

# Centre for Technology Management

Stockmarket Listing and Cleantech  
Business Development; Evidence from AiM

by Milena Müller and Elizabeth Garnsey

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# Stockmarket Listing and Cleantech Business Development; Evidence from AiM

Work in Progress

## **Abstract**

Investors have been showing interest in prospects for new environmental technologies launched by innovative enterprises. We analyse the experience of young environmental technology firms going public on London's alternative stock market, AiM. While firms that launched in the boom attracted needed funds, shareholder expectations and the controls used to promote shareholder value were not well aligned with the realities of business development of these emerging technology firms. These face challenging market and technology risks and require funding for business development that is more flexible and longer term than that provided by AiM investors. We suggest that a wider portfolio of investment alternatives is needed.

## **Key Words**

Environmental technologies, IPO, AiM, value creation, business development

## **Acknowledgements**

We are very grateful to the members of the companies who shared their knowledge with us and allowed us to name their companies. All errors are our own.

## Summary

Investors have been showing interest in prospects for new environmental technologies launched by innovative enterprises addressing urgent environmental problems. In principle, environmental enterprises should be an important source of such technologies but to grow and diffuse their technologies they need sufficient funding. A privately owned company can launch an Initial Public Offering (IPO) of its shares on a public market to access more investors. This prospect has encouraged environmental enterprises to list on stock markets such as London's AiM, London's alternative investment market.

The aim of this paper is to examine why young clean tech firms undertake an IPO and how this contributes to their business development. We began by addressing relevant literature and identifying gaps in knowledge. We selected as our research base the experience of young firms with environmental innovations launching on London's AiM. We asked why environmental companies have listed on AiM, and with what consequences. We constructed and analysed a dataset of environmental technology firms on AiM, operating in the UK, and carried out five qualitative case studies to gain further understanding of the impact of IPO on business development of young firms, measured by improvements in indices of value creation and capture.

Our conceptual model centres on the creation of value from firm-specific resources. A technology-based new firm often requires external finance to support the building of a resource base that can support value creation and capture. Value creation by environmental technology enterprises is addressed from the perspective of shareholder value and from a business development perspective. In principle these should coincide. Accordingly we predicted that an IPO improves a new company's business development opportunities and performance. We compared observations from the dataset and case studies with outcomes predicted by the model to see if share capital raised and pressure to achieve shareholder

returns were associated with advances in the business development of environmental technology firms on AiM.

We found that an IPO on AiM provided investment capital for the firms despite their high levels of reported market, technological and regulatory risk. Revenues and profits increased after IPO for most of the database firms. On the other hand, our data indicates that 60% of the analysed companies were not in profit three years after IPO. Stock market valuation of the shares of emerging technology firms is highly volatile and vulnerable to negative market sentiment during downturns. The valuation of these firms were shaped by a speculative upswing followed by negative market sentiment and did not map firms' revenues and business development. In volatile market conditions, share price did not respond to the value creating potential represented by advances in business development.

To elucidate these quantitative findings, we undertook detailed case studies of five environmental enterprises in five sectors; their histories are summarised briefly. The case studies point to conflicting perspectives on how best to generate returns and over what time period. The financial literature predicts that the creation of shareholder value is aligned with the creation and capture value by the firm. Our evidence showed a mismatch between investor expectations and development needs of young innovative firms seeking to generate value. We found that a public listing on AiM introduced reporting controls that formalised management's goals and methods and called for a focus not so much on capacity-building but on short term share price considerations.

We conclude from the case evidence that inflexible controls and targets are inappropriate in young companies that need to retain strategic flexibility under conditions of uncertainty and rapid change. Ill judged compliance requirements, though aimed at protecting investors, can inhibit creative solutions which could benefit shareholders in the longer term. In addition to adopting controls more compatible with entrepreneurial innovation, investors and policy makers could explore a wider portfolio of investment alternatives to support ventures with environmental innovations.

## **1. Introduction**

It is increasingly recognised that that if current trends continue, the world's climate will change rapidly for the worse (ICCP 2007). Since entrepreneurial innovation has contributed important new technologies in other sectors, technological innovations by new enterprises should be a key source of environmental solutions. It has been argued that significant business opportunities arise for entrepreneurial firms addressing environmental problems (Dean and McMullen 2007). However, markets for environmental innovations are predominantly in conservative and concentrated industries which often require pressure from regulatory constraints before they adopt innovations. Radical, revolutionary or disruptive innovations, in particular, face significant challenges from high levels of technology and market uncertainty. The unpredictability of regulatory legislation is another source uncertainty.

To develop and diffuse their technologies despite these uncertainties, environmental technology companies need access to more extensive finance than they can obtain from personal funds and loans. In principle, Initial Public Offerings (IPOs) can provide investment capital for environmental technology companies, but there is little research evidence on this issue. Accordingly this paper presents new evidence on why environmental companies have listed on London's alternative stock market, AiM, and with what consequences.

The paper is organised as follows. After an overview of sectors that provide market opportunities for environmental technology we review prior work. This informs our conceptual model, which frames propositions on why and with what effects new entrants have launched on AiM. The model is then applied to evidence from a dataset of environmental technology firms operating in the UK, created from the AiM website and company documentation. Issues raised by the database evidence are investigated in more detail through qualitative evidence from five case studies.

## **2. Environmental technology and enterprise**

Many environmental problems result from unsustainable patterns of production and consumption (European Union 2008). The DTI has found that there are: "... big problems in waste, water, energy and without innovation they will be prohibitively expensive to tackle". (2006: 2). While demand shaped by regulations and voluntary compliance creates opportunities for environmental technologies, resource constraints frequently hold back innovative entrepreneurs (Shell springboard 2006; UK CEED 2006).

Schumpeter (1934) argued that innovation occurs through creative destruction, with the replacement of incumbent companies by entrepreneurial innovators.<sup>1</sup> Larger organisations are often in a better position to diffuse new technologies than are resource-constrained new companies, but incumbent inertia may prevent them from doing so (Rothwell and Zegveld 1982). Technology can only have real impact when its use spreads through the economy (Miller and Garnsey 2000). Reluctance to produce and adopt innovations is especially strong in sectors where emissions and pollution are endemic such as heavy industry, construction, energy and utilities. In contrast, innovative new companies see opportunities in change (Hugo and Garnsey, 2005). In many cases the fate of an innovation and of the venture from which it originated cannot be separated, as the originating firm is needed to diffuse its technology (Miller and Garnsey 2000; Rosenberg 1994). A central question is how innovators can obtain the finance to grow such companies successfully.

