

Achieving Sustainability in Small to Medium sized Manufacturing Enterprises through Educational Awareness

Alan Davies^{*1}, Michael Packianather¹, John White², Sajith Soman²

¹School of Engineering, Cardiff University, Newport Road, Cardiff CF24 3AA, UK.
daviesa@cardiff.ac.uk, packianatherms@cardiff.ac.uk

²Brick Fabrication Ltd, Gemini Works, Estate Road, Pontypool, NP4 6YW, UK.
sajith@brickfabrication.co.uk

Abstract *Small and Medium sized Enterprises (SMEs) are widely accepted as being the driving force behind most of the economies in the world. They play a vital part in every country creating jobs, innovating new products and keeping markets both diverse and competitive. Small companies are equally important in both developed and developing countries for they provide opportunities for people of talent to use their innovative skills to achieve profitability and growth for a firm while reducing both unemployment and poverty. In the UK, although there are nearly four and a half million SMEs, around 50% of those set up each year will go out of business after only four years of trading. Why this should be so and what can be done about it, is an important question to answer and is the underlying reason for conducting this study. Also, a global attempt to be environmentally sustainable can never be achieved without the active participation of SMEs considering the scale of them present in any country. Economic sustainability of SMEs is vital for growth and environmental sustainability of SMEs contributes towards a greener future. In effect this inquiry attempts to identify those common factors which are linked to the lack of sustainability (both economic and environmental) in manufacturing SMEs and to see if these elements can be countered via the process of education. The results of the investigation show that one important reason for the demise of small companies is the lack of management and or engineering skills especially in manufacturing SMEs. Consequently such firms are handicapped in their ability to generate capital, market sustainable innovative products and develop environmentally friendly manufacturing systems. As a consequence of this finding an outline is presented here of the key stewardship skills required by managers in manufacturing SMEs and how these ought to be provided in undergraduate engineering degree schemes.*

1. Introduction

The Journal of the European Union (EU) defined in 2003 Small and Medium sized Enterprises (SMEs) as:-

“Any entity engaged in an economic activity that employs fewer than 250 people”

Such companies are widely recognised as being vital to any advanced or developing economy in the sense that they are drivers of innovation and thus the seeds of possible future multi-national corporations. Sustainability in business can have many different interpretations.

In the context of this study the focus is on a manufacturing firm’s economic sustainability and environmental sustainability. The economic sustainability may be defined as:-

The ability of a business to be profitable while expanding activity within any given trading environment.

Hence the economic sustainability of a business is characterised by its ***profitability*** year on year and its ***potential for growth***. Both these characteristics are intertwined as a lack of profitability limits growth and a lack of potential growth limits profitability. Each of these in turn is affected by any number of differing factors key among which are:-

The efficiency and effectiveness of company operations, together with the inherent ability of the organisation to innovate.

Both these key factors are intimately linked to the design and management of manufacturing systems, products and processes. If badly managed, these particular aspects of SME operations can drastically affect profitability and growth through their influence on product sales and manufacturing costs.

Sustainable development may be defined as:-

Meeting the needs of present generation without jeopardizing the ability of future generations to meet their own needs.

More than 99% of European businesses are SMEs according to European Commission figures. Of all the private sector jobs, 2 out of 3 are in SMEs. They also play a key role in R&D and innovation. [27]

With the World Business Council for Sustainable Development (WBCSD) creating a 'Vision 2050' plan of which one of many objectives include halving the carbon emissions worldwide based on 2005 figures, United States and China signing ambitious deals in reducing emissions and numerous similar projects in the pipeline, the role of SMEs is very evident [30].

Be it growth and job creating or moving towards a greener planet, SMEs play a vital role without the active participation of which, achieving these goals may be nearly impossible.

Consequently, the main aim of this study was to identify the factors which affect the sustainability (both economic and environmental) of manufacturing SMEs, while a secondary aim was to identify those factors which affect their growth. The overall objective being to summarise these findings into meaningful advice for current operational SMEs on those factors which are most important to a sustainable business. In addition, to inform educational institutions in respect of subject material that should be included in undergraduate degree schemes [1].

