity proposals (possibly accounting for some observed negative and unsympathetic attitudes towards entrepreneurial activities).

#### **2.2.8 LOSS OF ACADEMIC STAFF**

Eighth priority costs. Mean = -2.5, STD = 2.5, Range = 0-10.  
 Leslie Universities A/B/A+B, 25/33/58, Mean =  
 -1.1/-0.2/-0.6, STD = 1.6/0.7/1.2).

Eighth on the list of non-monetary cost is the loss of academic staff. This cost is not regarded by most Curtin respondents (-2.5) as major (32 percent of respondents indicate a zero cost valuation). Curtin has lost very few academic staff directly due to entrepreneurial activity. The lowest valuations of this cost item are in the engineering and science disciplines (-2.1), areas with the potential for high staff losses due to the nature of their activities and the attractiveness of their staff to industry.

In Leslie's study losses were perceived as minor (-1.1 (A), -0.2 (B) -0.7 {A+B}) and were limited to client organizations. At Curtin, respondents considered loss of staff for any reason relating to entrepreneurial activity, such as loss due to frustration (tiredness) with entrepreneurial work; moving to other, less enterprising (or wealthier) universities; and promotions due to entrepreneurial drive.

#### **2.2.9 SECRETIVENESS AND CONFIDENTIALITY**

Ninth/tenth priority costs. Mean = -2.2, STD = 2.5, Range = 0-10. Leslie Universities A/B/A+B, N = 29/32/61, Mean = -0.9/-0.1/-0.5, STD = 2.0/0.2/1.5).

Academic staff at Curtin indicate that they do not like to see contractual conditions that limit or may limit freedom to communicate research and development results, although they recognize that commercially sensitive information should be protected appropriately and judiciously. Very few respondents indicate personal experience with secrecy or confidentiality; they point out that academics have protected successfully individual privacy and organizational or personal anonymity for a very long time.

Curtin respondents value the cost of secrecy and confidentiality at a low level (-2.2). Thirty-one per cent of respondents regard the

cost as zero; 81 per cent put the cost at 4 or less. University administrators (-4.8) are significantly more concerned with the practical impact of secrecy and confidentiality than are other groups of academic respondents (range, -1.7 to 2.5). Leslie (1992, p.28-29) observes that the few "high negative ratings reflect strong personal values against confidentiality;" the same could be said for many Curtin responses.

#### **2.2.10 PRODUCT OR PROCESS LIABILITY**

Nineth/tenth priority costs. Mean = -22, STD = 2.3, Range = 0-8. Leslie Universities A/B/A+B, N = 28/33/61, Mean = -1.3/-1.3/-1.3, STD = 1.6/2.2/1.5).

The possibility that entrepreneurial work may lead to legal liability for a product or service is accepted by most academics, but it is not considered to be an issue that would personally affect them (33% of respondents record a zero response). Curtin University carries insurance against product and process liabilities. The 10 respondents (9%) who value this cost as high, have direct responsibility for major projects. The highest level of potential liability is perceived in the health sciences (-3.3); the lowest valuations are in engineering and science (-1.5). University administrators (-3.8) and junior staff (-3.5) are the most concerned academic groups; other groups ranked the cost from -1.7 to -2.0.

Again the valuations of Curtin respondents (-2.2) are significantly higher than the combined respondents' valuations at Leslie's Universities A and B (-0.5). Academic staff at universities taking less entrepreneurial risks may not see the cost of product and service liability as being of particularly high relevance to their institutions.

### 2.2.11 REVENUE SUBSTITUTION

Eleventh priority costs. Mean = -2.1, STD = 2.8, Range = 0-10.  
 Leslie Universities A/B/A+B, N = 22/32/55, Mean =  
 -1.5/-2.7/-2.2, STD = 2.4/3.3/3.0).

In general, Curtin respondents are not concerned about the potential impact of revenue substitution. Yet, many respondents consider that the government is already practicing some forms of revenue substitution, even if the university itself is not. If external funding levels continue to deteriorate, some respondents are concerned that those responsible for internal resource allocations may take notice of the superior ability of some academic units to raise external funds. Hence, it is feared that revenue substitution will occur. Despite these fears, the existing practice at Curtin is to reward successful fund-raisers.

In order to promote entrepreneurial activities, it is the practice and policy of Curtin University (1) to permit the revenue raised by external activities to remain, as far as possible, with the group that raised the revenue and (2) not to take into account the entrepreneurial funds of specific units when determining the university's recurrent and capital budget. This latter point must be tempered by the knowledge that external funding has recently (1993) helped some units (e.g. Cooperative Research Centers (CRC's)) to obtain accelerated capital construction priority.

Evidence from the USA suggests that, to date, there has been little, or no, recourse to revenue substitution in USA universities (Feller, 1989; Jaschik, 1988). The Leslie (1992, p.36) study also suggests that this is the case in Australia where respondents feel that "the forces balance out, that is, some substitution of self generated revenue for government revenue, but some additional government funds following from university success in commercial ventures."



Revenue substitution is the eleventh priority cost item for Curtin respondents. It is also the main item in the Fifth Factor of the Curtin data factor analysis discussed below, and despite its low priority place here in the order of cost items, it may be a distinctive and important item in the overall non-monetary situation. In both the Curtin and Leslie studies respondents value revenue substitution at similarly low levels (University A (-1.5), University B (-2.7, and Universities A+B (-2.2), Curtin (-2.1)). The Curtin respondents most concerned about revenue substitution are from business studies (-2.6), which is the highest earner of entrepreneurial activity discretionary funds<sup>5</sup> at the university; and from senior lecturer respondents (-2.8); and male respondents (-2.55).

#### 2.2.12 PATENT COSTS

Twelfth priority costs. Mean = -0.8, STD = 1.4, Range = 0-9.  
 Leslie Universities A/B/A+B, N = 28/33/61, Mean =  
 -1.0/-0.3/-0.6, STD = 1.7/0.7/1.3).

Sixty-two percent of Curtin respondents rate patent costs as zero. In the Leslie study patent costs are also minimal. Patenting activities and other similar legal processes are almost non-existent in the three Australian universities. Compared with universities in the USA patent costs are not an issue in Australian universities. When patents have been established at Curtin, often the patent processing has been carried out and paid by commercial partners outside the university. An increase in the cost of administering patents, royalties, and copyright is expected by many respondents as entrepreneurial expansion continues.

---

<sup>5</sup>. Discretionary funds are funds over which the academic staff and or the university may freely determine, within legal limits, how they will spend the funds. They are not governed by the requirement to spend the money according to contract, or on the teaching program, as is the largely the case for funds supplied by the Government.

### 2.2.13 LEGAL FEES

**LEGAL FEES:** Thirteenth priority costs. Mean = -0.4, STD =0.8, Range = 0-5. Leslie Universities A/B/A+B, N =29/33/62, Mean = -0.9/-0.2/-0.5, STD =1.2/0.5/1.0).

It follows, that there are low levels of legal fees at Curtin. This cost is perceived as the lowest of the set on non-monetary cost (-0.4). The Leslie study respondents (-0.5) also rate legal costs as minor. Many Curtin respondents indicate that they expect legal costs to increase in the future.

### 2.3 COSTS AND BENEFITS IN TABULAR SUMMARY

The above general discussion of cost and benefit item information is tabulated below in Tables 4.1 and 4.2.

TABLE 4.1 LESLIE AND HARROLD'S (1993) TAXONOMY AND THE RESULTS OF THIS STUDY A COMPARISON OF INDIRECT BENEFITS <sup>1</sup> (* denotes $p < 0.05$ )						
RANK	MEAN	STD	ITEM	RANK	MEAN	STD
LESLIE				CURTIN		
R1	7.00	2.20	prestige *	R1	7.60	1.70
R2	6.90	2.00	relations with external bodies	R2	7.50	1.90
R3	6.50	2.30	spillover to research	R4	6.80	2.40
R4	5.80	2.70	spillover to teaching	R5	6.20	2.50
R5	5.70	3.00	future consulting opportunities *	R3	7.30	2.00
R6	5.10	2.90	graduate employment	R8	5.20	2.90
R7.5	4.50	2.80	service contributed	R6.5	5.50	2.30
R7.5	4.50	3.30	equipment gains *	R6.5	5.50	2.60
R9	4.20	2.90	employment of students	R11	4.30	2.70
R10	4.00	3.00	student recruitment	R9	5.20	2.60
R11	0.90	1.78	recruitment of faculty*	R10	4.80	2.80
<sup>1</sup> . Items with an asterisk (*) show significantly different valuations between the two studies. In all cases Curtin respondents have the higher valuation.						

Without exception Curtin staff put the benefits as higher than did the Leslie respondents. Despite some minor changes in the Curtin rank

ordering of the items in Table 4.1 (future moves up 2 places in comparison with the Leslie rank order, and graduate and student employment move down 2 places), there is no statistically significant difference in the overall rank order of benefits. There are some significant difference among the means of individual items in the two studies, and the statistically significant items have been marked in Tables 4.1 and 4.2 with an asterisk (\*).

TABLE 4.2 LESLIE AND HARROLD'S (1993) TAXONOMY AND THE RESULTS OF THIS STUDY: A COMPARISON OF INDIRECT COSTS <sup>1</sup> (* denotes $p < 0.05$ )							
RANK	MEAN	STD	ITEM	RANK	MEAN	STD	ADJ. RANK
LESLIE			INDIRECT COSTS	PHILPOTT			
R1	-3.10	2.60	academic resources consumed *	R2	-4.60	2.50	R1
R2	-2.80	2.80	loss of time for basic research	R4.5	-3.50	2.90	R3.5
R3.5	-2.10	1.90	time of higher support personnel	R6	-2.70	2.10	R5
R3.5	-2.10	1.90	revenue substitution	R11	-2.10	2.80	R10
R5	-2.00	2.90	equipment wear *	R4.5	-3.50	2.60	R3.5
R6	-1.80	2.13	loss of teaching and preparation time	R3	-3.80	2.70	R2
R7	-1.40	1.90	secretiveness	R9.5	-2.20	2.30	R8.5
R8	-0.70	1.50	loss of academic staff *	R8	-2.50	2.50	R7
R10	-0.50	1.50	monetary loss *	R7	-2.60	2.20	R6
R10	-0.50	1.00	legal fees *	R13	-0.40	0.80	R12
R10	-0.50	0.90	patent costs	R12	-0.80	1.40	R11
R12	-0.20	0.70	product or process * liability	R9.5	-2.20	2.50	R8.5
NA	NA	NA	Social costs	R1	-5.70	2.60	N/A
<sup>1</sup> . Items with an asterisk (*) show significantly different valuations between the two studies. In all cases Curtin respondents have the higher valuation.							

Table 4.2 details the results for the set of thirteen non-monetary costs suggested in the Leslie study plus an additional "personal social cost" factor identified in the Curtin study. With two exceptions, costs

are considered to be greater than at the Leslie universities. The almost unanimous concern attached to personal social costs by Curtin staff is reflected in their valuing of the importance of this item above all the cost items identified in the literature and in Leslie's study.

Of 13 possible rank-order cost comparisons, nine costs change rank order more than two places for Curtin compared with the Leslie data. One item, revenue substitution, moves from third-fourth place on the Leslie data to eleventh place in the Curtin data. The difference in rank-order for costs is significantly different between the two studies. Levels of significance and rank-order aside, respondents' perceptions of cost items are closer together in the two studies, than are the benefits item values. Staff concern with high cost levels may be an aspect of high levels of entrepreneurial activity.

### **3 INTER-UNIVERSITY ANALYSIS**

Common data from the three universities, University A (n =29), University B (n =33), and University C (n =112), are combined, the raw scores standardized and analyzed.<sup>6</sup> Eleven benefit items and thirteen cost items are manipulated in a factor analysis (see Appendix C for the specific items and item abbreviations used for the tables throughout this Chapter). From the factor analysis, five factors levels are selected based on an examination of the graphed Eigenvalues of the factor analysis. The Eigenvalue for the five factors (Tables 4.3 and 4.6) are Costs = 4.11; Benefits = 3.35; Employment = 2.47; Legal = 1.81; and Resource = 1.43).<sup>7</sup>

---

<sup>6</sup>. Missing response data are automatically replaced in the statistical process by the separate item means. Unless otherwise stated all references to statistical significance in this chapter are at the  $p < 0.05$  level.

<sup>7</sup>. Eigenvalues provide an indication of the amount of variance a given factor accounts for in a set of common factors. In this par-

TABLE 4.3 ALL THE UNIVERSITIES COMBINED: FIVE FACTOR ANALYSIS <sup>1,2</sup>				
FACTOR ONE (F1) COSTS	FACTOR TWO (F1) BENEFITS	FACTOR THREE (F3) EMPLOY	FACTOR FOUR (F4) LEGAL	FACTOR FIVE (F5) RESOURCES
FIRST SET TotCost 0.73189 TeachLoss 0.71541 AcadResource 0.67523 LossMoney 0.66116 EquipWear 0.65845 ProdLiab 0.58625 Higher 0.55360	Future 0.78166 External 0.68579 Prestige 0.63878 R&DSpill 0.58940 TeachSpill 0.62823	GradEmploy 0.75568 StudEmploy 0.68734 StudRecruit 0.58005	Legal 0.70946 Patent 0.61459	AcadResource 0.76966 RevSub 0.54930
SECOND SET R&DLoss 0.49233 StaffLoss 0.47219 Secret 0.44453	EquipGain 0.48438 TotRevenue 0.47371 StaffJobs 0.44611	Service 0.38176	ProdLiab 0.4182 R&DSpill 0.40538	EquipGain -0.35257
<sup>1.</sup> 1. Abbreviations are described in Appendix C.				
<sup>2.</sup> 2. Costs = General University Cost Factor, Benefits = General University Benefit Factor, Employment = Employability Factor, Legal = Legalistic Factor, Resource = General Positive Resources Factor				

Eigenvalues for the first two factors are markedly higher than for the last two values. These two factors take up a substantial share of the overall variance, suggesting their prime importance to the overall analysis. Factor One explains 31 per cent of the variation in the factor analysis. Table 4.4 (in comparison to Table 4.3) indicates that while there are inter-institutional differences within the specific

---

ticular case, the Cost Factor's Eigenvalue of 4.11 must be looked at in the context of the total of all Eigenvalues of 13.17.

items making up the Factors, there are high levels of agreement on the specific items included in the factor analysis factors. Costs seem to take priority in the arrangement of the factors. Factors One, Three and Five are effectively cost factors, Factors Two and Three are effectively benefit factors.

**TABLE 4.4**  
**INTER-UNIVERSITY COMPARISONS FIVE FACTOR ANALYSIS<sup>2,3</sup>**

UNIVERSITY -	FACTOR ONE (F1) COSTS	FACTOR TWO (F2) BENEFITS	FACTOR THREE (F3) EMPLOY	FACTOR FOUR (F4) LEGAL	FACTOR FIVE (F5) RESOURCES
A and B	-	-	-	0.0001 A	-
B and C	0.0001 C	0.0001 C	-	0.0001 C	0.0180 C
C and A	0.0001 C	0.0086 C	-	-	-
D and A	0.0001 D	0.0011 D	0.0292 D	-	0.0178 A
D and B	0.0001 D	0.0001 D	0.0130 D	0.0001 D	0.0004 D
D and C	NA	NA	NA	NA	NA
A and E	0.0001 E	(0.0629)E	-	0.0001 E	-
B and E	0.0001 E	0.0002 E	-	0.0001 E	-
C and E	NA	NA	NA	NA	NA
D and E	-	0.0128 D	0.0078 D	-	0.0037 E

<sup>2</sup>. Bracketed P values are not significant.