## **2.1 Entrepreneurial value creation; prior literature**

Most of the prior literature on IPOs focuses on investor returns and not on the question of the new firm's capacity to grow to the size where it can effectively launch and diffuse its environmental innovation. We revisited the entrepreneurship literature to address these issues. A starting point is to understand the opportunities entrepreneurs pursue. Entrepreneurship studies have aimed “to understand how opportunities to bring into existence ”future” goods and services are discovered, created and exploited, by whom and with what consequences.” (Venkataraman 1997: 120). This research tradition has been shown to be distinct from that of firm formation studies which assume that ‘opportunities exist, have been discovered, and will be exploited through the creation of new firms’ (Shane and Ventkataraman 2000 p. 218). Venkataraman's original statement suggests that both sets of issues could be addressed together. This is appropriate for environmental enterprise.

However, technical entrepreneurs must not only pursue opportunities, but find ways to match their use of resources to market openings if their enterprises are to achieve value creation and value capture. Sales revenues measure only a part of the value created for others by innovative enterprise, and social value created by entrepreneurs is higher than the economic value their firms capture as profit (Teece 1986). These spillovers include value for the natural environment for firms in the environmental goods and services sector.

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<sup>1</sup> Not all entrepreneurial innovations displace substitutes, however. Some make possible completely new activities, as in IT.

## 2.2 Evidence from the environmental technology industry

The environmental technology sector has been of increasing interest to investors in recent years (Library House 2007) but it is not known to what extent entrepreneurs have been facing funding difficulties that prevent their innovations from having environmental impact. As we are interested in business development rather than start up funds, we examine IPOs rather than venture capital as a source of funding for environmental ventures. IPOs have been recognised as an exit route in the case of companies facing lower market and technology risk than early stage ventures. Recently the LSE's AiM has provided opportunities in Europe for less mature companies. New ventures go public to raise cash and working capital and thus break through the "entrepreneurship growth ceiling" (Welbourne et al. 1998; Roberts 1991). It is argued that as an IPO can help to accelerate product development programmes and enable the broadening of distribution channels (Roberts 1991). Many young companies have exhausted other sources of funding (Roberts 1991) or prefer not to yield control over their decision making to venture capitalists (Moore 2005).

Research has highlighted that there are advantages from public listing for a young company beyond obtaining funds. However, there are also disadvantages associated with IPOs. The costs and benefits identified in the literature are summarised in table 2.1. We examine these issues in relation to our evidence in the empirical part of the paper.

**Table 2.1- Costs and benefits of public listing**

Going public	Benefits		Costs/ Risks	
	Being public	Going public	Being public	Going public
- Capital to retire debt and increase liquidity (Moore 2005)	- Enhanced ability to raise capital (Kensinger et al.2000)	- IPO and underwriting fees - Listing fees	- Listing fees	- Professional fees (Mendoza 2007)
- Exit for investors can improve pre-IPO funding (Wuestenhagen and Teppo 2004)	- Growth via acquisitions of other companies (Kensinger et al. 2000)	- Professional fees (Mendoza 2007)		
- Marketing opportunity (Song et al. 2001; Röell 1999)	Attract or hold employees through stock-based incentives (Pagano et al. 1998; Welbourne and Cyr 1999)	Underpricing (Mendoza 2007)	Continuous public visibility and scrutiny (Roberts 1991, Jacobs 1991, Porter 1992).	
- Possibility for entrepreneurs to regain control lost in earlier VC rounds (Moore 2005)	Enhanced reputation and image (Kensinger et al. 2000; Gompers and Sahlman 2002)	Regulatory costs (Mendoza 2007)	Regulatory costs (Mendoza 2007)	
- Will create public market for the sale of holding (Roberts 1991)	- Entrepreneur or early investors can realise returns (Black and Gilson 1999; Roberts 1991)	Loss of proprietary information (Mendoza 2007)	Loss of proprietary information (Mendoza 2007)	

Among the identified issues faced by a young firm going public are the pressures to demonstrate short-term performance. However, it is not clear in how far capital markets in practice focus on short-term performance (Bushee1998). Recent research has found that management of publicly-listed companies often *perceives* pressure to show short-term performance and reacts accordingly (Kensinger et al. 2000). Whether short term performance can be a real priority depends on pressures to sacrifice, as predicted in the financial literature longer term objectives.

The majority of IPO studies assume that returns to investors are the main issue of interest (see e.g. Carter et al. 1998). Shareholder value is delivered by capital gains and dividends, known as creating shareholder value, sometimes shortened to creating value. However in our model (figure 3.2) value *created* by the firms is on behalf of customers and users, while shareholder value represents value *capture* or appropriation. In our model, the two processes will not necessarily coincide because of swings in market sentiment, externalities, diverse stakeholders and divergent time horizons.

Proponents of the shareholder value approach to governance maintain that investors will allocate returns to their most efficient use, with associated welfare benefits (Lazonick and O’Sullivan 2000). It is held in this school of thought that a system of corporate governance promoting the interests of the shareholders will reduce information asymmetries and help firms to obtain further funding (Markman et al. 2001).

However the assumption that firm performance is stimulated by pressure to achieve returns to shareholders is questioned by those of the stakeholder persuasion, who do not see capital markets as invariably optimal allocators of resources. They cite evidence to show, for example, that firms that many firms that grow through retained earnings become more prosperous than do companies answerable to external shareholders (Lazonick and O’Sullivan 2000). Without entering the stakeholder debate here, we investigate whether share capital raised and pressure to achieve shareholder returns were associated with advances in the business development of environmental technology firms on AiM.

We specify our research question as follows: *Why and with what consequences have environmental technology companies listed on AiM?*

To address this question we first investigate some underlying issues in the analysis of

entrepreneurial value creation, using a conceptual model of early business development.

