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ARTICLE

A Study into the Wealth of Successful Technology Entrepreneurs in the UK

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ABSTRACT

This paper describes an academic study into the wealth of successful technology entrepreneurs in the United Kingdom. Here we are concerned with the dimensions of wealth in terms of its measurement. The methodology used involved three stages to determine the nature of the wealth involved. Initial sources (predominantly literature) and further sources (mainly business information) were considered in stage one to understand the measurement of the wealth of successful technology entrepreneurs. Analysis and synthesis of data undertaken in stage two determined the net wealth for technology entrepreneurs in different areas of activity. The nature and importance of the measurement of the wealth of technology entrepreneurs were examined in stage three to formulate conclusions. The research question investigated "what is the average net wealth of successful technology entrepreneurs in the United Kingdom?" The contribution of the study is to bring together findings of the research in terms of the measurement of the wealth of successful technology entrepreneurs.

1. Introduction

This paper describes a contemporary study into the wealth of successful technology entrepreneurs in the United Kingdom. Dimensions of wealth in terms of its measurement have been investigated. The methodology for the study was undertaken in three stages. In order to obtain an understanding of the measurement of the wealth of technology entrepreneurs initial sources (literature) and further sources (business information) were investigated in stage one. Analysis and synthesis of data were undertaken in stage two to determine the wealth of technology entrepreneurs in different areas of activity. A coding process was used to identify areas and enable the measurement of activity for comparison purposes. In stage three the nature and importance of the measurement of the wealth of technology entrepreneurs was examined in detail to formulate conclusions.

Overall objectives and mission of the paper are to compile an up-to-date and academic study into the wealth of successful technology entrepreneurs. The research question considered "what is the average net wealth of successful technology entrepreneurs in the United Kingdom?" Here we are concerned with the dimensions of wealth using data obtained from the Rich List [1] includ-

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ing the number of entrepreneurs in each area, their rank (highest and lowest), the total wealth for the area in terms of the number of billionaires and millionaires, increase in wealth since 2018 for entrepreneurs in the area, and the number of entrepreneurs who have increased or decreased wealth, those with no change and new entries since 2018.

The findings of the research show the average net worth of technology entrepreneurs in terms of their annual wealth. This is according to the technology areas of Chemicals, Technology, Pharmaceuticals, Industry, Internet, Plastics, Software, Aviation, Computers, Engineering, Telecoms, Biotechnology, Electronics, Energy and Mobile phones. It takes into account the ranked order according to calculated wealth. In answer to the research question it was established that the extent of wealth of individuals in different technology areas was dependent on the amount of activity and development of the area and also the accumulation of wealth by individuals.

The paper has a structure with sections on background, research methodology involving the three stages of the research, findings in terms of the wealth of technology entrepreneurs in the different areas of their activities, analysis, discussion of the findings and conclusions for the study. The following section provides the background to the study.

2. Background

Wealth can be described as the amount of financial assets or possessions that can be transferred into a means for transactions to be made. The core meaning originates from the old English word "weal" from an Indo-European word stem [2]. In modern society wealth is important in all economies especially in terms of growth and development. Indeed, a person who possesses a substantial net worth of wealth is commonly known as "wealthy". The definition of net worth is the current value of assets less their liabilities, exclusive of trust accounts [3]. In this research we express Net Worth (NW) as follows:

$$NW = CVA\text{-}L,$$

where CVA is the Current Value of Assets of technology entrepreneurs and L is the Liabilities of technology entrepreneurs.

At a general level wealth can be defined as "anything that is of value", and various definitions have been given for different contexts [4]. The process of defining wealth can have ethical implications since wealth maximisation is often seen as a goal [5,6]. A country, region or community that is seen to possess a large amount of resources or possessions of benefit to the good of those involved is perceived as "wealthy".

Inclusive wealth has been defined by the United Nations as a monetary measure including physical, human and natural assets [7]. In terms of capital this includes natural capital (land, forests, energy resources and minerals), human capital (skills and education) and physical capital (infrastructure, buildings and machinery).