The paper is organised as follows. The background of this study is given in section 2. The internal and external factors effecting SMEs economic sustainability are described in sections 3 and 4 respectively. Factors affecting environmental sustainability are described in section 5. Finally, a review of the previous sections is given in Section 6, and conclusions in section 7.

2. Background

The Richard Report [2] submitted to Shadow Cabinet clearly summarises the importance of SMEs in the UK. Although the figures can vary with time, the key statistics given in the report provide a snapshot picture of small businesses as outlined below.

1. The number of SMEs in the UK is around 4.4 million.
2. The proportion of all UK enterprises which are SMEs is 99.7%.
3. The Proportion of the UK workforce employed in SMEs is 47.5%.
4. The Proportion of UK turnover generated by SMEs is 48.7%

From the above statistics it is obvious that SMEs play a crucial part in the UK economy. However, it is not just in the UK where SMEs are important, they play a vital part in the world economy as a whole. They create employment, and are recognised as an important source of innovation in all the main sectors of a productive economy. SMEs are particularly important in developing countries for they provide jobs for people, thereby stabilizing society and thus allow many of the population a way out of poverty. In developed countries SMEs are often the largest contributors to employment, and are essential for a competitive marketplace. They remove regional imbalances and increase competition within the economy. They are especially important in rural and deprived areas where there may be no other form of employment available [3].

In 2008 there were a total of 270,000 new businesses of all sizes established in the UK. At the same time 219,000 businesses were closed down. The SME sector has a relatively high survival rate, as 80.7 percent of new businesses were found to be still in operation after two years and 54.7 percent of companies were still trading after four years (Office for National Statistics, 2009). Although these figures are prior to the recession, they are important as they suggest that in a steady state economy almost half of SMEs are likely to fail after four years operation. This also suggests that the initial startup of SMEs is not a significant problem in the UK, while indicating that company sustainability is. Given that SMEs have such a large effect on both the world and the UK economy, it is obvious that research into the sustainability and growth of this type of enterprise is therefore of some importance.

At the same time, SMEs play a vital role in environmental sustainability. The EU Sustainable Development Strategy focusses on achieving a low-carbon and low-input economy. A research conducted in partnership with WBCSD in Latin America concludes around 80% of Latin American CEOs see environmental sustainability as a priority. Almost half of them have implemented strategies to address the issue. The trend is seen to increase every year. The trend is not just limited to Europe or America. The combined membership of WBCSD is over 200 with growing strength in South East Asia as well.

The internal decisions SMEs make and the influences on them from the outside environment are recognised as being crucial as to whether an enterprise becomes a success or a failure. Since the driving force behind any small business is the entrepreneur involved in setting it up, the education of this individual plays no small part in the success or failure of the company. Accordingly, the dictionary definition of an entrepreneur as given below is instructive in outlining the main characteristic required of this individual.

“The owner, manager, organiser or contractor of a business or artistic enterprise” [4].

A more commonly accepted everyday definition of an entrepreneur may be expressed as: -

A person who sets up a business or businesses, thereby taking on financial risks in the expectation of making a profit.

In more detail, entrepreneurs are the chief decision makers at the head of any business they have high ambitions and often devote all their time into making a success of their companies. Taking risks is possibly the defining feature of an entrepreneur however this ethos that may well have given their business its first impetus could also be its downfall as it expands. This is particularly true where the individual concerned has limited understanding of corporate economics and the associated financial risks the company runs as a consequence of this lack of knowledge [5].

3. Internal Factors

From earlier investigations it is possible to group the features effecting SME sustainability into two distinct groups. These are firstly **internal** factors namely the decisions and actions made by the company itself and secondly **external** factors such as disturbances in the global market place and in the economy of the host country. As indicated above, in SMEs the main internal factor is the entrepreneur who is often the firm’s senior manager and the driving force behind its success. Previous studies highlight the entrepreneur’s **management style, experience and motivation** as major contributory factors in the success of a business. Accordingly, Ibrahim and Goodwin [6] used factor analysis to analyse those entrepreneurial features which contribute to the success of small businesses in Canada and the United States. Their findings indicated four clear success factors. These were: -

Entrepreneurial values, interpersonal skills, managerial skills, and environmental appreciation.