### **3. Applying a conceptual model to evidence on environmental ventures**

#### **3.1 Theoretical foundation of the conceptual model**

Our model of business development builds on Penrose (1959), applying her approach to the new firm, which must build a productive base in order to create value.<sup>2</sup> To survive and expand it must capture enough of this value to fuel business development. New firms often need outside funding before they are in a position to build the productive base needed to create and appropriate value. As Schumpeter (1928) pointed out, new firms lack retained earnings from prior production cycles to invest in their expansion. To attract early investors, they need to provide them with an opportunity to realize returns through exit. An alternative to an IPO as a form of early exit is a trade sale, but this ends the autonomy of the innovative entrepreneurs. By contrast, an IPO allows early private investors to exit while bringing on board new investors from the public capital markets for the still independent enterprise.

Using this approach, we adopt a wider conceptual lens than is used in prior literature on IPOs, though space precludes detailed attention to stakeholder issues. In particular, we differentiate value creation for customers and users from value capture for owners and investors. While the importance of value creation and capture is recognised by most management scholars, there is much disagreement about what value creation is, how value is created and how value can be captured (Lepak et al. 2007). Here we propose that value is generated and captured when the output from economic activity is worth more than the value of inputs.<sup>3</sup> By this definition, value created may extend beyond economic value to social or environmental value. A narrow economic calculation of value is in terms of the price people will pay for their preferred purchases. The issue of value generation is broad and contentious, but in this exploratory research, value as reckoned in standard accounting measures serves our purposes. Profit represents value the company is able to appropriate (Bowman and Ambrosini 2000; Enders et al. 2004). The ability to capture value is seen in firms that achieve economic profitability (Besanko et al. 2003).

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<sup>2</sup> Exceptions are cases where a productive base is inherited by a newly incorporated firm.

<sup>3</sup> This definition only makes sense with regard to value for users and not for speculators, as the latter make any definition of value problematic. Bowman and Ambrosini revive the classical distinction between 'use value' and 'exchange value' to make a similar point (2000).

### 3.2 Measuring value and conceptualising business development

We model growth in the young entrepreneurial firm engaged in a dynamic process of value creation and capture (Figure 3). Using our pragmatic definition, value is created when output is more valuable than the inputs they required,  $V = \Delta O/\Delta I$ . It would be desirable to compare value created and appropriated with what could be achieved with the same inputs applied to alternative uses, but to attempt to do so would offer spurious precision. To provide a basis for comparison without disguising imprecision, we use sales to measure value for customers and use profit to measure value captured.<sup>4</sup> Only value recognised by consumer choice is realised as economic value through sales revenues (Hax and Wilde 2001; Birley and Muzyka 1997).

**Figure 3.1 Growth through value creation in the new enterprise**

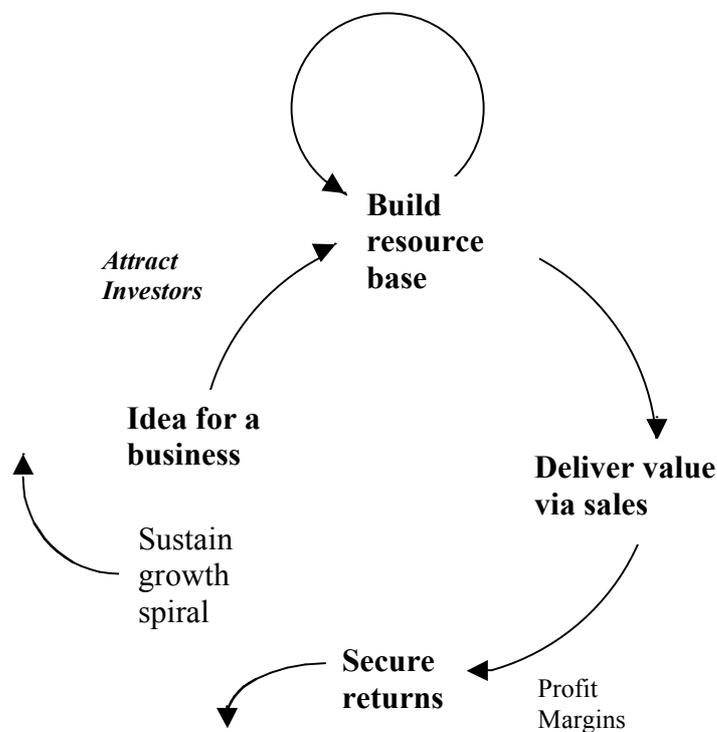


Figure 3 shows a firm start-up, based on a business idea translated into a business model that achieves value generation for customers and returns to founders and investors. If the firm is developing an offering unknown to the market, it is necessary to demonstrate the value of its output in an application endorsed by customers or partners. A self-sustaining company can deliver value to customers in return for sales revenues and capture part of this value through profit. To satisfy customer demand through sales, the new firm must have constructed a

<sup>4</sup> While this does not provide a reckoning of the cost of capital, as do measures of economic value added (EVA), nor is cost capital over-weighted as where hotel chains sell and rent back their property to improve measures of returns on capital.

productive base (upper loop), unless such a base is inherited. While sales revenues do not allow for differences in outsourcing, the ability to attract co-producers and pay for outsourcing is proxy indicator of business development. Value is appropriated by the firm when profit margins exceed costs of inputs and production. As resources are accumulated, the firm itself becomes a saleable asset. Depending on extent of business development and form of early exit, the growth spiral may continue.