<sup>3</sup>. For data exploration purposes, a "mock" or "dummy" university, Sub-University D, is created from the Curtin data (Engineering and Science respondents) and included in the analysis. Sub-University D\* is of interest for comparison with the Leslie study. Another "dummy" Sub-University E\* is created for exploratory purposes from the residual of Curtin after the exclusion of Sub-University D respondents.

Sub-Universities D and E are referred to in the text as University D or E, units D or E, or Engineering and Science respondents and Residual Curtin respondents.

The letters in each cell after the factor weighting signify the direction of the higher mean scores by referring to the University obtaining the score (e.g., C = University C, A = University A, E = Sub-University E, and D = Sub-University D).

NA = Not available (not calculated).

Table 4.3 presents the Leslie taxonomy cost and benefit items, arranged by factor with their factor weightings. The contributing items are arbitrarily split into two sections: the first section for variance weightings above 0.5, and the second section for items with a range of 0.3 to 0.5 variance weightings. Of analytical interest in this table, are the actual factors identified, their relative order of importance, the mix of items attributed to each factor and the variance weighting.

The five Factors from the factor analysis are the base for a subsequent comparative analysis with the three universities as independent variables. Table 4.4 shows the significance level of the probability (p) for the "F ratio" value of the difference of the factor means among the universities. The analysis tabulated in Table 4.4 contributes to the case for identifying Curtin as a frontier institution in entrepreneurial activities.

### **3.1 GENERAL UNIVERSITY COSTS FACTOR**

Factor One can be described as the General University Cost Factor. The words "General University" are added to distinguish this factor from the list of costs in the taxonomy of costs and benefits (and similarly "General University" are added to the Benefits Factor).

The emergence of a General Universities Cost Factor as the first and highest weighted factor suggests that the highest level of agreement (correlation of responses) among respondents is to the primacy of the Costs Factor. Factor One brings together respondent's perceptions of total non-monetary costs; loss of teaching and teaching preparation time; the total academic resources consumed; monetary losses; wear and tear on equipment; product, advice and service liability; and the time of higher support personnel--all of which are items above the 0.5 factor weight (also, excepting monetary loss they are all at the top of the

item rank order in Table 4.2). Three other cost items, loss of time for basic research and development, loss of academic staff, secrecy, and confidentiality contribute to this factor at a lower level (0.4 to 0.5).

Respondents at Universities A and B (lower values) are significantly different from Curtin University (C, D, and E) (higher values) in the perception of the General University Costs of entrepreneurial activity. University A is not significantly different from University B on this factor. Curtin respondents as a whole perceive the "cost" of entrepreneurship to be greater than do respondents at Universities A and B. No significant differences are found between the separate groups of respondents at Curtin. On the basis of the above and on further analysis cited in this chapter, Curtin University respondents (C) generally have higher responses to cost items than do the other two university's respondents (but not for overall costs and total costs). University A's overall response on the matter of the monetary to non-monetary cost relationship is 50 per cent compared with Curtin's 46 per cent (that is, *monetary costs* levels are double *non-monetary cost* levels, etc.)

### **3.2 GENERAL UNIVERSITY BENEFITS FACTOR**

Factor Two, the General University Benefits Factor, groups the responses (above 0.5) of future consulting opportunities, external relations, prestige, spillover into research and teaching, and to a lesser extent (0.4 to 0.5) equipment gains, revenue importance and academic staff recruitment. The presence of items such as prestige, external relations, and spillovers to teaching and research, highlights the claims of academics that they are "prestige maximizers" rather than "profit maximizers". The most highly valued benefit of entrepreneurial activity for all respondents is prestige not revenue.



In the perception of the General University Benefits Factors, respondents at Curtin University (C, D, and E) are more sensitive to benefits, rating them higher than do respondents at University B. Similarly, for benefits at Curtin University (C, D, and E) and University A, except that in the case of the higher valuations of the Residual Curtin (E) respondents, University A respondents are only close to a statistically significant difference. Respondents at Universities A and B do not show a significant difference (between themselves) on the Benefits Factor. In general for Factor Two, the Benefits Factor, Curtin respondents are significantly different from Universities A and B respondents, and in this case (benefits) there is a significant difference (higher values) within Curtin University between Engineering and Science disciplines (D) and the Curtin Residual (E). Not only do Curtin respondents perceive the Costs Factor as higher, they also see the Benefits Factor of entrepreneurial activity as higher than do respondents from the other two universities. It is suggested that the overall impact of entrepreneurial activity costs and benefits are presented by respondents as being greater (more extreme) at Curtin University than at Universities A and B.

### **3.3 EMPLOYABILITY FACTOR**

Factor Three, the Employability Factor, combines graduate and student employment opportunities and student recruitment (all above 0.5). The items in this factor, all benefit items, are a sub-grouping of benefits focusing on jobs, work, and employment. At a lower level (0.38), the services of project staff are also included in this factor.<sup>8</sup> One of the desired outcomes for entrepreneurial activity, as

---

<sup>8</sup>. Loss of time for basic research (0.38) may play a part in this factor. Loss of time for basic research is arguably less like the other three items in the factor, but still relates to work activities.

underscored by this Employability Factor, seems to be a university education leading to productive work.

On the Employability Factor, significant differences are observed among Curtin's Engineering and Science respondents (D) (higher mean), Universities A, B, and the Curtin Residual (E). This Factor has been labeled as Employability to distinguish it from the staff and student employment items, and to broaden the employment concept to include the services of project personnel and clients.

### **3.4 LEGALISTIC FACTOR**

Factor Four, the Legalistic Factor, includes strong contributions from legal and patent costs (above 0.5) and a lesser contribution from product liability and spillover into research (0.4 to 0.5). Respondents from Universities A and C and units D and E (higher means) are significantly different in their perceptions of the Legalistic Factor's values from University B (lower values). The Curtin Residual respondents (E) are significantly higher in their perceptions of the Legalistic Factor compared with University A respondents. Considering that the values given by respondents to the individual items in this factor are numerically very low, finding these items constituting a major factor was not anticipated. All the items in this factor have a logical affinity.

The term Legalistic is used to invoke a broad coverage of the formal, bureaucratic, legal, regulatory, approval, patenting, and permission-requiring process of dealing with entrepreneurial activities in society and in universities.<sup>9</sup> This factor can be described as the "necessary evil" factor in entrepreneurial activity; it affects few

---

<sup>9</sup>. A recent article by David Stockley (1993) deals with the issue of the bureaucratic-legal aspects of intellectual property in Australia and the trend towards formalization, contrary to Australian academic tradition.

respondents directly but its item components are ultimately a security requirement.

### **3.5 GENERAL POSITIVE RESOURCES FACTORS**

Some academics may take satisfaction from the fact that the Resource Factor is the lowest weighted (Eigenvalue) factor. For most respondents, entrepreneurial activity really does appear to emphasize other altruistic matters over the simple pursuit of resources. Factor Five places total non-monetary benefits, revenue importance (0.5) and equipment gains (0.35) in a factor labeled by the researcher as a General Positive Resources Factor.

University C and Engineering and Science respondents (D) hold significantly higher perceptions from University B respondents on this General Positive Resource Factor. Similarly, Universities A and the Curtin Residual respondents (E) indicate significantly higher valuations than Engineering and Science respondents (D) (but not more than for University B). This result is unlikely to have been anticipated; still, the Curtin Residual respondents (E) have a higher perception of resources than Engineering and Science respondents (D). Not only are resources a less prominent factor overall, they are also not as big an issue for Engineering and Science (D) as for the Curtin Residual (E). From this analysis, Curtin's Engineering and Science units do not appear to have as high a perception of resource needs as respondents in other academic areas at Curtin. Engineering and science disciplines are the most successful area (financial, prestige, activities) at Curtin in entrepreneurial enterprise; nevertheless, they may not be as dependent on entrepreneurial activities as other discipline areas.

In summary, Curtin University respondents (C) and the Residual of Curtin respondents (E) each differ significantly from Universities A and B respondents on six of ten potential comparisons. Curtin's Engineering and Science respondents (D) also differ significantly on seven of the ten possible comparisons although in one case University A, a traditional university, has the highest response levels. Engineering and Science respondents' (D) have higher valuations on 3 of the 5 factors.

On the other hand, across all the key factors, Engineering and Science (D) respondents are not significantly different from respondents in Universities A and B. University A respondents (the traditional university) attach higher valuations than do University B respondents (the commercial university) on only one of the six potential opportunities (the Legal Factor). The Residual Curtin group (E) is significantly different from Universities A and B respondents on five (almost significant on a sixth factor) of the potential ten factor comparisons. There are enough differences on a number of factors to indicate that, in general, University A and B respondents have lower perceptions of the costs and benefit items than do respondents at Curtin. Thus, it is suggested that Curtin University respondents have a higher entrepreneurial ethos in comparison to respondents at Universities A and B although the Leslie respondents were not strictly comparable to those at Curtin.

Given the relative lack of differences between University A and B and the substantial range of response differences among respondents in Curtin University, University A, University B, and Curtin's Engineering and Science respondents (D), further analyses of the Curtin data are merited in order to identify what may constitute Curtin's entrepreneurial uniqueness.

### 3.6 INTER-UNIVERSITY BY SPECIFIC COST AND BENEFIT

A comparison of responses to individual cost and benefit items (e.g., prestige, loss of staff) is made across all universities (A, B, C, and unit D). Table 4.5 lists only those factors with significant differences ( $p < 0.05$ ) in an inter-university comparison. Respondents at University C and Engineering and Science respondents (D) show significantly higher factor valuations than respondents from Universities A and B. Universities A and B only differ on the Legal Factor, where University A has the higher valuation.

<b>TABLE 4.5</b> <b>INTER-UNIVERSITY COST AND BENEFIT ITEMS</b> <b>DIFFERENCES BY UNIVERSITY<sup>1</sup></b>					
UNIVERSITIES A, B, C, D,  COST OR BENEFIT	A VERSUS B	B VERSUS C	A VERSUS C	A VERSUS D	B VERSUS D
<b>BENEFITS</b>	A	C	C	D	D
Staff recruitment	A	C	C	D	D
Equipment gains	A	C	-	-	D
Prestige	-	-	C	D	-
Future	-	C	C	D	D
Service	A	C	-	-	D
<b>COSTS</b>	A	-	A	-	-
Legal	A	-	A	-	-
Loss of staff	-	C	C	-	D
Equipment wear and Tear	-	C	C	-	-
Total resources Consumed	-	C	C	-	-
Product liability	-	C	C		D
Money Loss	-	C	C	D	D
Total costs	-	C	C	D	D
<sup>1</sup> . Each data cell shows an alphabetical letter indicating the university with the higher response mean. All cells with letters have a $P < 0.05$ .					

More areas of significant valuation differences exist for the set costs (8) than for the set benefits (5). Universities A and B respondents significantly differ in one area of costs (Legal) and in three areas of benefits. The contribution of the Engineering and Science respondents at Curtin (D) to the overall University (C) individual respondent cost and benefit difference is not directly assessed.

However, there is an overlap of significantly different responses for the two groups of respondents (Curtin and Universities A and B) in 13 cases out of a potential 19 cases (the main exceptions are equipment wear and tear and total resources consumed, items ranked lower in priority by Engineering and Science respondents compared to the other Curtin disciplines). The valuation differences for Engineering and Science respondents (D) versus Universities A and B seem to duplicate the Curtin University (C) pattern at an even higher level of difference.

#### **4 INTRA-UNIVERSITY ANALYSIS**

A separate factor analysis was undertaken for the data from Curtin respondents (see Table 4.6). Given the heavy weighting of Curtin respondents ( $N = 112$ ) in the inter-university analysis ( $112 + 33 + 29 = 174$ ), similar results in the Curtin data analysis are not surprising.

Curtin's five hypothetical factors are the same as those listed in Table 4.3 for the Inter-University data ( $F1 = \text{Costs}$ ,  $F2 = \text{Benefits}$ ,  $F3 = \text{Employment}$ ,  $F4 = \text{Legal}$ ,  $F5 = \text{Resources}$ ). The order and priority of the components within each factor are only slightly different, as are the factor variance contributions. The Eigenvalues for the factors are,  $F1 = 3.69$ ,  $F2 = 3.30$ ,  $F3 = 2.52$ ,  $F4 = 1.94$ ,  $F5 = 1.85$ . These values are close to the Eigenvalues (see just above Table 4.1) for the inter-university data. The proportion of variance contributed by each factor does not change very much between the combined university factor

analysis and the Curtin factor analysis. Nevertheless the Eigenvalues for Curtin data vary less than those for the combined data. This suggests greater similarity in importance of the factors, at Curtin.

TABLE 4.6				
CURTIN UNIVERSITY: FIVE FACTOR ANALYSIS <sup>1,2.</sup>				
FACTOR ONE (F1) COSTS	FACTOR TWO (F2) BENEFITS	FACTOR THREE (F3) EMPLOYMENT	FACTOR FOUR (F4) LEGAL	FACTOR FIVE (F5) RESOURCES
FIRST SET TeachLoss 0.75469 Total Cost 0.74836 SocCost 0.64157 EquipWear 0.59903 TotResource 0.57771 LossR&D 0.54451 Higher 0.51884	Future 0.77533 Prestige 0.65912 TeachSpill 0.63559 External 0.62728 EquipGain 0.61295 Revenue 0.60854 R&DSpill 0.58470	GradEmploy 0.79144 StudEmploy 0.75665 Services 0.53561	Legal 0.66171 Patent 0.56022 StaffLoss 0.52976	RevenueSub 0.70277
SECOND SET ProdLiab 0.47511 MoneyLoss 0.40372		StudRecruit 0.41868	R&DSpill 0.40962	TotResource 0.48419
<sup>1.</sup> Abbreviation descriptions are in Appendix C.				
<sup>2.</sup> 2. Costs = General University Cost Factor, Benefits = General University Benefit Factor, Employment = Employability Factor, Legal = Legalistic Factor, Resource = General Positive resources factor.				

In comparison with the inter-institutional data for Factor One (F1), the Curtin Factor includes the personal social cost (SocCost) item, which is high on the list of items contributing to the Cost Factor. For Curtin, product liability is demoted in importance, and loss of basic research time is promoted in importance in comparison with the

inter-university data. Monetary loss appears on the Curtin list but not on the inter-university list. Monetary loss is valued higher in the item priority list for Curtin than for the other universities. The reverse is true for secrecy and confidentiality.

For Factor Two, the Curtin analysis includes the item spillover into teaching (TeachSpill), and assigns a higher weight to equipment gains (EquipGain) and revenue importance (Revenue). For Factors Three and Four, apart from the inclusion of staff loss in the Curtin Legalistic Factor (F4), the patterns are similar for the combined data and the Curtin data. In Factor Five (F5) only a few items are involved and all items are of a resource nature.