The entrepreneurial values which they identified were to do with an individual’s characteristics and personality. These included a willingness to take risks, business intuition, extroversion and a sense of independence. Benzing et al [7] agrees with these traits also adding other psychological attributes such as

innovative orientation, good interpersonal skills and a competitive nature. The interpersonal skills factor was vital to achieving good customer and employee relations. These traits have shown to be particularly important when an entrepreneur is operating in a competitive business environment. Benzing et al [7] added that all these traits contribute to business success, but they can be suppressed and restrained by a lack of management experience and appropriate training. This is especially so in a manufacturing SME where senior management must also have a blend of engineering knowledge covering the areas of economics, design and production.

There is however a conflict of views regarding the traits many entrepreneurs show. *Small Business Survival: A Joint Report to the Governor in 2007* [8] argues that the same traits which aided the entrepreneur at first can lead to business failure if not tempered by experience or broadened by appropriate training. The tendency to be optimistic and undertake insufficient planning can often combine and work together to form the source from which most of the problems that lead to small business failure arise. Many entrepreneurs start up businesses believing that an innovative product is enough to achieve a successful business. They tend to believe that innovation will ensure considerable sales and so there will be no necessity to market the product. They also envisage profitability from the start of production and so do not plan for a lack of capital, which is a common cause of business failure. Many new business owners are successful only after experiencing several company start-ups and the corresponding failures. This supports the old adage that experience is dearly bought, and as such defines an inefficient process which needs to be countered by appropriate education and training prior to any company start up.

Apart from physiological aspects of an entrepreneur's personality, there are other factors relating to their previous experience which can affect the sustainability of the business. Benzing et al [7] found that the more experienced an entrepreneur, the higher their entrepreneurial quality will be, since this experience involves a learning process that helps the entrepreneur to reduce their initial inefficiency and also to improve their capacity in performing various tasks. Zimmerer and Scarborough highlight the need to get the correct type of experience and education in the area of the business. They suggest personal contact with suppliers, customers, trade associations, and others in the same industry as useful ways to get that knowledge. They adopt a business mantra which succinctly expresses these views.

“Successful entrepreneurs are like sponges, soaking up as much knowledge as they can from a variety of sources.” [9].

Benzing et al [7] agrees with this view, stating that the insights gained by experience in an industry similar to the entrepreneurs own business will increase the probability of survival and success. They add that if an entrepreneur did not have sufficient experience about their market, customers or products it would be difficult for the business to succeed. Barkham et al [10] found that the key characteristics of entrepreneurs running successful businesses were that they were younger owners with professional qualifications who own a number of businesses, a quality which indicated their possession of entrepreneurial drive and ability to work with others. Chittenden [11] adds that surviving firms were less likely to be established by founders who had left their previous jobs under negative circumstances and that entrepreneurs with higher education are more likely through their educational attainment to succeed in business, as they are more likely to be able to deal with any problems the business may encounter.

Managerial skills are a key asset of an entrepreneur in control of a successful business. Benzing et al [7] gives examples of such SMEs as having a concise organization structure, experience in the relevant fields, a high level of management education, a niche strategy and an effective budget system. A solid business plan is a crucial factor in ensuring the sustainability of any business. Zimmerer and Scarborough [9] express how without a sound business plan, a firm drifts along possibly leaving itself vulnerable to changes in the market and external economy. They also explain how a business plan can allow entrepreneurs to replace faulty assumptions regarding the market with facts. It also forces them to tackle some difficult but crucial questions about the future direction of the business. Barkham et al [10] identified that successful businesses often had a business strategy which was profit driven as well as recognising the importance of undertaking formal market research. The authors added that a successful strategy also focused on improving the production process and adopting policies of lowering costs. In this respect the current authors advocate the application of knowledge and the use of Flexible Integrated Technology (FIT) to achieve lean and agile production is essential in manufacturing SMEs.