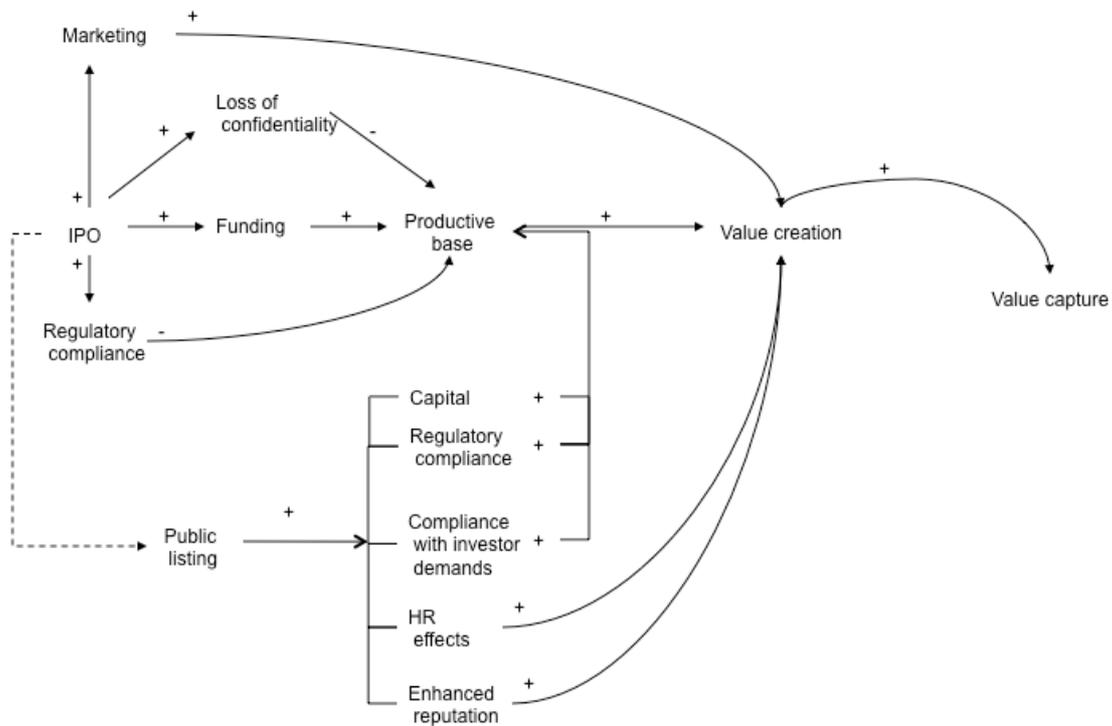
## **4. Applying the conceptual model to relevant evidence**

### **4.1. Constructs and indicators.**

To attract finance needed to fund resource-building, the new firm must convince funders that it has the potential to create value. Regulatory, market and technological uncertainties are factors that affect its value creating potential, which are the dependent variables of the model. The IPO is a liquidity event that may provide the firm with the funds needed to improve its resource base for value creation and capture. Building on the conceptual model depicted in Figure 3.1, the expected impact of an IPO on business development is shown in Figure 4.1. The model shows intervening variables as interconnected and hypothesises that an IPO and a public listing have a positive impact on value creation.

Feedback of the kind shown in the model are illuminating because “it is the analysis of such [causal] loops which facilitates understanding of how the processes, organisational boundaries, delays, information and strategies of systems interact” (Wolstenholme et al. 1993). Systems analysis has been concerned predominantly with information and resource flows. Cognitions (perceptions and sense-making) that motivate the actions of participants in economic systems are no less relevant. Penrose was recognising this when she described the business environment as an image in the eye of the entrepreneur (Penrose 1959). Accordingly our model includes such elements as reputation of the firm and market sentiment.

**Figure 4.1 The expected impact of IPO on business development of newly listed firms**



Indicators of the key variables in figure 4.1 are discussed in the evidence summarised below, drawn from our dataset of environmental product firms on AiM. The next part of the paper examines whether the observed evidence is congruent with the evidence expected from the model.

#### 4.1.1 Opportunities to attract investors on AiM<sup>5</sup>

We examined evidence on opportunities to attract investment that AiM has offered for environment enterprises in recent years. AiM is one of the world’s fastest growing exchanges by number of IPOs (Mendoza 2007). Ideally listing on AiM should contribute to a reduction of regulatory costs for companies while maintaining investor protection at an acceptable level. The lower regulatory costs of AiM provide an opportunity for small firms to go public (Mendoza 2007; Boone 2006). Though a few studies have reported evidence on AiM, the focus has been on its regulatory regime (Board et al. 2005; Board et al. 2006; Mendoza 2007). There is no literature analysing the experience of AiM-listed companies.

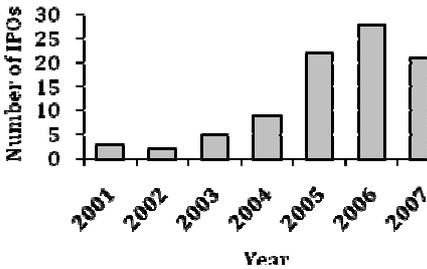
“... the emergence of AiM offers many smaller cleantech companies (and their investors)

<sup>5</sup> Unless otherwise specified this analysis is based on information from the ETC Database (2008).

opportunities to get a public market listing and gain exposure to a much wider range of investors” (Forum for the future 2007). AIM is emerging as the dominant international market for environmental firms (DTI 2006). It has been argued that AiM has been an alternative source of early-stage funding for many Environmental technology companies: “most AIM listings have acted to raise relatively small amounts, comparable to later stage venture capital investments, rather than allowing historic investors to cash in value” (Forum for the future 2007).

Of the 100 largest public environmental companies 78 are listed on AiM and 22 are listed on the official list.<sup>6</sup> Overall, 91 environmentally-focused companies are listed on AiM. The majority of these companies are incorporated in the UK (52%), followed by the US (20%), the Channel Islands (9%) and China (5%). At the time of the study, there were 1772 companies listed on AiM<sup>7</sup>, so about 5% of the AiM companies were active in the clean tech sector (JEMU, 2002; UK CEED, 2006).<sup>8</sup> The number of environmental goods and services companies undertaking an IPO increased since 2005, with a peak of 28 IPOs in 2006.