TABLE 4.7 CURTIN UNIVERSITY: FIVE FACTOR ANALYSIS <sup>1</sup> BY INDEPENDENT VARIABLES					
FACTOR OR VARIABLE	FACTOR ONE (F1) COSTS	FACTOR TWO (F2) BENEFITS	FACTOR THREE (F3) EMPLOYMENT	FACTOR FOUR (F4) LEGAL	FACTOR FIVE (F5) RESOURCES
GENDER	F0.0094				
ACADEMIC DISCIPLINE GROUPS					
HS - Eng	H0.0130	E0.0134			
Eng - AESS	A close				E0.0145
Eng - BS		E0.0003	E0.0159		
AESS - BS		E0.0087			B0.0457
ACADEMIC STATUS GROUPS					
Snr - Prof			S0.0182	S0.0188	
Snr - A/P			S0.0415	S0.0078	
Snr - SL			S0.0363		
Snr - L			S0.0464	S0.0537	
Prof - L	L0.0007				
A/P - L	L0.0046				
SL - L	L0.0119				
ENTREPRENEURIAL AND NON-ENTREPRENEURIAL					
<sup>1</sup> Abbreviation descriptions are in Appendix C.					



Revenue Substitution is paramount in the Curtin Factor Five (F5). It appears that as a university becomes more entrepreneurial, academic concern with revenue substitution may increase, even with the threat of revenue substitution.

For the first four factors there is a greater dispersal of items in the combined universities data than in the Curtin University data. Nevertheless, a similar pattern of costs and benefits items exist for the Curtin respondents and the combined university respondents.

Table 4.7 shows the significant differences in valuations ( $p < 0.05$ ) among the five factors at Curtin, according to the listed independent variables. The independent variables are gender (2 cases in the variable), academic discipline area (6 cases), academic status (10 cases), and entrepreneurship (2 cases). On reflection, there are good reasons for dividing respondents into the categories of ongoing Institute of Technology respondents and respondents appointed after Curtin had been designated a university.

#### **4.1 GENDER VARIABLE**

Female respondents at Curtin ( $n = 22$ ) perceive cost factors as significantly higher than do male respondents ( $n = 90$ ). This may imply that the female respondents at Curtin perceive there to be higher costs associated with entrepreneurial exchange than do their male colleagues. This could be explained by high levels of male involvement in entrepreneurial activity.

#### **4.2 ACADEMIC DISCIPLINE VARIABLE**

Respondents in the health sciences differ significantly (respectively  $p = 0.0130$  and  $0.0134$ ) from respondents in Engineering and

Science on the General University Cost Factor (F1) (higher mean) and on the General University Benefits Factor (F2) (lower mean). Respondents in health sciences view entrepreneurial activities as having lower benefits and higher costs than do their colleagues in engineering and science (significantly) and other discipline areas. If there is a lower pay-off for entrepreneurial activity in the health sciences, this may explain health science respondents having a lower level of enthusiasm for entrepreneurial activities.

Similarly, respondents in Engineering and Science disciplines differ significantly (higher means) from business studies respondents on the factors of General University Benefits (F2,  $p = 0.0003$ ) and Employability (F3,  $p = 0.0159$ ), and from AESS respondents on the Resource Factor (F5,  $p = 0.0145$ ). Compared with engineering and science respondents, business studies respondents' perceive lower values in both the Benefits Factor and the Employability Factor. AESS and business studies respondents also differ on General University Benefits (F4,  $p = 0.0087$ , business studies--higher mean) and Resource Factors (F5,  $p = 0.0457$ , business studies--lower mean). AESS respondents' perceive that the resources born of entrepreneurialism are substantially greater than do business studies respondents. AESS respondents are the recipients of the lowest level of entrepreneurial income at Curtin University; possibly they desire (envy) the entrepreneurial financial success of business studies and engineering and science.

Five of the eight significant differences identified above are between Engineering and Science, and other disciplines. They involve four of the five factors. Business studies respondents account for four of the eight significant differences on the factors. Generally, engineering and science and business studies respondents are at the opposite ends of the value scale spectrum (high-low), with Engineering and

Science frequently more favorably inclined towards entrepreneurial costs (lower) and benefits (higher) and business studies less favorably inclined.

#### **4.3 ACADEMIC STATUS VARIABLE**

Five academic status groups are considered in this study: university administrators, professors, associate professors, senior lecturers, and junior staff. University administrators and junior staff account for most of the significant differences among all the academic status group respondents, across all factors. The university administrators group places greater emphasis on the Employability Factor when compared with all other academic staff groups ( $p < 0.05$ ), and on Legalistic Factors when compared with professors and associate professors ( $p < 0.02$ ). Junior staff also differ from other academic groups on the Legalistic Factor, albeit not at a significant level. Junior staff are significantly different in their perceptions (higher means) from professors, associate professors and senior lecturers on the issue of General University Costs ( $F1$ ,  $p < 0.02$ ). Junior staff may not be as well informed on the financial operations of university entrepreneurial activity, or alternatively, may experience the cost impact more acutely

#### **4.4 ENTREPRENEURIAL VARIABLE**

No significant differences have been observed across the five factors on the entrepreneurial and non-entrepreneurial variable. It is a matter of some consequence that respondents who could be regarded as non-entrepreneurial see the whole range of non-monetary benefits and costs in a similar light as their entrepreneurial colleagues.

## 5 COMPONENT ANALYSIS

### 5.1 REVENUE IMPORTANCE

Mean =7.1, STD =1.9, Range = 2-10; (Leslie, Universities A/B/A+B, N =29/33/62, Mean =7.1/6.8/7.0, STD=3.0/2.2/2.6).

In an endeavor to provide respondents with a point of reference for responses to subsequent questions, the importance of the revenue earned was valued early in the survey by all respondents. The average valuation for this item were 7.1, with a distribution skewed to the left; fifty per cent of responses was at 7 or 8, and a median response of 7. This result suggests that the revenue generating aspects of entrepreneurial activity are considered to be important by respondents. Respondents' overall value for revenue importance is of the highest magnitude of all survey item.

In Leslie's study the average respondent values for entrepreneurial activity revenue importance at University A (traditional, broadly based university), and University B (modest, more commercial university) are respectively 7.1 and 6.9. Interviewees in the Leslie study are predominantly from academic disciplines in engineering and science and are heavily involved in entrepreneurial activity. Curtin respondents from the area of engineering and science (N =35) provided an average valuation for revenue importance of 7.9. The value of revenue importance for health sciences respondents is 6.8; for arts, education and social sciences 6.5; and for business studies 6.9. Entrepreneurial revenue generation is clearly important for respondents at the three universities.

At Curtin, revenue generation is important even for business studies and health science respondents who in their responses to individual benefit items tend to perceive benefits and costs less favorably

than do respondents in engineering and science. Although providing lower benefit to these discipline areas, entrepreneurial activity is still worthwhile because even at a lower level of benefit it is seen as "important" for the continuation of academic operations.

The question is then asked, does this perception of "importance" serve as a bench mark for respondents' responses to other questions (as is desired), or is the question of revenue importance regarded by respondents as a separate issue? It appears that respondents hold the former view in the benefits area, where revenue importance correlates highly with 10 of the 12 benefit items. However, there are no significant correlations for cost items.

For the purposes of determining the linkages (if any) between the monetary benefits to an academic unit's operation and the importance of the revenue from entrepreneurial activities to the related academic unit, additional information would have been required on the actual level of funding achieved by each academic unit. It is observed that respondents who rate the importance of revenue high also tend to value benefits items highly,<sup>10</sup> as compared with respondents who value revenue importance low and who also tend to value benefit items low. No significant differences are found for higher revenue importance valuers on cost items in comparison with respondents who rated the importance of entrepreneurial revenue low. In terms of benefits, nine of the set benefit items and one additional benefit item demonstrated significantly higher value for higher revenue importance valuers compared to low revenue importance valuers.

---

<sup>10</sup>. In one specific case for a new taxonomy item (i.e., the *traditional university role*), a significant difference was indicated; however, with a total 'n' of only 10, the item has not been advanced for consideration.

If it is true that revenue is important to academic operations and is valued highly, then one might expect that respondents' perceptions of other benefits would be valued highly and related costs would be valued low. The perception of costs as a function of revenue valuation appears (for both high and low revenue importance valuers) extremely similar for high and low revenue valuers, whereas perception of benefits are markedly different. There are strong respondent differences ( $p < 0.05$ ) for benefits on external relations, staff and student recruitment, equipment gains, prestige, future consulting opportunities, service contribution, and spillover to teaching and research (morale is the additional benefit item,  $n = 20$ ). In the area of costs, the higher revenue importance valuers assessed cost items less than did (not significant but consistent) the lower revenue group for the items, product liability, monetary loss, loss of teaching time and social costs. Higher valuers do not perceive these specific cost items as having as high a cost, as do the low revenue valuers.

## **6 MONETARY AND NON-MONETARY RELATIONSHIPS**

### **6.1 UNIVERSITY INCOME**

The total Curtin University income for teaching, research and public service for 1991 is A\$173 million<sup>11</sup> as shown in Table 4.8 (not fully adjusted)<sup>12</sup>. Of this the government provided an amount of \$10.7 million for capital development. A further \$0.5 million was allocated

<sup>11</sup>. In 1993 the comparable income is A\$191 million and is expected to be over A\$200 million in 1994. Note the tapering off of in the level of government grant money. A financial plateau of A\$125-\$130 million may be anticipated for Curtin government grants over the remainder of the decade.

<sup>12</sup>. Three years of income are shown to illustrate the tapering off of government-provided recurrent funds in relation to the total institutional budget.

to capital projects from the university's recurrent budget. The total government (federal and state) recurrent grant is \$105.217 million (fully adjusted as described in Chapter Three).

Taking into account the above adjustments, the total (1991) earned income from all Curtin entrepreneurial activities is estimated at \$57.5 million (35.3 per cent of total revenue). The modified government recurrent grant of \$105.2 million represents 64.7 per cent of total revenue. Approximately \$47 million or 28 per cent of the 1991 \$173 million income is allocated for expenditure on administration, general overheads and academic support areas. Of the \$47 million, \$40 million is from state and federal funds, the remaining \$7 million is money earned by staff on behalf of the university.

<b>TABLE 4.8</b> <b>CURTIN UNIVERSITY</b> <b>TOTAL TEACHING, RESEARCH AND PUBLIC SERVICE INCOME</b> <b>FOR RECURRENT AND CAPITAL DEVELOPMENT</b> <b>(\$1,000S)</b>			
<b>CATEGORY</b>	<b>'1991</b>	<b>'1992</b>	<b>'1993</b>
FEDERAL GRANT	117,565	122,700	123,556
STATE GRANT	6,289	7,324	5,736
DONATIONS & BEQUESTS	2,220	1,967	8,306
FEES & CHARGES	4,349	4,601	4,906
INVESTMENTS	6,879	4,644	3,223
TRADING INCOME	16,554	16,058	15,011
OTHER INCOME	6,902	7,520	9,046
FULL FEE INCOME	12,655	17,227	21,656
<b>TOTAL INCOME</b>	<b>173,415</b>	<b>182,042</b>	<b>191,444</b>

### **6.3 EARNED ENTREPRENEURIAL INCOME**

After determining total university earned income, the income is re-attributed to the main teaching areas (the four teaching divisions)

earning the income in a manner that is not as shown on the budget. (The university budget apportions earned money to areas supporting academic units, as well as to the academic units earning the income.)

In the university's Special Funds Accounts<sup>13</sup>, earned income is shown as \$42.7 million in 1991, rising to \$51.6 million in 1993. There is a discrepancy, for the purposes of this study, of \$14.8 million between the special fund's figure of \$42.7 million in 1991 and the estimated earned income of \$56 million. Some of this financial discrepancy can be accounted for by earned income being attributed to the Western Australian School of Mines (WASM), the Western Australian Federated School of Mines (Collie) and the Muresk Institute of Agriculture (Muresk), and to non-teaching areas, such as the university administration, vice-chancellory, university overheads, and university research infrastructure. Where appropriate (see Table 4.9), a large part of this earned money has been re-attributed to the teaching areas earning the money or to the teaching areas that could be deemed to be the caretakers of the resources earned. In total, some A\$10 million is re-apportioned as shown in column three of Table 4.9.

Table 4.9, column three, figures are an estimate of the earned monetary resources that the major academic areas brought to the Curtin University in 1991: They are not the figures shown as earned income in the university accounts. An amount of \$4.5 million (although known to exist) has not been re-attributed to the teaching areas either because it does not belong there or because there are difficulties in determining the appropriate re-location of the resources. Not all the A\$4.5

---

<sup>13</sup>. Special Funds Accounts are the financial bookkeeping accounts at Curtin into which all entrepreneurial earned income is eventually placed (and stored after deductions) and against which expenditures and transfers must be reconciled. They are controlled by the academics doing the work to earn the funds. Essentially, they cover almost all earned income available to the university including earned income provided by the government.



million can be legitimately attributed to teaching areas (e.g., research funds obtained by academic support areas). Where the known figure of \$43 million in special funds is referred to in this document, it should be noted that this may be an underestimate of the level of special funds of up to 20 per cent. For comparison with the Leslie financial data, Curtin University attributed between \$43 million and A\$53 million as earned revenue. The Curtin financial data in the amount of \$53 million may have been adjusted beyond the level of financial detail available to the Leslie study.

<b>TABLE 4.9</b> <b>CURTIN UNIVERSITY</b> <b>ESTIMATED 1991 EARNED INCOME BY MAJOR ACADEMIC DIVISION</b> <b>(A\$000's)</b>		
MAJOR ACADEMIC AREA <sup>1</sup>	INCOME SHOWN IN BUDGET	ADJUSTED TEACHING DIVISION EARNED INCOME
ENGINEERING AND SCIENCE	12,100	15,800
HEALTH SCIENCES	9,200	11,400
BUSINESS STUDIES	13,000	14,800
ARTS, EDUCATION, AND SOCIAL SCIENCES	9,700	11,100
TOTAL	43,000	53,100
<sup>1</sup> . An explanation of major academic area names is provided in Chapter Three.		

In Leslie's study (Leslie and Harrold, 1993, p.99-100) commercial activities at University A are stated as amounting to A\$16.3 million in 1989. However, A\$6.8 million of this amount is generated by one special project center at the university. This special project center revenue is considered to have only a marginal relationship to the university's mission, thus, the working figure adopted by Leslie for University A is A\$9.5 million (six per cent of total institutional revenue). At University B, the 1990 revenue from commercialization activities is

identified as A\$12.3 million (or 12 per cent of total revenue). It should be noted that these amounts of money are for the commercialization of science (COS) and are not the entrepreneurial revenue for all academic disciplines or all entrepreneurial activities, and exclude income from overseas fee-paying students.