In many cases SMEs start initially as a small family business. Often one of the key aspects involved in the sustainability and growth of the company is the transition from family to managerial control. Gill [12] observes this as a juxtaposition of what might be described as two distinct social systems, the family and the business organisation. He adds that often the two are interwoven and at times conflicting.

Chittenden et al [11] opposes this view, and instead he argues that the change from founder / owner to a managerial position changes and develops over time and is a necessary progression rather than a mutually exclusive transition. Zimmerer and Scarborough [9] also allude to the change in management style of an entrepreneur, expressing how, as the business grows, radically different styles of management may be needed, modes that entrepreneurs may not be very good at. The very abilities that make an entrepreneur successful often lead to managerial ineffectiveness. Growth of a business requires entrepreneurs to let go of hands on control of the daily running of the business and delegating authority, something which many cannot do. This leads them in to areas where they are not capable but continue in their initial style of making decisions, refusing to involve others.

SMEs hold a significant advantage over larger companies by way of their ability to adjust quickly to changing market demands. SMEs need to take advantage of this ability and respond to changes in the market more rapidly than the large companies they may be in competition with. To do this successfully, SMEs need to have an in depth understanding of their business and have current information about the markets they compete [13]. Manufacturing SMEs in particular also need to develop an infrastructure or management team which will work for the future, supporting the business as it grows, and allowing the company to focus on innovation rather than getting bogged down in the administration of its operations. This enables growth opportunities to be worked to their full potential [13]. It is accepted wisdom that organisations tend to grow as a result of managerial guidance through various stages of industry evolution and in SMEs this occurs by taking advantage of situations which arise in the market, innovation or by overcoming in some way the barriers to growth.

Thus SMEs often succeed through their ability to innovate and introduce new products quickly. O’Gorman [14] argues that innovation is often the source of individuality that gives SMEs a competitive advantage. This means that the more technically sophisticated or innovative SMEs are through the use of Flexible Integrated Technology the more likely they are to grow faster. Research by Kinsella et al [15] indicates that product introductions are positively related to growth. While Barkham et al (1996) [10] examines the type of products a small business should focus on, suggesting that it is beneficial to keep a narrow range of products rather than a wide range covering different markets. A key finding from his study was that incremental product improvements were an important success factor in sustainability, ranking alongside market research.

As SMEs often have a small number of employees it can be difficult to gain the educational levels needed. Robson and Bennett [16] show how the skill level of a firm has a positive influence on growth. This can be achieved by employing people with the relevant education / skills which the entrepreneur or the current staff may not have as reported in the literature [8]. This report also warns that hiring the wrong people can be dangerous in some industries where for example employees have access to the company funds. In respect of the number of employees a company has Chittenden et al [11] comment that as a firm becomes smaller relative to the minimum efficient size of its main industry competitor it will be more likely to close. To offset this in the UK, the Teaching Company / Knowledge Transfer Partnership (KTP) is a long running and successful scheme administered by Innovate UK. The scheme's objective is to place suitably qualified graduates in SMEs where their knowledge and skills supported by the University involved can assist the company to innovate and thus grow [17].

The age of a SME is often highlighted in previous research as being a major factor in the success or failure of the business. Although this is not a factor which the business can control, it cannot be ignored. An understanding of how the business will change and perform with time is crucial when developing a sustainable business strategy. As one would expect the most precarious time for a firm's survival is at its birth. Storey [18] explains how owners of young businesses are more likely to suffer from insufficient funding, poor products and ineffective marketing. In his investigation, he explains how as the companies studied aged the factors concerning them changed to strategic and environmental, areas which they may not have the managerial expertise to deal with. This again is an area which should be addressed in the education of undergraduates particularly those seeking employment in manufacturing SMEs.

This view is shared by McCaw et al [19] who concluded that as time goes on management strategy generally becomes more important. They also added that production and labour related problems tended to increase with time. However the effect of the loss of vital personnel and disputes between management decreased as time advanced. Small businesses with owner-managers tend to have a negative relationship between age, employment and turnover growth. Storey [18] suggests this can be explained by owner-managers having achieved the business objectives and goals they formulated when their businesses were established. Similarly businesses which have reached a secure position in their particular market may be reluctant to expand further in fear of risking their current success and weakening the company. This view is reinforced through research carried out by Bennett [20].