This study considers the wealth of successful technology entrepreneurs which forms part of the academic field of technology entrepreneurship. Technology entrepreneurship (TE) in the entrepreneurship literature is referred to in several ways including technology-based entrepreneurship and technical entrepreneurship [8]. Bailetti [9] reports that technology entrepreneurship is based on economic development and the growth of firms and involves the selection of stakeholders to take ideas to market and to educate scientists, engineers and managers. Further, Bailetti [9] describes technology entrepreneurship as "an investment in a project that assembles and deploys specialised individuals and heterogeneous assets to create value for the firm" [9].

In terms of definitions Bailetti [9] observes that technology entrepreneurship concerns (1) operation of enterprises by scientists and engineers, (2) identification of applications or problems with a technology, (3) setting-up new ventures, starting new applications or exploiting opportunities involving scientific and technical knowledge and (4) technical change collaboration (p.9). Moreover, Bailetti [9] comments that the field of technology entrepreneurship, when compared to other fields such as entrepreneurship, economics and management, is in its early development and provides the following definition "technology entrepreneurship is an investment in a project that assembles and deploys specialised individuals and heterogeneous assets that are intricately related to advances in scientific and technological knowledge for the purpose of creating and capturing value for a firm" (p.10). Overall, Bailetti [9] has noted that technology entrepreneurship in the past four decades has become an international phenomenon and is considered to be important for the growth of the firm, differentiation and competitive advantage at firm, regional and national levels (p.14).

A broad spectrum of business issues concerning technology entrepreneurship is apparent. These include issues at various stages of enterprise development involving growth and business success, strategy, resources and origins of the venture. There is growing awareness of the importance of technology entrepreneurship by business academics as a consequence.

Preston [10] (p.2) relates the success factors for technology entrepreneurship include clusters of excellence,

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location, attitudes, management talent, patents, passionate behaviour, quality investors, speed of innovation, high quality products to market quickly, and flexibility. Regarding attitudes radical innovations will not originate from a market leader [11]. Where a top management team with an average technology is evident this tends to be better than a lesser management team with a leading technology since top managers have a higher rate of success [10] (p.5). The basis of sustainable advantage for technology entrepreneurship is provided by patents and previously there have been incremental patents from laboratories' radical breakthrough patents [10] (p.6). Industries with creativity appear to have greater achievements (for example software) whereas industries exhibiting improvement appear to perform better (as evidenced by consumer electronics with improved manufacturing techniques) [10] (p.12). In order to shorten the time to market product development cycles repeated rapidly led to successful companies in semiconductor, computer, software and electronics industries, and speed to market has been an important determinant of success and profitability of products (also the case for those industries not dominated by intellectual property with patents given less importance) [10] (12-13). Lastly, location clusters create competitive advantage, and regional advantage can be attained by clustering enterprises with complementary and competitive skills leading to regional excellence [12].

In order to accelerate technology entrepreneurship for regional economic development and growth strategies for success include collaboration, technology alliances and partnerships with business, academia and government [13] (p.1). This is achievable through emerging industry clusters with growth potential involving intellectual property, incubators, innovation based growth, research and development (R&D) based growth, and business know-how (also important are knowledge-intensive new businesses, high tech companies, networks, company spinout activity, partnerships for research excellence, new technology-based organic growth ventures, collaboration and technology education) [13] (p.5).

A constructivist approach for technology entrepreneurship can be followed in order to achieve these strategies for success [14] (p.1). Although support of technology entrepreneurship has been prioritised by governments involving success initiatives to help technology ventures the results have not inevitably delivered expected returns [15]. Alvarez and Barney [16] reported there is a need for objective opportunities to encourage technology entrepreneurship involving dynamic environments [17]. In actual fact, technology entrepreneurship is seen as a process of plan, design and action as activities which are sequential and separate [18]. In the exploitation of technology there are also uncertainties [19] and in the initial stages of conceptualisation of technology opportunity, and by moving to an objective opportunity from a subjective idea [20]. Such iterative interaction has also seen other theoretical perspectives involving effectuation, creation theory and bricolage [16,18,21]. With such uncertain contexts there is incomplete knowledge about the processes and activities that develop the conceptualisation for technology enterprises [22] and the mechanisms used for the conceptualisation of opportunity to develop opportunity from human ideas [14]. Technology entrepreneurship can therefore be seen as a process concerning technology entrepreneurs facing a high degree of uncertainty [23] with business ideas involving disruptive market solutions and undetected technologies.