Leslie places the total university commercialization revenue at 18 per cent and 19 per cent of total university income, respectively, for Universities A and B. Hence, the university revenue element that constitutes non-commercialization of science activities represents more than one third of the earned revenue, or six to twelve per cent of total university revenue. A comparable commercialization of science (COS) figure for Curtin University is not fully determined in this research since the emphasis is on entrepreneurial activity not on the commercialization of science. An approximation of the equivalent commercialization of science funds for Curtin is the earned income for the engineering and science disciplines estimated at A\$12 to A\$15.8 million, less A\$2 million in fee-paying student income, to total A\$10 to A\$13.8 millions (6.1 to 8.4 per cent of total university revenue). This is not an insignificant effort for an institution only recognized as a university in 1987, and an institution that at the time of the Leslie study did not have full access to key government research funding at the same level as the institutions in his study.

Curtin's engineering and science and business studies are disciplines with high levels of entrepreneurial revenue (\$12-15 million). They are 25 to 35 per cent higher in total annual income level than AESS and health sciences (\$9-11 million). The relatively high level of earned income for business studies and AESS disciplines is due to the high level of revenue from overseas fee-paying students. If these

discipline areas were to exclude this income then their earnings would drop to less than one third of the present amount.

On a departmental basis, Leslie determines that earned income averaged 22 per cent to 50 per cent of total revenue (excluding some centers 100 per cent entrepreneurialy funded). Comparable figures for Curtin's engineering and science disciplines are 35 per cent to 44.5 per cent, and just over 50 per cent for all entrepreneurial income.

Curtin University is very successful in attracting overseas fee-paying students (2,500 + in 1994) compared with Universities A and B (who also have performed well), In addition since 1991 Curtin has achieved participation in five Cooperative Research Centers (CRCs), and has made other substantial entrepreneurial advances; hence, the earlier suggestion that Curtin is a frontier entrepreneurial university is not necessarily diminished by the similarities indicated in the 1991, COS financial comparisons with Leslie's study.

Four finance-related university management-administration matters are clear from the present research effort:

- 1) There is a need to establish clearly how much money entrepreneurial activities undertaken by Curtin University as a whole brought into the university, by major teaching area (teaching divisions) and other lower level administrative units (e.g., departments).
- 2) Some moneys earned through entrepreneurial efforts are difficult to re-allocate to the teaching division that own the resources being invested. For example, entrepreneurial activities, such as the investing of surplus funds in the short term money market, the earnings of university companies, and other activities carried out collectively by the administration on behalf of all areas of the university are in need of accounting clarification if entrepreneurial cost-benefit centers are to be attributed accurately.
- 3) Accounting standards or conventions should be established for account processing, such as how to maintain university special funds accounts and surplus funds accounts; whether to pass all earned funds through the earners' account first; how to make administration cost deductions before crediting accounts; how to calculate legitimate surpluses and losses in university entrepreneurial activities.

- 4) A reconciliation process for special funds accounts should be established. Despite having specified accounts for special funds, the amounts in these accounts do not balance with the earned income reported for the university as a whole in the university's budget papers.

If a university is entrepreneurial, the success or failure of the enterprise needs to be made clear to the people responsible for the entrepreneurial drive. Not knowing exactly how much, in financial terms, is contributed by an academic unit to the university's mission or how much the entrepreneurial activities of an academic unit cost, may lead to suspicion, misunderstanding, grievance and ultimately to lower efforts in entrepreneurial activities (or worse still, the shifting of some of those activities outside the university to the private domain).

#### 6.4 NON-MONETARY COSTS AND BENEFITS

BENEFITS: Mean =162.6, STD =96.4, Range = 25-500; (Leslie 1992, 1993; Universities A/B/A+B, N =25/33/58, Mean =166.0/196.4/183.3, STD =75.47/137.8/116.1). COSTS: Mean =46.7, STD =18.3, Range = 10-90; (Leslie 1992, 1993; Universities A/B/A+B, N =26/32/58, Mean =27.0/50.0/40, STD =19/88/67).

Curtin respondents' value non-monetary benefits against monetary benefits at a ratio of 1.62:1. A similar figure for non-monetary cost against monetary costs is the ratio of 0.46:1. The overall benefit-cost ratio is 3.5:1. The difference between respondents non-monetary benefits and non-monetary costs in percentage terms is 115.9 per cent. Respondents thus indicate that non-monetary income from entrepreneurial activities (designated in dollar terms) is substantially higher (by 62%) than the earned monetary income. Similarly, the comparable non-monetary cost of earning the above income (designated in dollar terms) are substantially lower than monetary costs (at 46.7%).

The respondents in Leslie's study valued non-monetary benefits at a ratio of 1.66:1 (University A) and 1.98:1 (University B): The non-

monetary benefits-costs are at the ratios of 3.7:1 and 2.9:1 respectively. Although the ratios are relatively similar, in terms of the perceived overall net non-monetary benefits (in dollar terms) the most "profitable" universities are University A, Curtin University and then University B. The more traditional a university is, the better it may manage its entrepreneurial benefits (be they large or small in quantity). Administrators in traditional universities may not have to work as hard to maximize entrepreneurial benefits as do administrators in universities still finding their niche in the university world. It may be more costly to find an effective niche than to carry on university management in the traditional university setting.

## **6.5 ADDITIONAL COST AND BENEFIT CATEGORIES**

After valuing the set of non-monetary benefit and cost items, the respondents expanded on the range of benefit and cost items, adding new items that they consider may play a role in entrepreneurial activity.

An additional 190 responses (114 benefit and 76 cost items) are identified by respondents. These items are listed in Table 4.10 for benefit items, and Table 4.11 for cost items. They are listed under a number of somewhat arbitrary categories (e.g., networking, image).

Some of the responses provided in the open ended cost-benefit questions overlap with the item categories shown in Tables 4.1 and 4.2 (the Leslie taxonomy). Nevertheless the responses are reported here because they are specifically added to the list of cost-benefit items by respondents. Only a more exhaustive testing of the perceptions of non-monetary costs and benefits may have unraveled the total number of items and the relative importance of those items against each other. Cost-benefit item importance may change with the level of commercialization a

university has attained and with the discipline areas that are represented.

**TABLE 4.10**  
**CURTIN UNIVERSITY**  
**BENEFIT CATEGORIES: FOR THE ADDITIONAL BENEFITS ITEMS**  
**SUGGESTED BY RESPONDENTS**

No	CATEGORY	DESCRIPTORS
'1	NETWORKING	extending activities, enhancing, links with companies, collaborations, broadening horizons, national and international links, friendships, social relationships, internationalization, community feedback, access, seed ideas, directions, open fields, school outreach, conference attendance facilitation,
'2	IMAGE	credibility, influence, reputation, focus activity vitality, recognition, puts us on the map, appropriate role play, stand tall,
'3	ACADEMIC AND PROFESSIONAL DEVELOPMENT	redefining roles, making good choices, access to information, discipline, being up- to- date, strengthening, staff advancement, knowledge, knowledge transfer, course development, positive change, teaching mechanism, inter-disciplinary development,
'4	MORALE AND MOTIVATION	vitality, enthusiasm, breaking the monotony, ethics, esteem, satisfaction, job satisfaction, happiness, self esteem, staff retention,
'5	PUBLIC RELATIONS	goodwill, public relations, community taking notice, attracting people to the university, involvement, feedback, recruitment in general, service to the people, community profile,
'6	OTHER ECONOMIC FACTORS	competition, personal gains (financial), repaying fund providers, general grinding down of resources, national needs, more resources, non-profit making, more money,
'7	OTHER SOCIAL FACTORS	time factors, security and safety, social change, juggling time (better), managing people and resources (better),

<b>TABLE 4.11</b> <b>CURTIN UNIVERSITY</b> <b>COST CATEGORIES: FOR THE ADDITIONAL COST ITEMS</b> <b>SUGGESTED BY RESPONDENTS</b>		
<b>No.</b>	<b>CATEGORY</b>	<b>DESCRIPTORS</b>
'1	TIME PRESSURES	not keeping up-to-date, less time with students, disproportional time taken up, getting it all done, increased liaison responsibilities, contact time reductions, competing demands (on time), core element (of work) down, travel commitments,
'2	STRESS	staff insecurity, physical stress, mental stress, organizational stress, interpersonal stress, individual stress, stress for students and staff, frustration, work tensions, increased responsibilities, inter staff friction, decision making, individual grinding down, personal responsibility,
'3	OTHER ECONOMIC FACTORS	space costs, out of pocket expenses, infrastructure costs, not being costed properly, no support staff, basic service shortages, effects of rivalry, bad competition, cost to community,
'4	ADMINISTRATION AND MANAGEMENT FACTORS	workload, fragmenting staff focus, less cohesion, committee decisions, support staff needs, growth of bureaucracy,
'5	OTHER SOCIAL FACTORS	ethnicity, unequal benefits, cost for those who do not participate, (negative) quality of life, ignore staff conditions, less promotion, same jobs lots more work, not doing job properly, disenchantment,
'6	PERFORMANCE WORRIES	accountability, non-delivery, failure, community censure, reputation at stake (personal), getting insufficient back,
'7	TRADITIONAL UNIVERSITY ROLE FACTORS	against nature of the university, wrong workload emphasis, effect on the nature of universities, loss of autonomy, effect on teaching skills, wrong role for universities,

Tables 4.12 and 4.13, respectively, summarize the statistical means, standard deviations, overall rank order, and number of responses for the additional benefit and cost items. If the additional benefit and cost items had been integrated into the pre-designed set of costs and benefits, the order of the "set" costs and benefit (see Tables 4.1 and 4.2) may have been altered substantially, since among respondents who mention these additional items the valuations on all items (Table

4.10) are very high. (Of course, respondents who did not mention these items might have assigned very low values to them.)

TABLE 4.12 CURTIN UNIVERSITY ADDITIONAL BENEFITS BY CATEGORY				
RANK	ITEM	No.	MEAN	STD
'1	ACADEMIC AND PROFESSIONAL DEVELOPMENT	'22	7.80	1.30
'2	MORALE AND MOTIVATION	'20	7.80	1.80
'3	OTHER ECONOMIC ITEMS	'18	7.30	2.00
'4	IMAGE AND PUBLIC RELATIONS	'15	7.20	1.40
'5	NETWORKING	'28	6.60	1.80
'6	OTHER SOCIAL ITEMS	'11	6.50	1.70

The possibility of combining the set items and the additional items is mentioned only with caution and strong reservations in mind. Thus, care must be taken in interpreting the results presented in Tables 4.10 to 4.13. The category groups are formed by the researcher; thus, categories may not reflect the perceptions of respondents.

TABLE 4.13 CURTIN UNIVERSITY ADDITIONAL COSTS BY CATEGORY				
RANK	ITEM	No.	MEAN	STD
1'	PERFORMANCE WORRIES	9'	7.80	1.10
2'	STRESS	14'	6.30	1.60
3'	OTHER ECONOMIC ITEMS	11'	6.00	2.40
4'	ADMINISTRATION AND MANAGEMENT	5'	5.00	1.90
5'	TIME PRESSURES	18'	4.90	2.00
6'	TRADITIONAL UNIVERSITY ROLE	11'	3.40	1.60
7'	OTHER SOCIAL ITEMS	8'	3.30	2.70

Furthermore, few respondents suggest these response item. The count of respondents for any one item range from a minimum of 5 to a maximum of



28, with an average of 19 responses per benefit category and 10 responses per cost category.

## **7 ADDITIONAL COST AND BENEFIT ITEMS**

### **7.1 BENEFITS**

For illustrative purposes the additional benefit items have been incorporated into a revised taxonomy of non-monetary costs and benefits (see Table 5.1). These new items may be important in any future study, since they may "round out" or complete the non-monetary costs and benefits taxonomy. Coping with items such as stress, networking, and performance worries (performance anxiety may be a better term) may be significant factors in the future management of institutional change along entrepreneurial lines. Unless management can overcome the impact of these (cost) factors or better enhance the benefits, individual university staff members may lower their entrepreneurial sights as the process becomes too demanding on them. Alternatively, some academics may decide to sell their academic skills in the open market place, possibly for higher personal financial gain.

#### **7.1.1 ACADEMIC AND PROFESSIONAL DEVELOPMENT**

Academic and professional development (staff development) is identified as a distinctive benefit arising from involvement in commercial activities. It differs in focus from the categories of spillover into teaching and research. Here the individual staff member personally gains in a developmental manner.

### **7.1.2 MORALE AND MOTIVATION**

As a benefit item, morale and motivation may be considered akin to a pleasantness and enthusiasm factor for both the individual staff member and the environment in which he or she works. Benefits in this category appear to be personal, interactive, and inter-relational.

### **7.1.3 OTHER ECONOMIC ITEMS**

This category of responses, the third highest in valuation represents a diverse group of responses with no clear thrust other than a relationship to economic considerations. The item tend to relate closely to the nature of economic enterprise (e.g., competitive, economic needs) rather than to strictly remunerative or dollar valued factors.

### **7.1.4 IMAGE AND PUBLIC RELATIONS**

Respondents' valuation of the image and public relations item is also high. Image and public relations could be considered aspects of both "prestige" and "external relations." Prestige may be a part of institutional image. External relations are defined by Curtin respondents as being more in the line of official connections (with government, by letter, media release, formal and intentional). Image making and public relation skills have to be exercised in attending to external relations, but respondents still perceive these items to be benefits additional to external relations (and prestige). This item category may also have a negative cost if public relations are badly managed.

### **7.1.5 NETWORKING**

Networking can be considered a sub-category of external relations. Respondents differentiate external relations from networking, however; they understand the former to be official, authoritative, and directed at formal relationships. Networking is interpreted as less formal, more individualistic, and as an activity entered into by personal choice. Networking is particularly relevant to people with high levels of mutual interests.

### **7.1.6 OTHER SOCIAL ITEMS**

Other social factors include time and timing considerations, people and resource management. This item is similar to the "other economic factors" item, as there is no clear focus to the diverse collection of item suggestions other than social concern.

## **7.2 COSTS**

### **7.2.1 STRESS**

Stress relates to general physical, emotional and mental frustrations, tensions and uncertainties of life. This form of stress is given a lower mean value than is the stress arising from academics' performance worries, as discussed below. It should be noted that stress can arise from many causes in the academic experience, causes not related to entrepreneurial activities. Performance worries as separately identified by respondents are, in most instances, specifically caused by concern over the delivery of commercial contracts. Stress in general probably has diffuse origins for each individual.

### **7.2.2 PERFORMANCE WORRIES**

Performance worries could be considered a sub-category of stress. Such worries however are singled out very clearly by respondents and in a few cases are identified along with stress. Performance worries are the concerns of individual academic staff about their ability to deliver on commercial contracts entered into, while simultaneously maintaining customary obligations to students, the university, and the profession. The primary focus of the respondent concerns is timely delivery at the required level of client satisfaction. Self-esteem may play a major role in this item. The specific category items raised by respondents are diverse and individualistic.

### **7.2.3 OTHER ECONOMIC ITEMS**

Other economic items are non-monetary and are of an economic nature, for example, commercial rivalry and the effects of competition. Factors such as these serve as a warning that some additional non-monetary economic cost factors have not been taken into account in the current cost-benefit taxonomy.