**Figure 4.2 Number of IPOs of environmental goods and services companies 2001 – 2007**



This research concentrates on companies which are incorporated in and have their main operations in the UK and on four other companies with significant operations in the UK. The

<sup>6</sup> Envirodaq (2008a)

<sup>7</sup> AiM (2008)

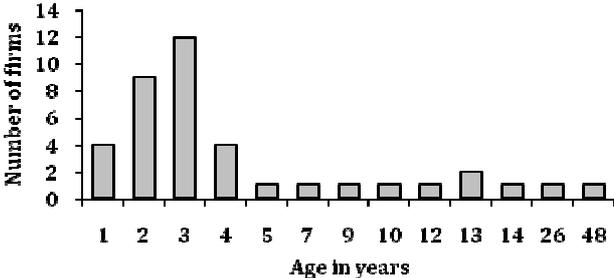
<sup>8</sup> The following sub-sectors are found in the UK DTI’s classification of clean technologies (JEMU): Air Pollution Control, Cleaner Technologies and Processes, Contaminated Land Remediation, Energy Management, Environmental Consulting Services, Environmental Monitoring and Instrumentation, Marine Pollution Control, Noise and Vibration Control, Renewable Energy, Water and Wastewater Treatment, Waste Management and Other (JEMU, 2002).

emphasis is on companies that were currently listed on AiM.<sup>9</sup> For this research, only companies involved in the environmental technologies industry and not in the environmental services or environmental financial services industry have been analysed. On this basis a focal dataset of 38 companies was created for the analysis.

The listed companies are active in sectors in which they detect market opportunities for clean tech innovations, in particular in Renewable Energy (27%), followed by Waste Management (24%), Energy Management (18%), Cleaner Technologies and Processes (13%) and Air Pollution Control (5%). Companies active in the Water and Wastewater Management, Air Pollution Control and Reclamation and Remediation of Land sectors are also represented.

The majority of UK Environmental technology companies listed on AiM are relatively young and at an early stage of development. The average age of the companies is 6.0 years. The average age at IPO was 3.8 years.

**Figure 4.3 Age of environmental technology companies at IPO**



**4.1.2 Reasons for listing on AiM<sup>10</sup>**

Admission documents reveal that funding is the most important reason environmental technology companies have for going public. Funding is mainly to be used as working capital and for the recruitment and retention of personnel, product development and executing the business strategy in general. Other important reasons for a public listing are that firms sought to raise their company profile and repay their loans.

<sup>9</sup> The dataset also includes two companies which have recently delisted from AiM (Biofuels Corporation plc and Compact Power Holdings plc). One company has switched from the LSE to AiM. According to public domain information, only one company of the dataset had ceased trading by July 2008, namely Compact Power, which was bought by Ethos Energy.

<sup>10</sup> Unless otherwise specified this analysis is based on information from the ETC Database (2008).

**Table 4.1. Reasons for listing on AiM**

<b>Reason for listing</b>	Increase Working capital	Raise company profile	Funding for HR	Funding for product development	Funding for business strategy
<b>Percentage of admission documents specifying reason</b>	70	55	50	41	28

There are 38 companies but each admission document specifies several reasons

Thus, the database of environmental technology firms on AiM reveals that these firms identify opportunities in a wide range of sectors and that they see funding through IPO as increasing their chances to create and capture value.

#### **4.1.3 Risk factors of AiM-listed environmental technology companies**

The conceptual model proposes a link between technological, market and regulatory risk and the availability of funding. The number of risk factors listed in IPO admission documents provides proxy evidence of higher or lower risk incurred (Moore, 2005). This offers a pragmatic way of comparing risk, though without measuring the severity of the risk factors or their potential impact on cash flow (Moore 2005). The ‘Risk factors’ listed on AiM admission documents tend to be similar and to a certain degree standardized. However IPO prospectuses cite diverse risk factors for different firms and acknowledge real and distinctive risks, if only as a defence against possible investor litigation.

Risk factors apply both to the company and to the market in which the company operates. An analysis of 32 AiM Admissions documents has yielded mention an average of 12.46 risk factors; the lowest number of risk factors being 3 and the highest number of risk factors being 27, with a mode of 11 (5 times).<sup>11</sup> In 64% of the admission documents the early stage of development of the company is mentioned as an explicit risk. Marketability risk and commercialisation risk are mentioned in 52% and 33% of the analysed documents respectively. 76% of the admission documents explicitly highlight the investment risk for shareholders. Other important risk factors identified are competition, the reliance on key personnel and IP risk.

<sup>11</sup> The admissions documents of the two delisted companies could not be obtained. Three relevant admissions documents were not disclosed. One admission document does not specify risk factors.

**Table 4.2 Risk factors**

<b>Risk factor</b>	Key personnel	Investment	Competition	Early stage company	IP	Marketability	Commercialisation	Forward-looking statements
<b>Percentage of admission documents specifying factor</b>	82	78	77	65	64	60	38	40

In our conceptual model we proposed that technical, market and regulatory uncertainties reduce funding opportunities, which, in turn, reduces the propensity of firms to create value (see e.g. Maine and Garnsey 2006). These companies recognised risks and sought IPO funding in part to overcome them. What was in question in the inquiry was whether IPO opportunities on AiM made this possible by enhancing the ability of firms to create value.

#### 4.1.4 Value creation and capture<sup>12</sup>

Accounting measures have limitations already referred to as measures of value, but they provide for some degree of comparability of evidence from different firms. Accordingly we used sales revenues and profits as proxy indicators of value creation and capture. Share price provided a further measure of value capture from the investors' perspective. The evidence showed that many of the firms in the dataset had not yet achieved revenues or profits, unlike firms launching on stock markets that require a trading record. Of the companies in the dataset, 36% were pre-revenue at the time of IPO and 79% were pre-profit at the time of IPO (figures 4.5 and 4.6).

**Table 4.3 Revenues of Environmental Technology Companies**

<b>Year</b>	IPO-1	IPO	IPO+1	IPO+2	IPO + 3	
<b>Revenues in £ ,000</b>						
0		41*	37	12	11	17
1-100		6	20	8	5	0
101-1000		22	6	35	16	17
1001-10000		9	20	12	37	33
10001-20000		16	9	15	16	8
> 20000		6	9	19	16	25

\* Percentage of companies

<sup>12</sup> Unless otherwise specified this analysis is based on information from the ETC Database (2008).