In terms of this study, in order to provide a clear understanding of technology entrepreneur, as the focus of the investigation, we have taken into account what is meant by technology and entrepreneur to formulate an appropriate definition. Accordingly, technology is defined as "the application of scientific knowledge for practical purposes, especially in industry" [24]. Also, "technology refers to methods, systems, and devices which are the result of scientific knowledge being used for practical purposes" [25], and the "study of knowledge of the practical, especially industrial, use of scientific discoveries" [26]. Further to this, an entrepreneur is "someone who starts their own business, especially when this involves seeing a new opportunity" [26], and "is an individual who creates a new business, bearing most of the risks and enjoying the rewards. The entrepreneur is commonly seen as an innovator, a source of new ideas, goods, services, and business/or procedures" [27]. Taking into account these definitions we define a technology entrepreneur as a person who applies their business ideas using technology to make a profit and create wealth.

3. Research Methodology

The methodology for the study into the wealth of successful technology entrepreneurs in the United Kingdom was undertaken in three stages. By using a systematic process [28] each research stage used appropriate methods (Table 1) [29]. The most suitable method for analysis was used at each stage taking account of potential downfalls by not relating some hidden underlying trends. The research question investigated "what is the average net wealth of successful technology entrepreneurs in the United Kingdom?" In order to respond to the research question, initial sources (predominantly literature) and further sources (mainly business information) were investigated [30] in stage one to gain an understanding of the measurement of

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the wealth of technology entrepreneurs. The study utilises text analysis involving secondary documents [31]. Analysis of the Rich List (2019) [1] and synthesis of information were undertaken in stage two to determine the average net worth of wealth for technology entrepreneurs in different areas of activity. In this research the Average Net Worth (ANW) is expressed as:

$$ANW = \frac{\sum_{i=1}^{n} CVA - L}{N}$$

where CVA is the Current Value of Assets of technology entrepreneurs;

L is the Liabilities of technology entrepreneurs;

N is the Number of technology entrepreneurs.

Table 1. Research Strategy

Focus of the study into the measurement of the wealth of successful technology entrepreneurs in the United Kingdom		
Research Stage	Research Focus	Research Methods
Stage 1	An understanding of the measurement of the wealth of technology entrepreneurs.	Existing research and secondary data sources. Secondary data sources have included literature in the area.
Stage 2	Analysis and synthesis of data on the wealth of technology entrepreneurs.	Analysis of data to determine the average net worth of wealth for technology entrepreneurs in different areas of activity.
Stage 3	The nature and importance of the measurement of the wealth of technology entrepreneurs.	To examine in detail the nature and importance of the measurement of the wealth of technology entrepreneurs to formulate conclusions.

A coding process was used to identify areas and enable the measurement of activity for comparison purposes (Table 2). This was based on an alphabetical listing and number system. Also, the ranked order of technology entrepreneurs was determined according to calculated wealth. Stage three considered in detail the importance and nature of the measurement of the wealth of technology entrepreneurs to articulate conclusions. Table 1 shows the research strategy adopted for the study.

The research stages described in Table 1 investigated the following aspects of the wealth of technology entrepreneurs in the United Kingdom:

Stage 1: An understanding of the measurement of the wealth of technology entrepreneurs

The research has set out to obtain an understanding of the measurement of the wealth of technology entrepreneurs in the UK. It has drawn initially on existing research and further data sources. Further data sources have included literature in the area.

Stage 2: Analysis and synthesis of data on the wealth of technology entrepreneurs

This part of the research has consisted of the analysis of data from the Rich List (2019) [1] to determine the average net worth of wealth for technology entrepreneurs in different areas of activity.

Sage 3: The nature and importance of the measurement of the wealth of technology entrepreneurs

The objective of this stage of the research has been to examine in detail the nature and importance of the measurement of the wealth of technology entrepreneurs to formulate conclusions. Indicators were determined from information, concepts and factors identified in the literature, data available, and findings.

The coding system [32,33] used to identify areas and enable the measurement of activity for comparison purposes in the second stage of the research is shown below in Table 2.