### **7.2.4 ADMINISTRATION AND MANAGEMENT**

Despite the low number of responses (5), the administration and management factor is initially developed as a specific item group and not as a sub-group of other economic factors. There seems to be a perceived need to look more deeply into infrastructural or organizational factors in non-monetary costs situations (as do Leslie and Harold (1993) in the discussion on their research). Items such as workload distribution, committee decision-making, and the decision making process in general can be real costs in commercial projects and

institutional management. However, these costs in the university situation are rarely costed even as monetary costs. They can have substantial monetary cost implications and may be one of the underlying causes for some of the staff stress mentioned in the course of this study.

#### **7.2.5 TIME PRESSURES**

Time pressures are exemplified in areas such as trying to keep up-to-date, additional time needed to meet liaison requirements, competing time demands, and extra-travel commitments due to commercialization contracts. Other responses included under the time pressure category are work-place time requirements (e.g., early classes), time management decision making and time use choice (limitations).

#### **7.3 TRADITIONAL UNIVERSITY ROLE**

This cost category is representative of responses indicating respondents' fundamental disagreement with university commercialization and preference for the traditional role of universities, or perhaps more appropriately, staff members' perception of the traditional role of universities. The traditional role of universities is changing, including the resort by university administrators to more entrepreneurial activities. In effect, staff practices and behavior are changing in relation to students and academic work and these are seen as costs arising in part from the commercialization process.

### **7.3.1 OTHER SOCIAL ITEMS**

Eight responses are recorded in the category of other social items. The classification covers areas such as the impact of commercialization on the quality of academic life and on job satisfaction. This cost is perhaps partly attributable to time and resources stresses and the difficulties for academic staff to perform in a traditional manner.

## **8 GENERAL COMMENTS**

Respondents from three university institutions, a number of sub-institutional categories, and as classified on a number of independent variables have been the subject of an inquiry into the non-monetary costs and benefits of university entrepreneurial activity. There are more similarities than differences among the various research situations examined. The differences have been reported at some length in this tabulation of research findings and results. However, sight should not be lost of the important presence of the similarities and commonalties that are present in far greater measure than are the differences. Universities are becoming more entrepreneurial and their work ethos is changing accordingly. Some universities, Curtin University in particular, are changing more rapidly than universities such as Universities A and B.

## CHAPTER FIVE

### DISCUSSION AND CONCLUSIONS

This chapter is divided into 3 parts: (1) a review of the purpose for the study, (2) a general discussion of research issues, and (3) conclusions.

#### 1 REVIEW OF THE STUDY PURPOSE

*The purpose of this study is twofold:*

- 1) to investigate and establish, for 1991, the nature and level of non-monetary costs and benefits that accrued to Curtin University from university staff involvement in entrepreneurial activities, and*
- 2) to examine the proposition that Curtin is a frontier entrepreneurial institution.*

The level of total monetary benefits that accrued to Curtin University in 1991 as a result of entrepreneurial activity is estimated at A\$57.5 million, of which A\$43 million is clearly identifiable as money earned through entrepreneurialism by academic areas (special funds). An attempt is made to re-apportion the remaining A\$14.5 million in entrepreneurial income to the academic areas. Ten million dollars (Australian) has been re-apportioned leaving A\$4.5 million in un-attributed income. Thus, the total adjusted earned income by main teaching area is set at A\$53 million.

Non-monetary benefits from entrepreneurial activity are, in the perception of Curtin respondents, 162 per cent of the A\$53 millions

monetary benefit, or an additional A\$85.8 million in monetary terms, for a total entrepreneurial activity benefit of A\$138.8 million.

Non-monetary costs are regarded by respondents as 46 per cent of the monetary costs, that is A\$24.4 million in monetary terms. At this level of costs a hypothetical, dollar equivalent, non-monetary *net* benefits of A\$61 million is determined.<sup>1</sup> The value of monetary and non-monetary entrepreneurial activity is substantial overall, and substantial in terms of the total perceived non-monetary gains (the difference between of benefits minus costs).

Other aspects of the nature of entrepreneurial activity explored in this study include

***1) the range and extent of items that may constitute individual perceptions of non-monetary costs and benefits;***

A revised taxonomy of non-monetary costs and benefits is presented (based on the Leslie taxonomy) in section three of this Chapter (Table 5.1). The revised taxonomy is in a potential order of item priority based on responses from the three universities in the study. Nine distinctive, additional cost and benefit items are identified of which seven (stress, personal social costs, performance worries, networking, administration and management, professional development and motivation) are suitable for further exploration.

***2) the differences, if any, within universities in the perception of non-monetary costs and benefits;***

---

<sup>1</sup> In a commercial organization the difference between income and expenditure is usually referred to as profits. In order to facilitate discussion of the dollar equivalent difference between non-monetary costs and non-monetary benefits, the above concept has been transferred to the non-monetary benefit and cost situations of universities and labeled "net benefit" rather than profits.



Within Curtin University there are many more similarities and agreements on non-monetary costs and benefits among the constituent academic areas of the university than there are differences. A number of statistically significant differences have been identified, but all-in-all, there are very few patterns of difference. Examples of the few such patterns are (1) the relatively favorable perception of entrepreneurial activities by engineering and science discipline respondents, (2) the relatively depressed valuations for both cost and benefit items accorded by business studies academics, and (3) the relatively pessimistic valuations of costs (high) and benefits (low) by health science academics. Individual areas of difference have been itemized in Chapter Four. Within university response differences for University A and B were not examined.

***3) the differences, if any, among several universities in the perception of non-monetary costs and benefits;***

Differences in the perception of entrepreneurial costs and benefits do exist among the study's universities, but the similarities are more substantial than the differences. The differences may arise from differences in staff interviewed and in the level of university staff effort expended in developing the institution into an entrepreneurial university.

The differences that do exist are largely, in order of magnitude, strength of value and priority order of factors rather than in the recognition or rejection of specific items in the set of research non-monetary benefits and costs. These differences may serve to divide the universities into more-entrepreneurial or less-entrepreneurial classes.

***4) the overall relationship of non-monetary costs and benefits to monetary costs and benefits;***

In comparison with monetary costs and benefits, respondents at all the study's universities suggested a substantial non-monetary benefit and a relatively low non-monetary cost. If confronted with the dollar value derived from their responses, respondents might be surprised. There is, however, some directional consistency of results across the universities, for example, from more-entrepreneurial to less-entrepreneurial. The actual monetary income from entrepreneurial activity is substantial, for example, reaching 35 per cent of the total current income of A\$167 million available at Curtin in 1991 (excluding capital programs).

Monetarily successful and unsuccessful entrepreneurs similarly value benefits; a relatively "rosy" picture of benefits is shared by most respondents. Other observations on this matter (the percentage relationship of monetary to non-monetary costs (and benefits) include

- 1) In very few cases are the item valuations of the low-percentage cost or low-percentage benefit groups higher than the valuations of the comparable high groups. On average if respondents rated percentage costs or benefits low, they also rated individual cost and benefit items low. The implications are that if an entrepreneur perceived low-monetary costs generally their perceptions are likely to be consistently low.
- 2) Responses on nine cost items from the taxonomy list of 12 items plus personal social costs and 3 additional cost items, out of a total of 12 possible additional items, differ significantly in valuation levels between the high-percentage benefit and low-percentage cost groups. The issue of non-monetary cost appears to be an area of sensitivity and disagreement among academics.

***5) the interrelationship of non-monetary costs and benefits, if any;***

The five identified factors and their constituent items (based on factor weightings) provide a good measure of the interrelationship of the study's cost and benefit items.

***6) insight arising by coincidence or through the exercise of the research process, into the nature of university enterprise (entrepreneurship in academic staff);***

No substantial observations are made on this matter. However, at the level of minor importance, it may be worthwhile to examine individual academic units' financial data and the associated non-monetary costs and benefit responses for insight into the nature of university entrepreneurial activities. Another issue that has arisen in the course of the Curtin study is varying perceptions of staff who worked in the Institute of Technology before the Institute was upgraded to university status compared with staff who have only known Curtin as a university.

***7) factors that may be of assistance to university entrepreneurs and the managers of university entrepreneurs in understanding the processes of change that are affecting universities.***

The following key items of advice could be given to Curtin University administrators:

- 1) The issue of the personal social costs for academic staff involved in entrepreneurial exchange should be addressed as a matter of urgency. In the short term high personal social costs may be tolerated. In the long term, they may serve to undermine entrepreneurial enthusiasm and ultimately entrepreneurial effectiveness.
- 2) Academic staff working in engineering and science discipline areas have a number of relatively extreme entrepreneurial activity perceptions compared to staff in other academic areas. Advice on entrepreneurial activity policy should be sought from discipline areas across the university. Taking advice from the most financially successful entrepreneurs in engineering and science could lead to decisions not adequately supported by academics in other discipline areas.
- 3) Close attention should be paid to the orientation and staff development of junior academic staff (lecturers and below) on matters relating to entrepreneurial activity. In general, junior staff appear to consider that they may not be getting a good deal from entrepreneurial activities; they see themselves as bearing more of the institutional costs and receiving fewer of the institutional benefits.

- 4) Compared with other academic staff, university administrators have high perceptions of entrepreneurial non-monetary benefits. Administrators should be guarded in their judgment of entrepreneurial prospects because their perceptions are not necessarily shared by academic staff who implement activities.
- 5) The perceptions of costs and benefits of entrepreneurial activity in health sciences, compared to other discipline areas at Curtin, are relatively pessimistic, with benefits estimates depressed and costs inflated. Why is this the case?
- 6) Although, business studies is one of the most financially successful entrepreneurial disciplines at Curtin, business studies academic staff tend to assess lower values to specific costs and benefits arising in entrepreneurial activities. Why is this the case?
- 7) The full earned income that can be attributed to each academic operating unit from entrepreneurial activities should be clearly stated in the university budget papers, even if the income is eventually attributed to other areas for expenditure. An operating unit should know exactly how much it has earned from all its entrepreneurial activities. This includes attributed income from entrepreneurial activities carried out on the unit's behalf (e.g., the income from the investment of its surplus funds).
- 8) University administrators may wish to take into account the significant areas of additional benefits to academic staff arising from their involvement in entrepreneurial activities. These include professional development, motivation, personal linkages and networks, and an overall "pride" in achievement. This combined area of additional benefits may be valued almost as highly as prestige and external relations (which are more institution oriented). Professional development and associated benefits may be as important as institutional prestige in driving the pursuit of entrepreneurial activities.
- 9) Despite some differences on gender, level of entrepreneurial involvement, level of knowledge of the financial realities of entrepreneurial activities, academic status (excluding junior staff and university administrators), these variables, in general, do not appear to have much influence on the perceptions of entrepreneurial activities. However, academic staff in different discipline areas do differ significantly in perception of the non-monetary costs and benefits of entrepreneurial activity.
- 10) Engineering and science staff are singled out as having more positive perceptions of entrepreneurial activity.

The idea that Curtin is a frontier entrepreneurial university (at the frontier of university commercialization) can be sustained. Respondents from Curtin University, in comparison with respondents from Universities A and B, appear to derive a higher level of non-monetary

benefit from involvement in entrepreneurial activities. However, research may not yet have determined the full complement of important non-monetary costs and benefits for university entrepreneurial activity (especially non-monetary costs, which may turn out to be much higher than presently valued).

## **2 GENERAL DISCUSSION**

Universities in fact, do respond as firms. Clearly, entrepreneurial activities are designed to increase supplies of factors of production. Money is the direct object of that activity. However, the indirect results are more significant: the non-monetary benefits. These benefits serve the university missions of teaching, research and service. The non-monetary benefits may be stated as mission elements, e.g., spillover to teaching and research, or as benefits leading to mission accomplishment, e.g., prestige, equipment, student recruitment.

Although universities do respond as firms, there are a number of unusual (for a firm) characteristics in the specific dimensions of their responses. Political and social considerations may be given a very high weight in university planning and decision-making, higher than in even the most socially-sensitive and responsive firm. Economically rational decisions may not be made, or may not be made in their simplest form, unless there are additional benefits for the university such as prestige, spillover to teaching and research, and program and staff quality improvement potentials.

### **2.1 COST AND BENEFIT ITEMS**

In this section some of the research results from Chapter Four are stated in generalized form; the numbers in brackets beside each item

title refer to the paragraph numbers in Chapter Four, where further analysis details are to be found.

***PRESTIGE (2.1.1), TRADITIONAL ROLE (7.2.6), IMAGE AND PUBLIC RELATIONS (7.1.4):***

Academics who value entrepreneurial revenue highly also tend to perceive that prestige is an important outcome of enterprise. Entrepreneurial revenue helps to maintain prestige and successful revenue raising in itself may also increase prestige. In the emerging restructured university environment, if entrepreneurial revenue generation is "important" to the ongoing operations of an academic unit and the unit then experiences any type of reduction in entrepreneurial revenue, the academic unit's *prestige* may be threatened, regardless of the actual dollar value of the revenue lost.

The additional cost and benefit items identified in this research, namely image, public relations, and traditional university roles no doubt interact with or are parts of prestige. An institutional image is achieved in part through prestige and vice versa, and public relations can be used to promote university prestige. Traditional university roles tend to be prestigious in the general society (held in high regard and idealized). The understanding of prestige as a non-monetary benefit needs to be re-examined in light of these "additional" cost-benefit items. What is the contrary cost and risks of bad public relations? a decrease in prestige and a poor institutional image? all of which could arise in the course of university entrepreneurial activities. Entrepreneurial activity can add to and detract from prestige, image and traditions.

***EXTERNAL RELATIONS (2.1.2) AND FUTURE CONSULTING OPPORTUNITIES (2.1.3), NETWORKING (7.1.5), IMAGE AND PUBLIC RELATIONS (7.1.4):***

Keeping in close contact with both community and people who can help the academic in the pursuit of his or her interests may be desirable if not essential to career development. Entrepreneurial activity is possibly the main avenue for academics to maintain good external relations. Through the outgoing action of external relations, public relations, networking, and consulting, academics can become an accepted part of their professional and social communities. Through these outreach mechanisms, personal and institutional prestige can be increased, as there is a strong inter-connection among these items. Respondent valuations for prestige, external relations and future consulting opportunity items are highly correlated ( $p < 0.01$ ).

***PERSONAL SOCIAL COSTS (2.2.1), STRESS (7.2.1), PERFORMANCE WORRIES (7.2.2), MORALE AND MOTIVATION (7.1.2), TIME PRESURES (7.2.5):***

There has been a tendency to highlight the non-monetary benefit of entrepreneurial activity, possibly because non-monetary cost items are not rated as highly as benefits. The proper evaluation of the range of "personal social costs" now identified (e.g., stress, performance worries) may lead to a change in this perspective.

How "good" the academic feels in participating in entrepreneurial activity may have a marked impact on the personal and institutional benefits derived from such activities. Simply pursuing entrepreneurial activity for revenue reasons may not in the long term sustain academic interest in such activities. University management may not be recognizing sufficiently (probably because it hasn't been quantified, although, it certainly has been signaled by academics as a major

concern) the high level of personal social costs sustained by academic staff in the pursuit of entrepreneurial activity. This includes items such as performance worries, stress, social and family life deprivations, time pressures, and small out-of-pocket expenses sustained by academic staff in order for university entrepreneurial activities to take place. These issues are particularly and strongly felt by junior academic staff. If personal social costs are suitably quantified, they may well reduce substantially the present large advantage of non-monetary costs over non-monetary benefits. In the researcher's view, the potential reduction could be as large as one half of the existing gap.