**Table 4.4 Profits of Environmental Technology Companies**

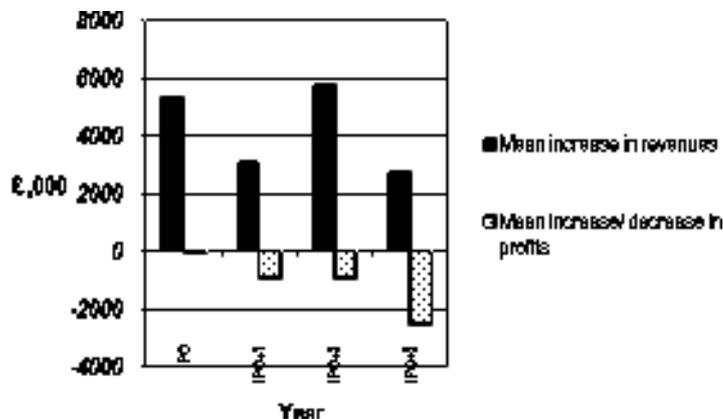
Year	IPO-1	IPO	IPO+1	IPO+2	IPO+3
<b>Company performance</b>					
Loss-making	77*	72	59	66	60
Profit-making	23	28	41	34	40

\* Percentage of companies

We also examined company growth in terms of revenues and profits. Growth in revenues was measured as the difference in sales compared to the previous year. This measure of absolute change was chosen over growth rates or percentage growth which are not computable for firms starting with initial revenues of zero (Eisenhardt and Schoonhoven 1990). For comparability, profit growth was also measured in absolute terms.

We found that value creation moved ahead of value capture, as predicted by our conceptual model where value creation is a necessary but not a sufficient condition for value appropriation. Figure 4.9 shows that the majority of companies increased their revenues in the IPO year and the three years following IPO. In contrast, only a minority of firms increased their profits in the IPO year and the first two years after IPO. This only changed in the third year after IPO, by when a majority of firms increased their profits. This suggests that business development must reach some threshold before sales can be generated on a profitable basis (Garnsey 1998).

**Figure 4.4 Mean revenue and profit growth after IPO**



**Table 4.5 Performance compared to pre-IPO level**

Year	IPO	IPO+1	IPO+2	IPO+3
<b>Company performance</b>				
With revenue growth	48*	72	82	76
With profit growth	39	42	47	42

\* Percentage of companies

We saw that at the time of IPO, 36% of the dataset firms were pre-revenue and 79% were pre-profit (see figures 4.5 and 4.6). Three years after IPO, only a small minority (14%) of the firms were not generating revenues, but 60% were not yet profitable. Of the majority firms launched without profits, only a quarter had achieved profitability three years later. Share price did not move in synchrony with the advance in business development demonstrated through increasing sales, falling instead in response to profit delays (figure 4.9).

**Table 4.6 Post-IPO revenue, profit and share price increase for 38 AiM listed environmental companies**

Year	IPO	IPO+1	IPO+2	IPO+3
<b>Company performance (% of companies)</b>				
revenue growth		48	68	67
profit growth		39	44	45
share price increase			55	39

Not all revenue data provided by the firms maps sales performance. The revenues of CERES power plc, Oxford Catalysts plc and Axeon plc, for example, included income from partner development agreements. The revenues of Renewable Energy Generation plc, Oxford Catalysts plc and Tanfield plc included government grants.<sup>13</sup> But revenues measured to include the attraction of such funds does provide some indication of whether AiM status enhances the ability of firms to attract grants and investment which should benefit cash flow and future value creation.

While revenues were achieved before profitability, as predicted, other predictions are not supported. As the number of firms with revenue and profits increased, so the proportion of

<sup>13</sup> CERES Power Annual Report 2007; Oxford Catalysts Annual Report 2007; Axeon admission document (2005), Renewable Energy Generation Annual Report 2007, Tanfield admission document (2003)

firms showing a rise in share value should increase, but this did not occur. Business development did not enhance stock market performance under conditions of falling share values. Advances in business development through further share issues on the stock market were thereby rendered problematic.

Share prices are affected by many factors other than company performance, while company performance is also influenced by numerous factors. Prior research has highlighted that share prices of small and difficult-to-value stocks are particularly vulnerable to cyclical market sentiment unrelated to business performance (Baker and Wurgler 2007; Levis 2001). For a number of reasons, therefore, the growth patterns shown above cannot be attributed solely to the companies’ IPO experience. It is impossible to say what growth might have occurred in the counterfactual situation, had these companies not carried out an IPO; we can only record performance that has accompanied IPO for these firms. On this basis, the variance between predicted and observed findings is summarised in Table 4.1

**Table 4.7 Summary of database evidence**

	<b>Predicted impact on funding</b>	<b>Observed impact on funding</b>
Technical uncertainty	Negative	Negative
Regulatory uncertainty	Negative	Negative
Market uncertainty	Negative	Negative
	<b>Predicted impact on share price</b>	<b>Observed impact on share price</b>
Value demonstration measured by sales	Positive	Negative
Productive base measured by patents and sales	Positive	Not available

Share price of the clean tech ventures was closely linked to market sentiment accompanying speculative interest in clean tech companies prior to 2006, followed by a fall in values that occurred before the financial crisis of 2008. A downward trend marked the AiM FTSE Allshare index from late July 2007. This trend accelerated in September 2008. While these trends would explain the lack of response of share price to business development, the effects were not uniform but firm specific. Thus information from individual cases is needed to throw light on disparities between predictions from our model and the evidence summarised here.

## **4.2 Case Studies**

To elucidate anomalies between predicted outcomes and evidence observed in the dataset, we undertook four case studies from our AiM dataset. The companies were selected from different environmental technology sectors, with level of commercialisation of technology and company growth illustrating differing levels of maturity. Table 4.2 provides a comparison of the case companies. Concise case summaries follow, with a focus on our main research question, why and with which consequences the selected case companies listed on AiM.