Table 2. Coding Table

Coding used to measure the wealth of successful technology entrepreneurs in the United Kingdom		
	Technology Area	Code
1	Aviation	AVI
2	Biotechnology	BIO
3	Chemicals	CHE
4	Computers	COM
5	Electronics	ELE
6	Energy	ENE
7	Engineering	ENG
8	Industry	IND
9	Internet	INT
10	Mobile technology	MOB
11	Pharmaceuticals	PHA
12	Plastics	PLA
13	Software	SOF
14	Technology	TEC
15	Telecoms	TEL

The coding table uses an alphabetical (AVI-TEL) listing and number system (1-15). From this the ranked order of technology entrepreneurs was determined according to calculated wealth. The list of entrepreneurs generated for each technology area is based on estimates of the minimum wealth of the technology entrepreneurs. Actual size of fortunes may be larger than the figure recorded. The figures were calculated up to the end of March 2019. Identifiable wealth has been measured including land, property, art or significant shares in publicly quoted companies.

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Some technology entrepreneurs have generated their personal wealth from the sales of their enterprises. The value of the enterprises takes account of the tax paid on sale proceeds (18%). Here entrepreneurs' relief is applied at 10% lifetime limit. Private companies are valued at a multiple of their profits depending on the strength of balance sheets, track record and sector. Where an enterprise has strong net assets but low profits, the net asset figure is used as a benchmark for valuation.

The results of the research are presented in the following sections of the paper under the headings of Findings, Analysis, Discussion, and Conclusions.

4. Findings

The research findings of the study into the wealth of successful technology entrepreneurs in the United Kingdom are shown in Table 3. There are eight columns which show the number of areas (1-15), the name of the area, the code for each area (AVI-TEL), the number of entrepreneurs in each area, the 2019 Rich List Rank (highest and lowest), the 2019 total wealth for the area in the Rich List (bn, m), increase in wealth since 2018 for entrepreneurs in the area, and the number of entrepreneurs who have increased or decreased wealth, those with no change and new entries since 2018.

Table 3 shows that there are 170 technology entrepreneurs in the 15 technology areas investigated. The 2019 Rich List Ranking for the highest and lowest ranked entrepreneurs is shown. The total wealth for each area is shown with a total of £195.255bn. The increase in wealth since 2018 for each area is also shown and by calculating the total increase taking the total for those areas showing an increase and the decrease this equals £15.011bn - £4.985bn which gives £10.026bn. The last column in the table shows the increase/decrease in wealth for technology entrepreneurs since 2018 for each technology area and also if there was no change for each area and new entries since 2018. This shows that 92 entrepreneurs had an increase in wealth, 30 had a decrease, 39 showed no change and 9 were new entries.

5. Analysis

The analysis of the research findings for the study into the wealth of successful technology entrepreneurs in the United Kingdom is shown in Table 4. There are eight columns which show the number of areas (1-15), the name of the area, the code for each area (AVI-TEL), the number of entrepreneurs in each area, the 2019 Rich List average rank for the area, the 2019 total wealth for the area (bn, m), the average wealth for the area (bn, m), and the percentage in-

Table 3. General Findings for the study into the wealth of successful technology entrepreneurs in the United Kingdom

No	Area	Code	No of Entrepreneurs	2019 Rich List Rank Range		2019 Total Wealth for area (£)	Increase/ Decrease in Wealth for area since 2018 (£)	Wealth Increase (I), Decrease (D), No Change (NC), New Entry (NE)			
								I	D	NC	NE
1	Aviation	AVI	13	62	964	6.32bn	-26m	7	3	1	2
2	Biotechnology	BIO	2	405	585	523m	23m	2			
3	Chemicals	CHE	8	3	964	35.19bn	-4.586bn	2	4		2
4	Computers	COM	8	118	876	3.19bn	199m	3	1	4	
5	Electronics	ELE	5	452	978	705m	8m	4		1	
6	Energy	ENE	2	751	848	300m	10m	2			
7	Engineering	ENG	10	111	848	5.69bn	-51m	4	2	4	
8	Industry	IND	23	1	843	49.73bn	5.151bn	14	2	6	1
9	Internet	INT	38	2	978	37.85bn	5.637bn	22	4	10	2
10	Mobile technology	MOB	7	97	978	4.33bn	-158m	4	3		
11	Pharmaceuticals	PHA	32	15	978	25.69bn	559m	15	8	7	2
12	Plastics	PLA	1	26		5.40bn	243m	1			
13	Software	SOF	12	47	731	6.09bn	-164m	6	3	3	
14	Technology	TEC	5	5	768	13.44bn	3.14bn	4		1	
15	Telecoms	TEL	4	283	606	1.33bn	41m	2		2	
Total			170			195.255bn	10.026bn	92	30	39	9