***SPILOVER TO RESEARCH (2.1.4) AND TEACHING (2.15), LOSS OF TIME FOR TEACHING (2.2.3), AND BASIC RESEARCH (2.2.4):***

Academics at traditional universities indicate that they are good integrators of entrepreneurial activities and academic programs, with an effective synergy being established between the two sets of activities. Possibly because so much academic staff energy has to go into developing entrepreneurial activities, less-traditional universities have yet to come into proper balance on their entrepreneurial and academic activity efforts. Furthermore, higher levels of financial success in entrepreneurial activities ultimately may ease the burdens on academics working on traditional academic pursuits.

***EQUIPMENT GAINS (2.1.6) AND EQUIPMENT WEAR (2.2.5)***

Due to entrepreneurial activities, Curtin is experiencing high demand on its equipment and thus may be experiencing smaller *net* equipment gain than traditional universities. Still the gain is substantial and positive.



# **PROFESSIONAL DEVELOPMENT (7.1.1),**

The non-monetary benefit items for entrepreneurial activity, as initially selected, focus on the institutional, student and learning processes of the university and to some extent ignore the possible benefits for academic staff. Many academic staff's entrepreneurial activities involve personal and professional development of a high order. Indeed, without the entrepreneurial activity it may be more difficult (besides through research publications) to ascertain if academics are maintaining their professional knowledge and skills at a social and economically relevant level. To some extent participation in entrepreneurial activity is a re-assurance for the community that the university possesses and can transmit "useful" knowledge.

## ***EMPLOYMENT OF STUDENTS (2.1.11) GRADUATES (2.1.8) AND PROJECT PERSONNEL (2.1.7).***

Compared with the USA, in Australian universities the employment gains and losses for students, staff and project workers are at a low level, although they would be missed if lost. The presence of entrepreneurial activity is of some assistance to limited numbers of individuals, more so for higher degree students. The emergence of Cooperative Research Centers in Australia may increase employment opportunity to a greater extent than past entrepreneurial activities.

## ***RECRUITMENT OF STUDENTS (2.1.9) AND STAFF (2.1.10), LOSS OF STAFF (2.2.8)***

In regard to entrepreneurial activity, the recruitment and loss of students and staff may be moving from a lower level of importance to a modest but still higher level of importance.

**LEGAL (2.2.13), PATENT (2.2.12), SECRETIVENESS (2.2.9), AND  
PRODUCT LIABILITY (2.2.10)**

The items of legal and patent costs, product liability, secrecy and confidentiality still are relatively minor concerns for Australian academic staff. These items are more of a "pending or threatening activities (to be feared)" nature for which academic staff desire to be protected and prepared, rather than events that the staff are experiencing. Because the cost of these items often can be ascertained, should they be treated as monetary rather than as non-monetary costs?

**REVENUE SUBSTITUTION (2.2.11), MONETARY LOSS (2.2.7)**

Enterprise may be seen as resulting in reduced resources in an absolute sense, as the substitution of earned revenues for appropriated revenues. Both are viewed by many academics as potential "punishments" for successful entrepreneurship or for failing to generate entrepreneurial revenues.

**ADMINISTRATION AND MANAGEMENT (7.2.4), TIME OF HIGHER SUP-  
PORT PERSONNEL (2.2.6):**

As central figures in the routine performance of many university entrepreneurial activities, academics are prone to ignore or forget the massive university infrastructure (personnel, facilities, systems, databases, decision making processes, etc., utilizing up 28 per cent of the 1991 Curtin University budget) that is in the background, quietly working away, often seemingly inconspicuous by its very pervasiveness, but nevertheless supporting the university's mission. Arguments have also been advanced that "administrative bloat" has occurred, particularly in the USA on the pretexts, among others, of being necessary for entrepreneurial activities and in response to government mandates. This

has increased the burden of funding university administrations and the proportion of earned resources being apportioned to general university overheads. A proper assessment of the importance of university administration and management contribution to entrepreneurial activities, including the contribution of higher support personnel, is unlikely to be provided by academics. Some direct measurement of the actual contribution is called for.

#### ***A SUMMARY VIEW OF ITEMS***

There may be some imbalances in this study as to the total pattern of non-monetary benefits compared with the pattern of non-monetary costs. Part of the imbalance may be due to inadequate accounting--especially perhaps, on the cost side. The difference between academics' perceptions of costs against benefits is very large, if not unbelievably large.

## **2.2 INTER-UNIVERSITY ANALYSIS**

Curtin's' uniqueness and entrepreneurial leading position has been strongly suggested through comparison with two other universities (and by implication, with many more Australian universities).

Basically, academic staff at Curtin select the same general factors and items as staff of the other institutions when evaluating the non-monetary costs and benefits of entrepreneurial activity. However, there are differences in item priority order, in the strength of response and in the full range of potential cost and benefit items considered. Being more entrepreneurial may not necessarily equate with being more financially successful in terms of the residual benefit to the institution. Most entrepreneurial contracts require the contract

funds to be spent on the activity, there is often very little financial residual to be used at the academic's or university's discretion. Many academics must come to almost exclusive reliance on non-monetary benefits to realize a "net benefit gain" from their entrepreneurial activity. This "net benefit gain" will not be sufficient to sustain the real need for monetary revenue that is being experienced by universities.

It is suggested that traditional universities (such as University A) in undertaking entrepreneurial activities have an advantage over less traditional universities, in that the former appear to be able to maximize their returns from entrepreneurial activity to a greater extent. They may not earn as much but from what they do earn they may be able to extract relatively good value. Whether more entrepreneurial venture-some universities will ultimately overtake the traditional universities level of realizing entrepreneurial benefits, is yet to be seen.

## **2.3 THE FIVE FACTORS**

Considering the Eigenvalues and other factor analysis information, it is seen that the *Cost Factor* contains the most consistently related constituent items. This may suggest the greatest consistency in academic focus and concern. Academic staff put the importance of non-monetary benefits as clearly higher than comparable costs. Non-monetary costs are perceived of "as of a low order" in comparison to monetary costs, and very low in actual magnitude in comparison to both monetary and non-monetary benefits. Part of the problem in understanding costs may lie with the fact that universities do not properly account for all the costs of entrepreneurial activities in their accounting and commercial fee charging systems.

Given the original Leslie taxonomy, the main cost items omitted from the list of Factor One costs (F1, Table 4.3) are revenue substitution' legal fees, and patent costs. The first-mentioned cost item is to be found in Factor Five (F5, Resources), the latter items form the basis of Factor Four (F4, Legalistic). The additional item on "personal social costs" is included in the Curtin Factor One costs items (F1).

Revenue substitution may have been omitted from Factor Five in the inter-university analysis because it is an item of less concern for academic staff at universities A and B. In marked contrast, in the case of the Curtin factor analysis, revenue substitution is a main item in Factor Five (F5, Revenue).

In the case of the General University Benefit Factor (F2) the items, employment issues, student recruitment and client services, are all in Factor Three (F3, Employability). Effectively, the factor analysis has identified three factors from the original set of cost items. Respondents at Universities A and B do not differ on four of the five factors; that is, they agree on all factors except the Legal Factor, where University A respondents see the issue as more important than academics at University B. Special conditions applied at University A in 1991 when the Leslie data were collected. The university after a long period of basic research, technology proving, and application development, entered into a period of product commercialization for a number of high profile products, thus at that time, there may have been a higher level of academic awareness of legal factors than prevails at other times.

The perceptions of Curtin University respondents (D, E, and C) differ from each other on three factors and differ from Universities A and B on at least three of the main factors. This suggests two possibilities. The first is that there is a pattern of difference (from

other universities) across Curtin respondents, regardless of academic area. This consistency would make Curtin respondents different as a whole from respondents at institutions A and B. The second possibility is that "University D" respondents at Curtin tend to hold views that are more extreme than respondents at the other universities and at the Residual Curtin University. This pattern of similarities and differences follows through (see table 4.3) on the individual components of costs and benefits, where there is considerable overlap between the statistically significant differences of Sub-University units C and D, in comparison with Universities A and B.

## **2.4 INDEPENDENT VARIABLES**

While there is research subject group cohesion between entrepreneurs and non-entrepreneurs in this study, there is still opposition to entrepreneurial activities within Curtin university, opposition that is driven by strong factors, probably not financial in nature. Some academics may participate in entrepreneurial activities, yet be philosophically opposed to them, speaking against them while accepting the benefits.

Table 4.5 reports relatively few statistically significant differences (18 out of a potential 100 opportunities) demarking the independent variables of gender, academic discipline, academic status and entrepreneur and non-entrepreneur status.

The figures in Table 4.4 and 4.5 serve to confirm the general uniqueness (high entrepreneurism) of engineering and science disciplines at Curtin in terms of the academic discipline variable. The uniqueness for engineering and science at Curtin may arise, in part, because of the high level of financial success that these disciplines enjoy. This, in turn, may cause benefits to be perceived as high and costs to be

perceived as relatively low. In other words, successful entrepreneurial activity reinforces the favorable perceptions of respondents. This pattern is observable on a discipline basis, with the exception of business studies, the most financially successful entrepreneurs at Curtin, but who are lower valuers (pragmatic ?) of the non-monetary aspects of the entrepreneurial activity than other discipline areas.

## **2.5 ADDITIONAL COSTS AND BENEFITS**

All the additional items identified by respondents are regarded as important and given high cost or benefit values by the academics who suggested the items. Respondents with high revenue values provide almost 80 percent of the additional responses. Respondents in business studies and health sciences suggest fewer additional benefits items and, in the latter case, also fewer costs items. Females provide proportionately more additional responses than men.

A proposed revised taxonomy of non-monetary costs and benefits is shown in Table 5.1. The taxonomy is split into "key items" and "ancillary items," the priority order within these groups may differ between institutions. The key items probably will be ranked as important in most Australian universities. Responses to ancillary items could be more varied depending on the level of enterprise achieved by the institution being examined.

It may not be necessary to test for the presence of all the above items in a particular university situation. The alternative may be to test with key items identified in the factor analysis (see Tables 4.1 and 4.4 for the five factor item details).

**TABLE 5.1**  
**A REVISED TAXONOMY OF NON-MONETARY COSTS AND BENEFITS**  
 (After Leslie and Harrold, 1993)

Non-monetary Benefits	Non-monetary costs
KEY ITEMS	
1. Academic and Professional Development	1. Performance Worries
2. Morale and Motivation	2. Stress
3. Prestige	3. Personal Social Costs
4. Relations with External Bodies	4. Administration and Management
5. Image and Public Relations	5. Time pressures
6. Future Consulting Opportunities	6. Academic Resources Consumed
7. Networking	7. Loss of Teaching time
8. Spillover to Research	8. Loss of the Traditional University Roles
9. Spillover to teaching	9. Equipment Wear
10. Equipment gains	10. Loss of Time for basic Research
11. Services Contributed	11. Time of Higher Support Personnel
12. Employment of Graduates	12. Monetary Loss
13. Student Recruitment	13. Loss of Academic Staff
14. Recruitment of Staff	
15. Employment of students	
ANCILLARY ITEMS	
12. Other economic Factors	14. Other Economic Factors
13. Other social factors	15. Other Social Factors
	16. Secrecy
	17. Product and process Liability
	18. Revenue Substitution
	19. Patent Costs
	20. Legal Fees

### **3 LESLIE PERCEPTIONS, STRATEGIES AND PRINCIPLES**

In section 3.1 of Chapter Two (pages 42-45) on the insights, strategies and principles from the Leslie studies, some 16 summary points are listed, the majority of which are endorsed by the outcomes of



this research (and not all elaborated here). The items on which further insight or exceptions may be found in this study are as follows:

**Item (3): *The scope for the expansion of commercialization activities.***

Leslie and Harrold (1993) reported that less than half the observed discipline areas are actively participating in entrepreneurial activities in any financially significant way: That is, only half the academic departments in the Leslie study are significantly involved in commercialization. In the case of Curtin, a much greater number of academic departments are heavily involved in commercialization, a commercialization that extends beyond the Leslie definition to include fee-paying students and other activities. There is still room for commercialization expansion at Curtin. The limiting factor on entrepreneurial expansion may be the level of staff stress and the failure of university management to recognize officially the personal social costs.

**Item (9): *The interest on up front contract payments.***

Interest on the up-front funds (or accumulated funds) for commercial contracts has been an aspect of revenue generation assisting Australian university commercialization. With the lowering of interest rates (to 3-5%), this important source of revenue has substantially diminished. Many new activities at Curtin, such as the post of Deputy Vice-Chancellor for Research and Development, initially were funded from this source. This is no longer the case since the revenue flow became totally inadequate.

**Item (11): *On university organizational structures (departments and R&D centers).***

University organizational structures and their role in promoting entrepreneurial activities deserve some further elaboration drawn from the Curtin experience. At Curtin and similarly at University A, research and development (R&D) centers must be sponsored by an academic department, a collection of academic departments, or a teaching division as a whole.

Internal resources flow to the R&D center through an academic department and any center net revenue gains belongs to the sponsoring department. With some exceptions no central university funds can be given to a center except through a department. This structure appears to have worked best where there is strong academic unity and purpose. When more inter-disciplinary and inter-divisional centers are needed (to say nothing of extra-institutional difficulties), the development and operation of centers becomes more difficult.

For example, at Curtin the lack of a single academic area focus for food industry studies (marketing, microbiology, engineering, design, health and safety, chemistry, etc.,) makes it difficult to find an academic champion to develop this cross-disciplinary program. Research contracts for more than A\$270 million in government and quasi-government research are administered each year for this industry, since it is a national economic priority, part of the national global participation strategy. Curtin already possesses most of the areas of academic expertise required by the discipline, and could be a leader in this field, but so far the university community has been unable to put the operation together, mainly because of the vested interests in the single-discipline control of university organization and structure. The consequence is that a major potential area of enterprise (R&D for the food industry) is severely limited, if not excluded from the Curtin's entrepreneurial activity potential.

Another shortcoming of the organizational structure is the difficulty or inability of departments and centers to move to new organizational locations, change academic sponsors, or when warranted, take on an independent existence. Often contributing to the difficulties is the limited vision of a center's staff and the sponsoring academic departments. For example the Curtin Center for English Language Studies (as a second language) has been operating for over 20 years. The Center, as an independent university entity, may have been able to participate in the market for South-East Asian English Language learning at a higher level, but for among other factors, for its institutional location. The Center remains firmly controlled by (and profitable for) the English Language Department (School of Communication and Cultural Studies), in which location its potential is largely ignored by other academic disciplines.

### **3.1 ADDITIONAL INSIGHTS**

As the extent and nature of entrepreneurial activity in universities becomes more established, a radical transformation in university structure and function may be appropriate for the basic university organizational unit, the academic department (and its collective counterpart the faculty, school or division). Academic departments at the lowest level of university organization may need to become more diverse in their constituent parts and more open to different ways of operating. Universities have been engaging in more commercial activities and their administrative structures have become more service and total quality management oriented (commercially oriented); however, the fundamental university functioning unit, the academic department, has remained largely unaltered. This administrative unit is apparently entrenched in its traditional form and in the university's traditional

organizational structure (a view also supported by Leslie and Harrold, 1993).