However, it should be noted that such a policy makes the company ripe for takeover by a larger competitor or one who seeks entry into that particular market.

SMEs do not enjoy access to same size markets as some larger companies. O’Gorman [14] suggests that with fewer customers the best way of gaining a competitive advantage is to focus on qualitative factors such as customer service rather than cost and price factors. Antunes [13] adds that customer retention is a significant success factor for SMEs and retaining business with existing customers is one of the most cost effective ways to increase revenue. Therefore focusing on customer satisfaction and loyalty is an important factor in ensuring a sustainable business. Chittenden et al [11] elaborates on this point as a basis for differentiating a company from its competitors emphasising that a firm is founded on what it does best. For small companies, that basis is often customer service, convenience, speed of delivery, quality, or whatever else is important to attracting and retaining happy customers.

Exporting allows SMEs to access much larger markets abroad. Robson and Bennett [20] used statistical analysis techniques which proved that SMEs which export tend to grow faster and achieve higher profits. O’Gorman [14] confirms that exporting often leads to high growth but recognised that most SMEs do not export. One of the problems with exporting is the introduction of exchange rates. The domestic currency value relative to the company exporting can lead to a significant increase in export costs. This is illustrated by a case involving China and America, an 18% appreciation of the Chinese Yuan relative to the US Dollar between 2005 and 2007 led to China losing some of its competitive advantage in manufacturing exports to the US. To be successful in overseas markets SMEs need advice from individuals with experience of exporting goods to target countries. This is an area which many undergraduate degree schemes neglect to the detriment of budding entrepreneurs.

4. External Factors

When looking at factors which effect sustainability and survival in a business it is useful to look at the reasons which contribute to a business failing. One such study to determine the reasons for failure of small businesses in the UK was undertaken by The London Business School. McCaw et al [19] surveyed 437 failed businesses and found that for 58.35% of the companies involved there were 17 significant factors as to why the businesses had failed. These factors are presented in Table 1.

<u>Reason for company failure</u>	<u>% as a primary factor</u>	<u>% as a linked factor</u>	<u>Ranking</u>
Undercapitalisation	54	77	1
Poor operations management	29	57	2
Poor management accounting	26	60	3
Short term liquidity	26	54	4
Poor chief executive officer	23	37	5
High gearing	23	50	6
Poor state of local economy	16	35	7
Poor marketing	16	54	8
Theft and dishonesty	11	18	9
Bad debts.	11	27	10
Increased competition	8	40	11
Other personal reasons	8	9	12
Loss of vital personnel	6	17	13
Obsolete product	6	15	14
Other management reasons	6	8	15
Poor quality product	5	21	16
Poor facilities and machinery	4	25	17

Table 1: A study to determine the reasons for failure of small business in the UK [19]

The research carried out in this study shows how undercapitalisation is ranked as the most influential factor in the failure of a business. This outcome agrees with research undertaken by Chittenden et al [11] which suggests that the survival of any business is in part a function of the management's ability to secure and gain access to finance and working capital. Monks [21] adds that these financial resources regularly determine the rate of growth of a SME. The ability to access finance enables SMEs to acquire assets and research the latest technology. This enables the business to expand and allows it to maintain a competitive position in its market. There are a number of problems which SMEs are generally faced with when attempting to obtain credit or equity. One of the main difficulties is that the conditions applying to the finance acquired do not work well with the business

strategy of the companies. The conditions often require the SME to repay loans in a short time frame or incur higher interest rates than would be faced by an established business. Monks [21] concluded that the only sector that actively finances small business is that of venture capital funds these however are generally limited to the high technology sectors of industry.