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Table 4. Analysis of the Findings for the study into the wealth of successful technology entrepreneurs in the United Kingdom

No	Area	Code	No of Entrepreneurs	2019 Rich List Av. Rank for area	2019 Total Wealth for area (£)	Average Wealth for area (£)	Wealth Increase (I), Decrease (D), No Change (NC), New Entry (NE) (%)			
							I	D	NC	NE
1	Aviation	AVI	13	456	6.32bn	486m	53.8	23.1	7.7	15.4
2	Biotechnology	BIO	2	495	523m	261.5m	100			
3	Chemicals	CHE	8	300	35.19bn	4.40bn	25	50		25
4	Computers	COM	8	489	3.19bn	399m	37.5	12.5	50	
5	Electronics	ELE	5	748	705m	141m	80		20	
6	Energy	ENE	2	800	300m	150m	100			
7	Engineering	ENG	10	425	5.69bn	569m	40	20	40	
8	Industry	IND	23	282	49.73bn	2.16bn	60.9	8.7	26.1	4.3
9	Internet	INT	38	441	37.85bn	996m	57.9	10.5	26.3	5.3
10	Mobile technology	MOB	7	440	4.33bn	619m	57.1	42.9		
11	Pharmaceuticals	PHA	32	486	25.69bn	803m	46.9	25	21.9	6.2
12	Plastics	PLA	1	26	5.40bn	5.40bn	100			
13	Software	SOF	12	420	6.09bn	507m	50	25	25	
14	Technology	TEC	5	421	13.44bn	2.69bn	80		20	
15	Telecoms	TEL	4	434	1.33bn	333m	50		50	
Total			170	6,663	195.255bn					
Av.			11	444	13bn		62.6	14.5	17.4	3.7

crease, decrease in wealth for the area together with those entrepreneurs showing no change and new entries (since 2018).

In Table 4 it is shown that for the 170 technology entrepreneurs in the 15 technology areas the average number of entrepreneurs in each area is 11 with an average Rich List rank in 2019 for areas of 444. The 2019 total wealth for technology areas in the Rich List was £195.255bn giving an average of £13bn. The average wealth of technology entrepreneurs in the Rich List for 2019 was £1.15bn (average net worth). In terms of the increase or decrease in wealth for technology entrepreneurs for all areas investigated some 62.6% of technology entrepreneurs had an increase in wealth, 14.5% had a decrease in wealth, there was no change for 17.4% and 3.7% were new entries.

6. Discussion

The discussion has been undertaken according to discussion point comparisons for technology areas as shown in Table 5. There are eight points (1-8) and comparisons have been undertaken for each one. These include areas with the highest number of technology entrepreneurs and lowest; areas with the highest average rank and lowest; the highest total wealth and lowest total wealth areas; the highest average wealth and lowest average wealth areas; areas with the highest increase and highest decrease in wealth; the highest and lowest number of technology entrepreneurs showing wealth increase/decrease for areas; the number of male/female technology entrepreneurs in areas; and the number of billionaires/millionaires in areas.

Table 5. Discussion Points

Discussion Point Comparisons for Technology Areas	
Point	Comparison
1	Areas with highest number of technology entrepreneurs and lowest
2	Areas with highest average rank and lowest
3	Highest total wealth and lowest total wealth areas
4	Highest average wealth and lowest average wealth areas
5	Areas with highest increase and highest decrease in wealth
6	Highest and lowest no/% of technology entrepreneurs showing wealth increase/decrease for areas
7	Male/Female technology entrepreneurs in areas
8	Billionaires/Millionaires in areas

With regard to the number of technology entrepreneurs those areas with the highest number are the Internet (38), pharmaceuticals (32), industry (23), aviation (13), software (12) and engineering with 10, chemicals and computers with 8 each, and mobile technology with 7. Those areas with the lowest number of entrepreneurs are electronics and technology with 5 each, telecoms with 4, biotechnology and energy with 2 each, and plastics with 1. This shows that both new technology areas as well as more established areas had high and low numbers of entrepreneurs.