The Australian academy is being stretched to physical and mental limits to maintain traditional working rights and prerogatives under the avalanche of new work requirements (commercialization, more publications, higher class numbers, different bureaucratic requirements). Some of this pressure may be reduced or eliminated if new approaches are taken-up in the basic university administrative unit. For example, university organization along *program*, rather than *discipline* lines; the employment of trained university organizational unit managers (*professional managers*) to be in charge of academic operations and logistics;<sup>2</sup> major reductions (not elimination) in *collegial participation* activities; or the exercise of *academic allegiance freedom* (for staff, centers, departments, as a right) to move around and link with other university organizational units (taking their funding with them for the same work).

The role of the non-academic worker in university enterprises should be fully recognized as contributing significantly (and expected to do so) towards university commercialization, and with appropriate rewards. All university staff can be regarded as co-participants in the entrepreneurial exchange process of universities.

#### 4 CONCLUDING COMMENTS

Non-monetary costs and non-monetary benefits interact to play an essential role in encouraging and discouraging academic staff to be involved in entrepreneurial activities. A better understanding of how these items are affecting university staff may lead to an increase in

---

<sup>2</sup> It is not being suggested that such managers will be responsible for academic research, program content or teaching methods; their responsibility would be for organizational operations.

the positive aspects of university entrepreneurial activity. Given that, as suggested by Miller (1976) (based on Schumpeter, 1942), there is a set of university responses to financial stress similar to a commercial organization. There are still other elements in the current "survival" behavior of universities that merit caution in pursuing the full commercial metaphor. Over time it is unlikely that monetary benefits alone will drive university staff to participate in entrepreneurial activity, as there is only a small financial net gain (i.e., of discretionary funds) in the exercise (usually funds raised must be spent on contracted items). Non-monetary entrepreneurial activity benefits that exceed the costs of the activity (expressed in monetary terms) appear to be substantial when compared with the monetary net gain achieved (benefits minus costs) and may in practice be more fairly distributed across participating academic staff than monetary benefits.

Researchers are still some distance from the goal of properly understanding the impact of non-monetary factors in the commercialization of universities. Perhaps the application of Kelly's (1952) repertory grid techniques would help determine the full range of non-monetary costs and benefits and their order of importance, at least within the participating institutions of this study.

Without exception the insights and observations of Leslie (1992) on non-monetary costs and non-monetary benefits have been validated throughout this study. An incremental extension of understanding and insight into the process of university commercialization has also occurred.

### Indirect Benefits and Costs to Universities from Commercialized Scholarship

Indirect Benefits	Mean (/10)	S.D.	Relevant Literature	Comments
Relations with external bodies	6.9	2.0	Blumenthal et al., 1986; Feller, 1989.	Credibility and political base enhanced.
Prestige	7.0	2.2	Fairweather, 1988; Weiner, 1986.	"It's not the money; it's to make your mark as a university."
Spillovers to research	6.5	2.3	Blumenthal et al., 1986a, 1986c; Crean, 1990; Geiger, 1989.	Commercial research creates or adds greatly to a unit's research "atmosphere".
Spillovers to teaching	5.8	2.7	Blumenthal et al., 1986a; Crean, 1990; Fairweather, 1989.	Some commercial problem solving provides material which is highly relevant to teaching and "field experience".
Future consulting opportunities	5.7	3.0	Fairweather, 1988; Ommen, 1982; Slaughter & Rhoades, 1990.	Success breeds success. Successful contracts lead to other consulting opportunities.
Employment of graduates	5.1	2.9	Feller, 1988a; Geiger, 1989; Gilley, 1986.	Involvement of students in contracts provides the practical experience useful to employers.
Student recruitment	4.0	3.0	Blumenthal et al., 1986b; Fairweather, 1989; Stauffer, 1986.	More significant with post-graduates.
Services contributed by project personnel	4.5	2.8	Fairweather, 1989.	Project personnel work alongside and help induct students to practical problem-solving.
Equipment gains	4.5	3.3	Stauffer, 1986; Fairweather, 1989.	Project equipment remaining after project and/or donated by grantors.
Employment of students	4.2	2.9	Blumenthal, 1986b; Fairweather, 1988.	Out-of-semester jobs for students.
Recruitment of faculty from clients	0.9	1.8	Fairweather, 1989.	Happened infrequently in Australia.
<b>Indirect Costs</b>				
Academic resources consumed	-3.1	2.6		Uncompensated secretarial time, fax and telephone costs, and space.
Loss of time for basic research	-2.8	2.8	Anderson & Sugarman, 1989; Blumenthal et al., 1986a, 1986b; Geiger, 1989; Fairweather, 1989; Malkin, 1990.	Contracted time deflects resources from more basic, fundamental research. But commercial research can also stimulate basic research.
Time of higher support personnel	-2.1	1.9	Rosenthal & Fung, 1990; Feller, 1988b.	Subsidization by department and central administration.
Revenue substitution	-2.1	1.9	Blumenthal et al., 1986b; Fairweather, 1989; Feller, 1989.	May result in reduced subsidies from Commonwealth government in long run.
Equipment	-2.0	2.9		Uncompensated wear on university equipment.
Loss of teaching and preparation time	-1.8	2.1	Anderson & Sugarman, 1989; Blumenthal et al., 1986a, 1986c; Fairweather, 1989.	Most likely to occur as contract deadlines approached.
Secretiveness, confidentiality	-1.4	1.9	Anderson & Sugarman, 1989; Blumenthal et al., 1986c; Fairweather, 1989; Johnson, 1984.	Against university ethos. No respondent quoted personal experience.
Departure of faculty/staff to client organizations	-0.7	1.5	Dimandean & Botkin, 1986; Malkin, 1990.	
Monetary losses	-0.5	1.5		Rarely happens as most commercial contracts prohibit losses to the university.
Legal fees	-0.5	1.0	Geiger, 1989; Blumenthal et al., 1986a; Rosenthal & Fung, 1990; Weiner, 1986.	Mainly concerned with patent activity.
Patent/copyright application fees	-0.5	0.9	Blumenthal et al., 1986a; Feller, 1988b; National Science Board, 1985.	
Product or process liability	-0.2	0.7	Anderson & Sugarman, 1989.	University generally insures against such liabilities.

## APPENDIX B

### Non-Monetary Costs and Benefits of University Entrepreneurial Activities

This instrument is one component of an attempt to gain information about the value, to your university, of technology or knowledge transfer to the commercial arena, whether to business or to government. The questions concern your views of the costs and benefits of that technology or knowledge transfer to commercialization activities within your unit.

A major difficulty in this research is in assigning values to non-monetary costs and benefits. In some cases, such as teaching time donated by individuals funded separately through the commercial activity, it is possible simply to calculate the value of that individual's time. There are, however, more difficult cases, and this is where we seek your assistance.

**DIRECTIONS:** Using values from 0 (no benefit) to 10 (highest benefit), please assign a value to each of the following items, using as your basis, the extent to which the technology/knowledge activity of your unit contributes to your University's mission of teaching, research, and service.

Begin by assigning a value to "revenue generation," and using this value as a reference point, proceed to the other items.

- \_\_\_ revenue generation
- \_\_\_ relations with external bodies (e.g., govt., industry)
- \_\_\_ recruitment of faculty/staff from clients
- \_\_\_ student recruitment
- \_\_\_ equipment gains
- \_\_\_ prestige
- \_\_\_ future consulting opportunities
- \_\_\_ services "contributed" by project personnel (e.g. service, teaching, advising)
- \_\_\_ employment of your graduates
- \_\_\_ employment of your students
- \_\_\_ spillovers to teaching
- \_\_\_ spillovers to research
- \_\_\_ other, specify \_\_\_\_\_
- \_\_\_ other, specify \_\_\_\_\_
- \_\_\_ Recognizing that there are some overlaps in the above, what value would you assign to the total of the non revenue items in comparison with the value of the revenue generated (e.g., 30% as important, 150%, 350%)?

Using values from (-) 10 (highest cost) to 0 (no costs) please assign a value to each of the following costs, again using as your basis, the extent to which the activity represents a cost to your University's mission of teaching, research, and service.

- \_\_\_ legal fees
- \_\_\_ patent/copyright application fees
- \_\_\_ departure of faculty/staff to client organizations
- \_\_\_ loss of teaching time
- \_\_\_ equipment (e.g., wear and tear, increased demand)
- \_\_\_ academic resources consumed
- \_\_\_ time of higher support personnel (e.g., administration)
- \_\_\_ loss of time for basic/generic research
- \_\_\_ secretiveness (e.g. publication delays)
- \_\_\_ product or process liability
- \_\_\_ monetary loss
- \_\_\_ revenue substitution (i.e., money taken from the University because of success in raising revenues for the project)
- \_\_\_ other, specify \_\_\_\_\_
- \_\_\_ other, specify \_\_\_\_\_
- \_\_\_ Personal social cost \_\_\_\_\_
- \_\_\_ Recognizing that there are some overlaps in the above, what value would you assign to the total of the non monetary costs in comparison to the value of revenues generated (e.g. 30%, 150%, 350%)?

## APPENDIX C

## ABBREVIATIONS: CHAPTER FOUR DATA ANALYSIS TABLES

TABLE ABBREVIATIONS	MEANING
A	University A
ACADEMIC RESOURCES CONSUMED	Academic resources consumed
AcadResource	Academic resources consumed
AESS	Arts, education and social science discipline areas
A/P	Associate Professor
B	University B
BENEFITS	Benefits
BS	business studies discipline areas
C	Curtin University
COSTS	Costs
D	Engineering and Science discipline areas at Curtin University
E	Curtin University minus the discipline areas of engineering and science
EMPLOY	Employability
Eng	Engineering and science disciplines
EquipGain	Equipment gains
EQUIPMENT GAINS, Equipment gains	Equipment gains
EquipWear	Equipment wear and tear
EQUIPMENT WEAR	Equipment wear and tear
Equipment wear and tear	Equipment wear and tear
EMPLOYMENT OF STUDENTS	Employment of students
External	External relations
F1	Factor One
F2	Factor Two
F3	Factor Three
F4	Factor Four
F5	Factor Five
Future	Future consulting opportunities
FUTURE CONSULTING OPPORTUNITIES	Future consulting opportunities
GradEmploy	Graduate employment
GRADUATE EMPLOYMENT	Graduate employment
HS	Health science disciplines
Higher	Time of higher support personnel
L	Lecturers
LEGAL Legal	Legalistic



LEGAL FEES	Legal costs and fees
LOSS OF TIME FOR BASIC RESEARCH	Loss of time for basic research
LOSS OF TEACHING AND PREPARATION TIME	Loss of time for teaching and preparation for teaching
Loss of staff	Loss of staff
LossMoney	Monetary loss
MONETARY LOSS	Monetary loss
Money loss	Monetary loss
NA	Not Available
Patent	Patent
PATENT COSTS	Patent
PRESTIGE, Prestige	Prestige
Prof	Professor
Product liability	Product liability
PRODUCT OR PROCESS LIABILITY	Product liability
ProdLiab	Product liability
R&DLoss	Product liability
R&DSpill	Spillover into research
RECRUITMENT OF FACULTY	Staff recruitment
RELATIONS WITH EXTERNAL BODIES	Relations with external bodies
Research	Research
RevenueSub	Revenue substitution
REVENUE SUBSTITUTION	Revenue substitution
RESOURCES	Resource Factor
Secret	Secretiveness and confidentiality
SECRETIVENESS	Secretiveness and confidentiality
Service	Services contributed by project personnel
SERVICES CONTRIBUTES	Services contributed by project personnel
SL	Senior lecturer
Snr	university administrators
SOCIAL COSTS	Personal social costs
SocCost	personal social costs
SPILOVER TO TEACHING	Spillover into teaching
SPILOVER TO RESEARCH	Spillover into research
StaffJob	Staff recruitment
StaffLoss	Loss of staff
StudEmploy	Student employment
StudRecruit	Student recruitment
Staff recruitment	Staff recruitment
STUDENT RECRUITMENT	Student recruitment

TeachLoss	Loss of teaching and preparation time
TeachSpill	Spillover into teaching
TIME OF HIGHER SUPPORT PERSONNEL	Time of higher support personnel
Total costs	Total costs
ToTCost	Total costs
Total resources consumed	Total resources consumed
TotRevenue	Total revenue

## REFERENCES

- Alpert, D. 1985. "Performance and Paralysis: The Organizational Context for the American Research University." Journal of Higher Education. 56(3):241-281.
- Anderson, R. E., and Sugarman, B. 1989. "Options for Technology transfer." Capital Ideas. July, 4(1&2):1-15.
- Aslanian, C. B., and Brickell, H. M. Fall 1981. "On Beyond Alliances? The New Reality for Companies and Colleges." College Board Review. 121:16-19.
- Atkinson, S. H. 1988. "Universities in World Markets." les Nouvelles, March, (23) 1:4-7.
- ASTEC. 1989. National Policies for Science. Canberra: Australian Science and Technology Council.
- Bach, M., and Thornton, R. 1983. "Academic-Industrial Partnerships in Biomedical Research: Inevitability and Desirability." Educational Record. 64(2):26-32.
- Barrow, C.W. 1990. Universities and the capitalist state: corporate liberalism and the reconstruction of American higher education, 1984-1928. Madison: University of Wisconsin Press.
- Bernstein, M.h. 1986. Higher Education and the State: New Linkages for Economic development. Postsecondary Education for a Changing Economy Project. Washington, D.C.:Bernstein Group, Inc.; National Institute for Work and Learning.
- Blumenthal, D., Epstein, S., and Maxwell, J. 1986a. "Commercializing University Research: Lessons from the Experience of the Wisconsin Alumni Research Fund." New England Journal of Medicine. 314(25):1621-1626.
- Blumenthal, D., Gluck, M., Louis, K. S., and Wise, D. 1986b. "Industrial Support of University Research in Biotechnology." Science. January, 213:242-246.
- Blumenthal, D., Gluck, M., Louis, K. S., Stato, A., and Wise, D. 1986c. "University - Industry Research Relationships in Biotechnology: Implications for the University." Science. June, 232:1361 - 1366.
- Bok, D. 1982. Beyond the Ivory Tower. Cambridge, Mass.: Harvard University Press.