The reasons for this reluctance to invest are outlined in the literature [22] as being linked to the nature of SMEs having relatively high failure rates and often few assets which make them a high risk investment. Furthermore younger SMEs may have little or no credit history and inadequate business plans this makes it hard for investors to assess whether they will see any return on their cash. In addition, the relatively high transaction costs of lending or investing small amounts often makes SME financing a non profitable business. Consequently, the inability to raise capital is a recurring theme as a factor in SME failure. Monks [21] concurs with this, showing how the additional risk which is introduced by doing business with SMEs cause an increase in the cost of finance. This increase can be in the form of interest rates, commission, administration fees, transaction fees or bank charges. There is some assistance for SMEs dealing with this problem from governments and international financial institutions. They have tried to lower the higher cost of credit which comes with the risk of investing in SMEs by creating subsidised credit programs and providing loan guarantees. However, these programs have been in some cases ineffective and largely failed to reach the businesses they were aiming for.

The next two most important factors outlined in Table 1 involving SME failure are poor Operations Management and Management Accounting. Both topics can be and should be addressed in undergraduate engineering degree schemes. This is to ensure that future entrepreneurial innovators are aware of their importance to the sustainability of a business and have some experience in applying the techniques involved. SMEs have industry specific factors which come from the market the business competes in. These factors make up the market conditions and the actions of competitors, suppliers and consumers [23]. From previous research it is understood that the two most important factors are market condition and competition. Market conditions are important when starting up or diversifying the company. A market with potential for high growth can lead to high profits; whereas a market of limited size may lead to poor growth and failure. Many SMEs compete in the same industry and so face high competition. Viviers et al [24], proposes that a clear understanding of the competition and a well designed strategy to compete is essential for the survival of an SME. This leads to the conclusion that

engineering undergraduate schemes should provide for students to study this topic area also.

Economies of scale can be a fundamental factor in the failure of SMEs. The term is used to describe how total cost per unit produces changes as more units are produced. Generally the cost per unit is expected to decline as you increase output volume as products can be mass produced. However the cost can then start to increase as other factors become more expensive, such as product distribution. Total costs include production, selling and distribution cost and therefore is dependent of the state of a firm's technology, the size of the market and the location of potential customers. The unit cost for any industry is dependent on a number of factors and can increase or decrease at a relatively low level of output. The technology used in production plays an important role in this respect and can limit the optimum size of the business. Where an industry has large economies of scale, SMEs would find it impossible to compete in such a market and so in the long run would not be able to survive without some form of innovation either in their product or production process.

However there are examples when SMEs are able to survive when economies of scale exist but are less important. If a market or product is new often companies have not had time to grow to their optimal size, in this case the SME would have to grow quickly in order to survive. Another case is in highly specialised or niche markets, where the market for the product is limited and the theoretical optimal size is unattainable. This issue of Economies of Scale is also given prominence in the literature [8]. The report found that in the marketplace companies price their products at the same level as their competitors, even if they are significantly larger. This means that because SMEs do not have the economies of scale that the large businesses do they end up not being able to cover the cost of producing and distributing the product and hence fail if they use the same or inferior technology.

Research has determined that external advice can be a major contributory factor to the success of SMEs. However it hard to know the real impact such advice has on success for it may be that growing businesses seek help rather than the help leading to growth [16]. The most common reason why external advice is sought is to fill the gaps in internal staffing and management expertise for specific and one off tasks. This explains why the advice market is dominated by highly specialised sources such as consultants, accountants and lawyers [16]. Customers, suppliers and business friends also contribute whereas government backed sources in general play an important but less active role. This view is not however shared by

Ihua [25], who suggests that they have large role to play in helping SMEs and in this outlook he is supported by the current authors.

Ihua [25] gives the example of The Tony Blair led labour government of 2006, where specific policies were implemented with the precise aim of assisting the SME sector. These included building an enterprise culture; encouraging a more dynamic start-upmarket; building the capability for small business growth; improving access to finance for small businesses etc. Research undertaken by Robson and Bennet [16] found that external advice was useful in sustaining SMEs in growing markets where gaps in business knowledge may appear and it was also useful in declining markets. Their research also found that 84% of all SMEs in the UK used external advice, so it can be concluded that such advice is used because it improves the performance of the company. The take up rate of Knowledge Transfer Partnerships from Innovate UK by SMEs also supports this finding, with 52% of companies who completed the final project report reporting an increase in the overall value of the business, while 62% recorded an increase in sales [17].