Those areas with a higher average rank (shown with a lower number) were plastics, industry and chemicals,

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and low average rank (shown with a higher number) were electronics and energy. These were more established technology areas with newer technology areas in between.

For those areas showing the highest total wealth industry was the highest with £49.73bn followed by the Internet £37.85bn, chemicals £35.19bn, pharmaceuticals £25.69bn, and technology £13.44bn. The areas of aviation, software, engineering, plastics, mobile technology, computers and telecoms follow with between £6.32bn to £1.33bn total wealth. Areas with the lowest total wealth were electronics £705m, biotechnology £523m and energy £300m. Again this shows that more established technology areas had higher and lower wealth with newer technology areas between.

In relation to the average wealth for technology areas those with the highest figures were plastics (£5.40bn), chemicals (£4.40bn), technology (£2.69bn), industry (£2.16bn), Internet (£996m) and pharmaceuticals (£803m). Other areas had average wealth from electronics (£141m) to mobile technology (£619m) with energy, biotechnology, telecoms, computers, aviation, software, engineering in between.

For the increase in wealth for the area for 2019 since 2018 areas with the highest were the Internet (£5.6bn), industry (£5.2bn) and technology (£3.1bn). Other areas showing an increase in wealth for 2019 since 2018 were pharmaceuticals (£559m), plastics (£243m), computers (£199m), telecoms (£41m), biotechnology (£23m), energy (£10m), and electronics (£8m). Areas showing a decrease in wealth for 2019 since 2018 were aviation (-£26m), engineering (-£51m), mobile technology (-£158m), and software (-£164m). The area with the largest decrease in wealth was chemicals (-£4.6bn).

The areas showing the greatest number of entrepreneurs with wealth increase were the Internet with 22 (57.9%), pharmaceuticals 15 (46.9%), and industry 14 (60.9%). Areas showing a reasonable number of entrepreneurs with wealth increase were aviation 7 (53.8%), software 6 (50%), electronics, engineering, mobile technology, technology all 4, and computers 3. Those areas showing a low number of entrepreneurs with an increase in wealth were biotechnology, chemicals, energy and telecoms, all with 2, and plastics with 1.

There were 5 areas with female technology entrepreneurs and these included pharmaceuticals with 8, Internet 4, industry, 3, aviation 2, and software 1. In these areas there were 24 male entrepreneurs in pharmaceuticals, 34 in Internet, 20 in industry, 11 in aviation, and 11 in software. This shows that pharmaceuticals had 75% male and 25% female entrepreneurs, Internet 90% male and 10% female, industry 87% male and 13% female, aviation 85% male and 15% female, and software 92% male and 8% female.

Areas which had the most billionaires were pharmaceuticals with 11, industry 10, Internet 9, chemicals 5, engineering 3, and aviation 2. Further to this areas with the most millionaires were the Internet with 29, pharmaceuticals 21, industry 13, and aviation and software with 11 each.

These comparisons illustrate how successful technology entrepreneurs can accumulate considerable net wealth through innovative work in important technology areas.

7. Conclusions

The paper has investigated the wealth of successful technology entrepreneurs in the United Kingdom. Here the dimensions of wealth in terms of its measurement have been studied. The methodology involved three stages including stage one to obtain an understanding of the measurement of the wealth of technology entrepreneurs. Analysis and synthesis of data were undertaken in stage two to determine the net value of wealth. In stage three the nature and importance of the measurement of the wealth of successful technology entrepreneurs were examined to formulate conclusions. The contribution to knowledge of the research is that it provides a detailed comparison of wealth in different technology areas. In response to the research question the average wealth of technology entrepreneurs in the Rich List for 2019 was £1.15bn (average net worth). It was also found that the extent of wealth of individuals in different technology areas was dependent on the amount of activity and development of the area and also the accumulation of wealth by individuals. The limitations of the study are that it only considers comparisons between different technology areas. Recommendations for future research are to undertake studies to compare the technology areas investigated in the research with other areas of activity. This will provide important policy implications for academics, professionals and government experts.

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