- Bowen, H.R., and Schuster, J. H. 1986. American Professors: A National Resource Imperiled. New York: Oxford University Press.
- Boyer, E.L. 1987. "American Higher Education: The Tide and the Undertow." International Journal of Institutional Management in Higher Education. March:5-11.
- Buchbinder, H., and Newson, J. 1985. "Corporate-University Linkages and the Scientific-Technical Revolution." Interchange 16(3):37-35.
- Business-Higher Education Forum, 1983. America's competitive challenge: the need for a national response. Washington, D.C.: Business-Higher Education Forum.
- Business-Higher Education Forum, 1986. An action agenda for American competeiveness. Washington, D.C.: Business-Higher Education Forum.
- Carley, D. 1988. "Enter the Entrepreneur: Engaging in Large Scale Business Development." Currents. 14(3):26-33.
- Chew, P. 1992. "Faculty--generated inventions: Who owns the Golden Egg?" Wisconsin Law Review. 19:259-314.
- Collins, R. 1979. The Credential Society. New York: Academic Press.
- Constable, J., and Webster, A. 1990. "Strategic research alliances and 'hybrid coalitions'." Industry and Higher Education. (December): 225-230.
- Crean, S. 1990. "Science Policy." Conference Papers, Canberra: The Australian Tertiary Institutions Consulting Companies Association. June 1990.
- David, E. E., Jr. 1982. "Supporting Research with a Commercial Mission." Change. 14(6):26-29.
- Dickson, D. 1984. The New Politics of Science. New York: Pantheon Books.
- DiMaggio, P., and Powell, W. 1983. "The Iron Cage Revisited: Institutional Isomorphism and Collective Rationality in Organizational Fields." American Sociological Review. 48(2):147-160.
- Dimancescu, D., and Botkin, J. 1986. The New Alliance: America's R&D Consortia. Cambridge, Mass.: Ballinger.

- Dorsett, R. A., and Weiler, W. C. 1982. "The Impact of an Institution's Federal Research Grants on the Economy of Its State." Journal of Higher Education. (53) 4:419-428.
- Douglass, J. M. (editor) 1984. "Do Academic / Corporate Partnerships Pose New Threats to Faculty Employment in Institutions of Higher Education?" Newsletter of the National Center for the Study of Collective Bargaining in Higher Education, and the Professions. September / October 4:1-6.
- Dunn, I. F. 1977. Quantifying non pecuniary returns. The Journal of Human Resources. Summer, (XII) 3:347-359.
- Emery, J. S. 1987. "Education and Enterprise." Unicorn. May, 13 (2):83-88.
- Etzkowitz, H. 1983. "Entrepreneurial Scientists and Entrepreneurial Universities in American Academic Science." Minerva. 21:198-233.
- Fairweather, J. S. 1988. Entrepreneurship and Higher Education: Lessons for Colleges, Universities and Industry. Washington, ASHE-ERIC Higher Education report No. 6.
- Fairweather, J. S. 1989. "Academic Research and Instruction: The Industrial Connection." Journal of Higher Education. July / August 60(4):388-407.
- Feller, I. 1984. "Political and Administrative Aspects of State High Technology." Policy Studies Review May, (3) 3-4:460-466.
- Feller, I. 1986a. Productivity, R&D, and basic research at the Firm level in the 1970's." American Economic Review. March, (76) 1:141-154.
- Feller, I. 1986b. "An Evolutionary Perspective on Emerging University-Corporate-State-Government Research and Development Relationships." Paper presented at a meeting of the Association for Public Policy Analysis and Management, October, Austin, Texas.
- Feller, I. 1988a. "Evaluating State Advanced technology Programs." Evaluation Review June (12) 3:232-252.
- Feller, I. 1988b. "University-Industry Research and Development Relationships." Paper for the Woodlands Center for Growth Studies Conference, November, Houston, Texas.

- Feller, I. 1989. "The Impact of State Technology Programs on American Research Universities." Paper for the Anglo-American Conference on Research Universities, September, University of York, United Kingdom.
- Feller, I., and Seshadri, S. 1990. "The Evolving market for University patent Rights." Mimeograph, The Pennsylvania State University.
- Geiger, J. 1989. "Educational Deans as Collaborative Leaders." Journal of Teacher Education. 40(6):2-4.
- Geiger, R. L. 1988. "Milking the Sacred Cow: Research and the Quest for Useful Knowledge in the American University Since 1920." Science, Technology, and Human Values. 13(3-4):322-48.
- Geiger, R. L. 1993. "The Ambiguous Link: Private Industry and University Research." in Becker, W. E., and Lewis, D. (editors) Higher Education and Economic Development.
- Gibbons, M., and Whitrock, B. (editors) 1987. Science as a Commodity. Essex, U.K.: Longmans Group Ltd.
- Gilley, W. 1986. "Higher Education and Economic Development: A Symbiotic Relationship." Issues in Higher Education and Economic Development. Washington, D.C.: American Association of State Colleges and Universities.
- Glaser, B. 1978. Theoretical sensitivity. Mill Valley, CA.: Sociology Press.
- Glaser, B., and Strauss, A. 1968. Time for dying. Chicago: Aldine.
- Griliches, Z. 1980. "R&D and the Productivity Slowdown." American Economic Review. May, 70:343-348.
- Haddad, J. A. 1986. New Factors in the Relationship Between Engineering Education and Research." The New Engineering Research Centers: Purposes Goals and Expectations. Washington, DC.: National Academy Press.
- Haveman, R. H., and Wolfe, B. L. 1984. "Schooling and Economic Well-Being: The role of Non Market Effects." Journal of Human Resources. 19(3):377-407.

- Haveman, R. H., and Wolfe, B. L. 1986. "Productivity, R&D, and basic research at the Firm Level in the 1970's." American Economic Review. March, (76) 1:141-154.
- Hill, S. 1993. "Concentration of minds: research centres in Australia." Paper presented to the Third International Conference on University-Industry Relations. SUNY (May)
- Hofstadter, R., and Metzger, W.P. 1957. The development of academic freedoms in the U.S. New York: Columbia University Press.
- Hutchins, R. M.. 1962. (2nd edition.) The Higher Learning in America. New Haven, Conn.: Yale University Press.
- Jaschik, S. 1987. "States Trying to Assess the Effectiveness of Highly Touted Economic Programs." Chronicle of Higher Education. June, :19.
- Johnson, L. G. 1984. The High Technology Connection: Academic / Industrial Cooperation for Economic Growth. ASHE-ERIC Higher Education Report No. 6. Washington, DC.: Association for the Study of Higher Education.
- Kenney, M. 1986. Biotechnology: The University-Industrial Complex. New haven, Conn.: Yale University Press.
- Kerlinger, F. N. 1986. Foundations of Behavioral Research. 3rd Ed. Orlando, Florida, Holt, Rinehart and Winston Inc.
- Kolm, J. E. 1990. "Science Transfer From Public Sector Research to Industry: Can we agree on intellectual guidelines for licensing intellectual property?" Conference Papers, June, Canberra: The Australian Tertiary Institutions Consulting Companies Association.
- Layzell, D., and Lyddon, J.W. 1990. "Budgeting for higher education at the state level: enigma, paradox and ritual." Higher Education Report No.4. Washington, D.C.: ASHE/ERIC Clearinghouse on Higher Education.
- Leslie, L. 1992. "Commercialization of Science In Australian Universities." Working Paper. Tucson, Arizona: Center for the Study of Higher Education, University of Arizona.
- Leslie, L., and Miller, H. F., Jr. 1973. Higher Education and the Steady State. Washington, D.C.: American Association for Higher Education.

- Leslie, L., and Brinkman, P.T. 1988. The Economic Value of Higher Education. New York and London: American Council on Education/Macmillan Publishing
- Leslie, L., and Harrold, R.I. 1993. "Commercialization of scholarship in Australian universities." Prometheus. Vol II, 1 (June): 97-109.
- Levine, R., Klevovick, A., and Nelson, R. 1987. "Appropriating the Returns to Industrial R and D." Brookings Paper on Economic Activity. No. 3. Washington, D.C.: Brookings Institute.
- Mansfield, E. 1980. "Basic research and productivity increases in manufacturing." American Economic Review. December, 70:863-873.
- Mansfield, E. 1989. "The Social Rate of Return to Academic Research." Paper presented to the American Economic Association, December, Annual Meeting.
- Martin, B. 1986. Intellectual Suppression: Australian Case Histories, Analysis and Response. North Ryde, N.S.W.: Angus and Robertson.
- Matkin, G. W. 1990. "Commercializing the University: The Practical Consequences of Overturning University Tradition." Paper presented to the 15th Annual Meeting of the Association for the Study of Higher Education, Portland, Oregon, November.
- McMahon, W. W. 1982. "Externalities in Education." Faculty Working Paper No. 877, Urbana-Champaign: University of Illinois.
- Miller, H. F., Jr. 1976. Institutional and Departmental Adaptions and the Steady State. Doctoral Dissertation, The Pennsylvania State University.
- Minasian, J. R. 1962. "The Economics of Research and Development." The Rate and Direction of Inventive Activity, National Bureau of Economic research, Princeton: Princeton University Press.
- Minasian, J. R. 1969. "Research and Development, Production Functions, and Rates of Return." American Economic Review. Proceedings Issue, 2:80-85.
- National Research Council. 1985. Education for the Manufacturing World of the Future. Series on Technology and Social Priorities Symposium. September 20-21, 1984. Washington, D.C.: National Academy Press.



National Science Foundation, 1959. Methodology of Statistics on Research and Development. Washington: D.C.

National Science Foundation, 1986. Academic Research Facilities: Financing Strategies. Executive Summary. Washington, D.C.: National Science Foundation.

Nelson, R. R. 1989. "What is Private and What is Public About Technology?" Science, Technology, and Human Values. Summer, 14(3):229-241.

Nelson, R. R., and Winter, S. 1982. An evolutionary theory of economic change. Cambridge: Harvard University

OECD. 1984. Industry and University. New Forms of Co-operation and Communication. Paris: OECD.

OECD. 1989. The Changing Role of Government Research Laboratories. Paris: OECD.

OECD. 1990. University Enterprise Relations in OECD Member Countries. Paris: OECD.

Olivas, M. 1992. "The political economy of immigration, intellectual property, and racial harassment: case studies in the implementation of legal change in campus." Journal of Higher Education. (63) 5:570-597.

Omenn, G. 1982. "Taking University Research into the Marketplace." New England Journal of Medicine. Summer, 307(11):694-700.

Peters, L., and Fusfield, H. 1983. "Current U.S. University / Industry Research Connections." In University- Industry Research Relationships: Selected Studies. Washington, D.C.: National Science Foundation.

Peters, L. S., and Etzkowitz, h. 1991. "University--industry connections and academic values." Technology in Society. 12:427-440.

Praeger, D.J., and Omenn, G. S. 1980. "Research, Innovation, and University-Industry Linkages." Science. 207(4429):379-384.

Price, D. K. 1965. The Scientific Estate. Cambridge, Mass.: Belknap Press of Harvard University Press.

- Rhoades, G., and Slaughter, S. 1991. "Professors, Administrators, and Patents: The Negotiation of Technology Transfer." Sociology of Education. Vol. 64. April: 65-77.
- Rosenthal, K., and Fung, C.A. 1990. "Technology Survey of 20 Universities." les Nouvelles. September, 25(3):133-137.
- Rossi, P., and Freeman, H. 1985. Evaluation: A Systematic Approach. (3rd edition), Beverly Hills, CA: Sage Foundation.
- Schon, W.R. 1983. The Reflective Practitioner. New York: Basic Books.
- Schuh, G. E. 1986. "Revitalizing Land Grant Universities: It's Time to Regain Relevance." Choices. Second Quarter: 6-10
- Schumpeter, J. 1950. (3rd edition) Capitalism, Socialism and Democracy. New York: Harper & Row.
- Skocpol, T. 1980. "Bringing the state back in: strategy of analysis in current research." in Bringing The State Back In. (editors) Evans, P.B., Rueschemeyer, D., and Skocpol, T. Cambridge:Cambridge University Press: 3-37.
- Seashore, L. K. 1989. "Entrepreneurs in academe: an exploration of the behaviors among life scientists." Administrative Science Quarterly. March, 34:110-131.
- Silva, E.T., and Slaughter, S. 1984. "Retrenchment in the 1980s: the politics of prestige and gender." Journal of Higher Education. 64,3: 250-281.
- Slaughter, S. 1990. The Higher Learning and High Technology. Albany, NY: SUNY Press.
- Slaughter, S. 1993. "Retrenchment in the 1980s: the politics of prestige and gender." Journal of Higher Education. 64, 3: 250-281
- Slaughter, S. 1994. "Academic freedom in the 1980s: decomposition of professional labour, patterns of gender preference and problems of faculty professionalization." (editors) Altbach, P.G., Berdal, R., and Gumpert, P. Higher Education and American Society. Buffalo: Prometheus. (3rd edition)
- Slaughter, S., and Leslie, L. (1994 forthcoming) "Entrepreneurial science and intellectual property in Australian institutions."

- accepted for publication in Smith, J. (editor) The Changing Labor Process in Higher Education. London: Open University Press.
- Slaughter, S., and Rhoades, G. 1990. "Renorming the Social Relations of Academic Science: Technology Transfer." Educational Policy. 4(4):341-361.
- Smith, B. 1990. "The Modern Australian University: Challenge for Leadership and Management." Journal of Tertiary Educational Administration. 12(1):243-254.
- Smith, J. 1991. "Theories of the state and recent policy reforms in higher education in Australia." Discourse: the Australian Journal of Educational Studies.
- Stankiewicz, R. 1986. Academics and Entrepreneurs: Developing University-Industry Relations. London: Frances Pinter
- Stauffer, T. M. 1986. "The Responsibilities of Public Universities for Economic Development." In Issues in Higher Education and Economic Development. Washington, D.C.: American Association of State Colleges and Universities.
- Strauss, A., and Corbin, J. 1990. Basic of Qualitative Research: Grounded Theory Procedures and Techniques. Newbury Park, CA.: Sage Publications.
- Stretton, H. 1988. "Conditions for Enterprising Behaviour: Case Studies of the South Australian Housing Trust and the University of Adelaide." Paper presented at the 10th National Conference on Making Public Enterprise Enterprising, Australian National University, Canberra, ACT, Nov.
- Swanson, D. 1986. "Transferring Technologies to Industry." Issues in Higher Education and Economic Development. Washington, D.C.: American Association of State Colleges and Universities :23-24.
- Terleckyj, N. E. 1974. Effects of R&D on the Productivity Growth of Industries: An Exploratory Study. Washington, D.C.: National Planning Association.
- Turpin, T., and Hill, S. 1991. "Boundaries of creation: observations on the impact of the unified national system of higher education research cultures." Higher Education Research and Development Society of Australia: News. November.

- Weiner, C. 1986. "Universities, Professors and Patents: A Continuing Controversy." Technology Review. February / March, :33-43.
- Weiner, C. 1987. "Patenting and Academic Research: Historical Case Studies." Science, Technology and Human Values. Winter, 12(1):50-62.
- Weisbrod, B. A. 1968. "External Effects of Investment in Education" in Blaug, M. (editor) Economics of Education. Harmondsworth: Penguin Press.
- Whiston, T. 1988. Restructuring and Selectivity in Academic Sciences. London: SPSG Concepts Paper, No. 5.
- Wood, F. Q. 1992. The commercialization of university research in Australia: issues and problems." Comparative Education. 28:293-313.
- Yin, R. 1982. "Studying the Implementation of Public Programs." in Williams, W., and Elmore, R. (editors) Studying Implementation. Chatham, NJ: Chatham House.
- Ziman, J. 1988. Restructuring Academic Science: A New Framework for UK Policy. London: SPSG Concepts Paper No. 8.