Unemployment rates in the economic environment is another factor which cannot be controlled by SMEs but is a factor which affects SMEs especially in areas where the rate is high. In times of high unemployment such as the recent recession, there is an increase in people looking for self-employment opportunities. The result of this is an increase in the number of SMEs which then leads to more competition between them. This is exacerbated as the high unemployment rate leads to smaller incomes reducing the size of the markets that SMEs are working in [26]. This is an important finding for innovative entrepreneurs to be aware of when contemplating the launch of a new SME.

5. Environmental sustainability

Educational awareness leading to sustainability also includes using available resources to increase the environmental sustainability.

Various models that can be adopted in this direction are available from different platforms. A few of them are suggested in literature which includes 'Front End of Eco-Innovation (FEEI)' as suggested in literature [28], 'ecodesign' in literature [29] are a few of them. Both are different strategies where the former emphasises on including the environmental sustainability thinking in the front end of product development whereas the latter suggests 8 eco design strategies for companies to be implemented at various stages.

But none of the above will be successful if not implemented which is where the drive and enthusiasm of decision makers in the business plays a part. This emphasises the importance of education and awareness and various knowledge transfer programs.

The application of above is relevant to both SMEs and large organisations. The following table shown below discusses a comparison of SMEs and large organisations from literature [28].

SMEs	Large Companies
<p><i>Advantages</i></p> <ul style="list-style-type: none"> • Flexibility of organisation – Less bureaucratic, Responsiveness to changing circumstances, Internal communications faster and more efficient • Owner/manager – Dynamic, entrepreneurial – Horizontal leadership style, Direct role in innovation as ideas generator <p><i>Disadvantages</i></p> <ul style="list-style-type: none"> • Owner/manager – Poor managerial skills, Dependency on, Lack of formalised planning • Financial – Difficulties attracting venture capital and bank investments, Failure of innovation projects may be financially disastrous, High fixed costs for technological investments and start-up • Labour – Difficulties attracting skilled personnel – Harder to update technological knowledge 	<p><i>Advantages</i></p> <ul style="list-style-type: none"> • Financial – Less difficulties attracting capital and bank investments, Innovation risks averted by diversity in projects • Labour – Less difficulties in attracting skilled labour • Knowledge – Participation in networks and conference visits to update knowledge, Information management systems • Management – Decentralised management style with decision power on lower levels in the organisation, Long-term strategic management capabilities <p><i>Disadvantages</i></p> <ul style="list-style-type: none"> • Management – Top management isolated from customers and work floor – Emphasis on short-term cost-cutting instead of long-term infrastructural enhancements • Labour – No entrepreneurial fanatics tolerated • Flexibility of organisation – Bureaucratic, highly formalised organisation structure

Table 2: Comparison of SMEs and large companies [28]

From the above table, it can be seen very clearly that for SMEs, the owner/manager plays a direct role in the innovation. Notable is the poor managerial skill of the senior management or owner. This is not so evident for large organisations. Thus again, it can be concluded that the education of the owner/manager is much more important for SMEs than big organisations.

As SMEs take up a large part of employment and economic contribution, similar applies for contribution towards environment. Generally, the business is driven by the senior management who are focussed on profitability, the tendency is to have the environmental sustainability factor becoming a lesser priority and thus neglected or never accomplished to the standards. This will have a larger impact on the overall objectives set out by various governments or collaborations.

The tendency then would be to enforce the environmental sustainability goals as regulations. This can be avoided with the introduction of Flexible integrated technology where projects can be formed to improve both the environmental and economic sustainability of the firm.

In the longer run, such projects that focusses on education awareness and introduction of Flexible integrated technology will serve the larger goal of economic growth and environmental sustainability.

6. Review

From the discussion undertaken in the previous sections, it is clear that there are many factors that affect the sustainability and survival of SMEs. However there are certain recurring or common factors which seem to be more significant than others in their effect on the business. The ability to acquire capital was a factor which could either ensure a business survival or lead to its demise. This was especially apparent in younger firms where in the first years of its life little or no profit was made. This severely affected SMEs where the innovative entrepreneur had not accounted for this scenario, and would then find it difficult to secure funds from investors due to the risk involved in investing in a young SME. Even in older companies the ability to raise funds was compromised by the expense incurred when dealing with a smaller business.