**Table 4.8 Overview of case studies <sup>14</sup>**

Company Name	Age	Sector	Value of products for customers	Environmental benefits of product	Business Model and Strategy	Risks	IPO on AiM	Net amount raised at IPO
CMR Fuel Cells plc	7	Energy Management	<ul style="list-style-type: none"> <li>- Address energy gap for portable solutions</li> <li>- Provide size and cost benefits</li> </ul>	Yes	<ul style="list-style-type: none"> <li>- Stack producer</li> <li>- Choose market that are insensitive to pricing</li> </ul>	Technology, market and regulatory risks	2005	£11.5 m
Modern Water plc	1	Water and Wastewater Treatment	<ul style="list-style-type: none"> <li>- Economic benefits</li> <li>- Enhanced sustainability</li> </ul>	Yes	<ul style="list-style-type: none"> <li>- Water treatment</li> <li>- Company develops and operates water projects that have lower operating costs</li> <li>- Proof of technology through showcase projects</li> </ul>	Technology, market and regulatory risks	2007	£ 28.6 m
Voller Energy plc	3	Energy Management	<ul style="list-style-type: none"> <li>- Noise, vibration, health &amp; safety</li> <li>- Sustainability</li> </ul>	Yes	<ul style="list-style-type: none"> <li>- Fuel cells systems integrator</li> <li>- Sales and market oriented</li> <li>- Targets niche markets in the military, construction and leisure industry</li> </ul>	Market, technology and regulatory	2005	£ 9.1 m
Kleenair Systems International plc	4	Air pollution control	<ul style="list-style-type: none"> <li>- Enable customers to comply with environmental regulation</li> <li>- Supply customers with products to execute CSR strategies</li> </ul>	Yes	<ul style="list-style-type: none"> <li>- Marketing and sale of NOx and particular filters</li> <li>- Manufacturing outsourced to licensee</li> <li>- First market: London's LEZ Later: other LEZs in UK and Europe and companies with CSR programmes</li> </ul>	Market and regulatory risks	2006	£ 1.1 m
Novera Energy plc	10 (1)	Renewable Energy	<ul style="list-style-type: none"> <li>- Enable customers to comply with renewables obligation and execute CSR strategies</li> </ul>	Yes	<ul style="list-style-type: none"> <li>- Renewable energy generation</li> <li>- Initial customers utility customers</li> <li>- Planned to target large end consumers</li> <li>- In recent years stronger emphasis on business development than investment</li> </ul>	Market, technology and regulatory risks	2005 (2007)	£ 5.3 m

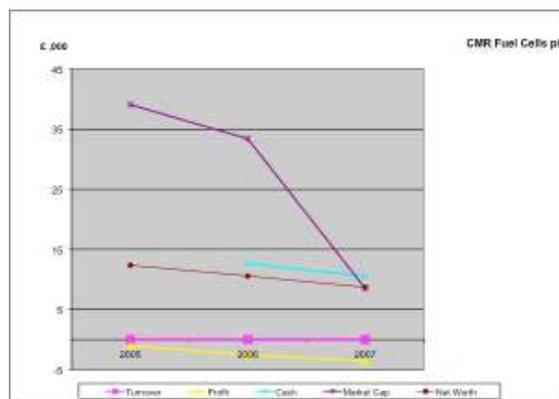
<sup>14</sup>

ETC database (2008), Company websites, Admission documents.

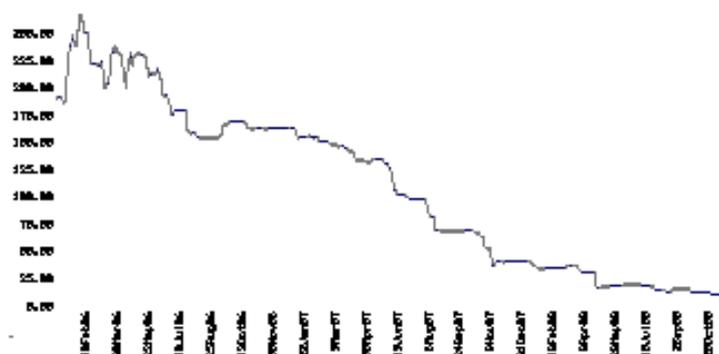
#### 4.2.1 CMR Fuel Cells plc

CMR Fuel Cells Limited was incorporated in October 2003, based on a novel fuel cell technology developed over the preceding four years when the inventors were working for the Generics Group in Cambridge, UK. CMR aims to commercialise fuel cell stacks for portable and small stationary power generation applications. In December 2005, the company successfully listed on AIM, raising £11.5 million. Share price has shown a declining trend since the flotation because of negative market sentiment, despite advances in product development. The slide in share price following a high value IPO resulted in a cash mountain over twice the size of its 2008 market capitalisation. These reserves provide prospects for the company to grow through acquisition.

**Figure 4.5 Metrics for CMR fuel cells plc**



**Figure 4.6 Share price of CMR Fuel Cells plc**



A punitive pre-IPO VC deal made it more difficult for CMR to achieve liquidity through IPO. However, flotation on AiM during the booming IPO market of 2005 was found (by those

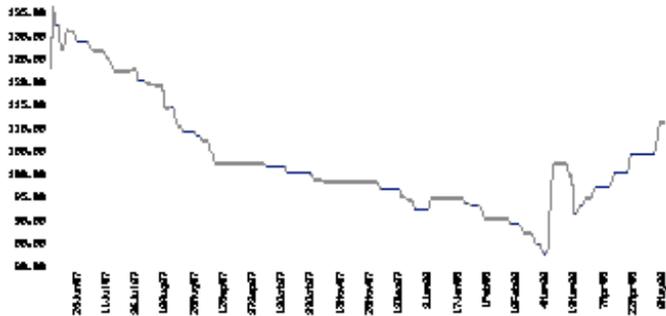
involved in both) to be “far less confrontational” than their previous VC-funding efforts. While CMR had to deal with challenges associated with lock-in, overhang and the relationship with their official advisors (NOMADS), the introduction of more professional management systems as required by the IPO was held by at least one founder to have been beneficial.

**4.2.2 Modern Water plc<sup>15</sup>**

The IP GROUP founded Modern Water in 2006 to pursue business opportunities based on the increased demand for water technologies. Modern Water’s technologies are more energy efficient than existing technologies and enabling the use of recycled water and seawater.

In 2007 Modern Water successfully floated on AIM to raise capital to develop projects and increase R&D efforts, to acquire new technologies and to recruit and retain employees.<sup>16</sup> Modern Water was able to recruit personnel for key management positions after the flotation on AiM. While its share price dropped initially, the trend later became more positive. Modern Water has a high proportion of long-term institutional investors<sup>17</sup> who apparently supported the company in its pre-revenue development phase on the assumption that progress was being made towards meeting projected targets. However, the company reported that the regulatory burdens associated with being listed on AIM can be a distraction from other business objectives.