The entrepreneur who is in charge of the SME is referred to in almost all studies as having an overwhelming influence on the success of the company. A study

conducted by Dun and Bradstreet in America found that 90 percent of business failures were due to the owners' lack of skills and/or knowledge. Reinforcing the point made in Table 1 regarding Management skills in Operations and Accounting. The study also found that 90% of businesses which had expert assistance from external sources were still in business five years later, longer than the expected mortality age for a new SME. From this it is easy to conclude that a significant factor in sustaining a business is for it to seek external advice from universities or consultants in areas where knowledge gaps are present in the business.

The past experience of an entrepreneur can have implications when it comes to managing a successful business. The evidence indicates that a business was more likely to survive if the entrepreneur had experienced failure with other small businesses in the past. It also showed that any previous experience in the market their SME was competing in adds to the chances of success. The physiological characteristics and values of an entrepreneur were another factor in the sustainability of the business. Much of research previously undertaken outlines how many struggled with the transition between the SME being a family type business where the entrepreneur is in full control to a more managerial style where responsibilities can be delegated. This factor was a major determinate of stopping the growth of a business.

Additional problems associated with the psychological characteristics of entrepreneurs was the tendency for their bold risk taking approach, which may have got the business started, only to backfire as the business matures and a more thoughtful strategy is required. This is similar to problems some entrepreneurs face when the company grows at a high rate. This can overstretch their knowledge of the business, and market, resulting in poor strategic decisions. This is where external advice is needed to "fill in the gaps" of their knowledge and expertise. Filling in such knowledge gaps can also be achieved by intelligent employment and further education. Having a high level of skill in a business is shown to increase the chances of success. High levels of skill in a business can often lead innovative behaviour. Innovation is often the key to success for SMEs as they can diversify quickly due to their flexible nature, allowing them to change direction and target different markets quickly.

This ability to respond quickly is the SMEs most valuable asset. In order to achieve this agility, research has indicated that company management need a clear understanding of the business and the marketplace together with a concise organisational structure and use of the latest technology. This enables SMEs to move quickly beating the bigger companies to the punch and avoiding economic

scaling problems. Going into markets where economic scaling is not present or cannot exist, increases the chances of SME survival. This is essentially a market choice, moving into a market with a high growth potential can produce high profits whereas entry into a mature market can ultimately lead to failure without some form of innovation. Previous investigations have shown that external advice was used by 84% of all SMEs in the UK, this has to imply that the advice given benefits such companies and makes them more successful. Accordingly such advice is a factor which ensures as far as is possible that the business becomes sustainable. Experts in fields where business lack knowledge may be able to guide the business in the correct direction and iron out any problems with their business plan before these difficulties affect the business.

Unemployment was shown to increase competitiveness in the market as well as reducing the market size. Although the unemployment rate is outside of the SMEs control it can still use this data to alter its business plan. For example it would be unwise to push for growth at the beginning of a time of high unemployment. Exporting can lead to high growth in SMEs, however it is not a significant factor due to the small percentage of specialised SMEs which send products abroad. Customer service appeared in a few of the research articles. The evidence showed that good customer service led to repeat business with the same customers. This was seen as the cheapest way to make profit as little or no marketing was needed.

7. Conclusions

It is clear that SME sustainability and survival cannot be set out as a discrete list of features or recipe for success as any one factor can be affected by a number of other factors. The main features that affect the sustainability of SMEs are the ability to raise capital and the managerial skills, experience and decisions of the innovative entrepreneur managing them. The external environment also plays a part in influencing SMEs sustainability, as the size of an SME may leave it vulnerable without suitable innovation and an experienced and knowledgeable management team. Properly designed engineering undergraduate degree schemes can do much to offset the lack of skills and knowledge required for manufacturing SME management. Universities should therefore be encouraged to look beyond providing basic engineering knowledge in their schemes and design their courses to equip budding innovative entrepreneurs with the skills they need to start and run successful SMEs.

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