**Figure 4.7 Share price of Modern Water plc**



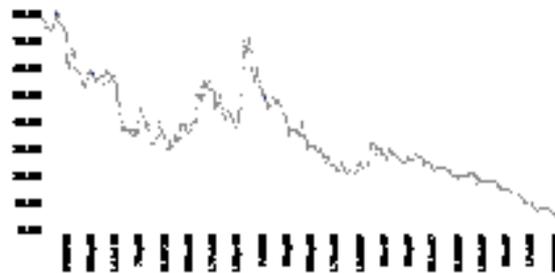
Source: www.lse.co.uk

<sup>15</sup> Unless otherwise specified this case study is based on an interview with Thomas Yeung, Business Development Director of Modern Water plc, on 15 April 2008.  
<sup>16</sup> Modern Water Aim Admission Document (2007)  
<sup>17</sup> Company website

### 4.2.3 Voller Energy plc<sup>18</sup>

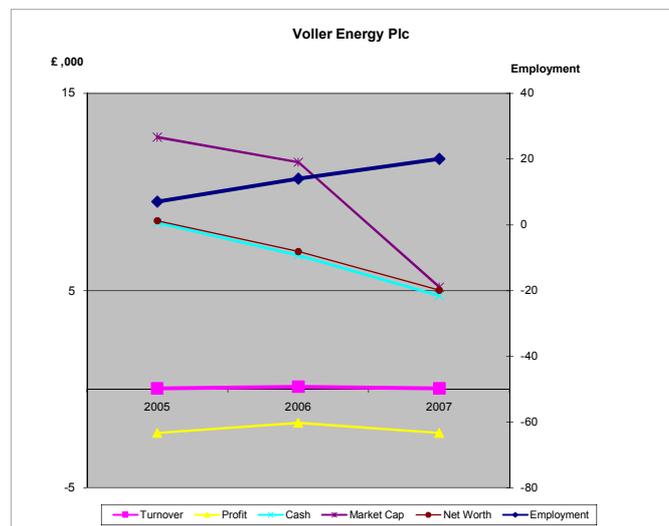
Stephen Voller (CEO) and Michael Clarke founded Voller Energy in 2002 to produce battery chargers and mobile generators based on fuel cell technology. Voller Energy raised additional funds for working capital, product development and commercialisation, partner programs and the acquisition of a subsidiary through its flotation on AIM in 2005.<sup>19</sup> The company's share price has been volatile with declining trend since the flotation in 2005.

**Figure 4.8 Share price of Voller Energy plc**



Source: [www.lse.co.uk](http://www.lse.co.uk)

**Figure 4.9 Metrics for Voller Energy plc**



In response to falling share values, Voller Energy launched a strategic review to anticipate and prevent any major cash problems. Options considered in this strategic

<sup>18</sup> Unless otherwise specified this case study is based on an interview with Stephen Voller, CEO of Voller Energy plc on 11 April 2008.

<sup>19</sup> Voller Energy AiM Admissions Document (2006)

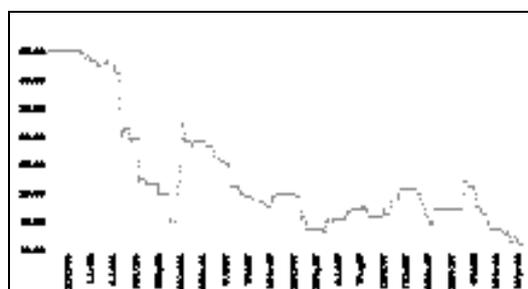
review are the formation of strategic alliances, mergers, refinancing or sale. Admission on AiM had created difficulties for Voller Energy. It is not yet clear which fuel cell technology will gain market acceptance, but to show rapid progress in product development, as required by investors. Voller had to commit to a specific milestone programme, curtailing their ability to experiment with different business markets and innovation possibilities. There were opportunity costs for a resource-constrained start up in the regulatory costs associated with being listed on AiM, which were experienced as heavy.

#### 4.2.4 Kleenair Systems International plc<sup>20</sup>

Kleenair Systems Limited was founded in 1997 as an affiliate of the US company Kleenair Systems Inc. Kleenair Systems had achieved some sales by 2007 but was still in pre-profit. After a private offering of shares raising about £1.5m Kleenair Systems listed on AiM in 2007 to raise working capital, achieve a more diversified shareholder base and raise its corporate profile. The CEO explains that he did not want venture capitalist involvement in the company as this would probably entail a loss of control. Kleenair Systems raised round £ 1m at IPO. At the beginning of 2008 the company successfully completed a further offering of shares raising more than £1m.<sup>21</sup>

The share price of Kleenair Systems has been volatile with a downward trend. In July 2006 the price rapidly declined because of a lock-up dispute. In addition, Kleenair Systems' share price has been negatively affected by regulatory uncertainties.

**Figure 4.10 Share price over time of Kleenair Systems**

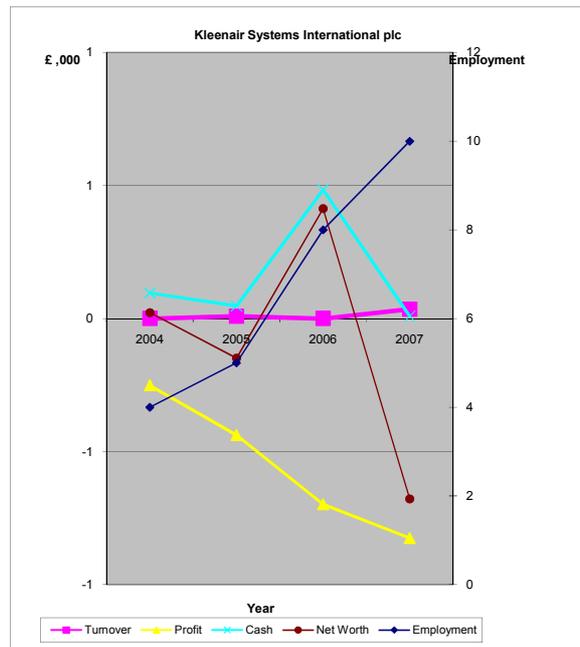


Source: [www.lse.co.uk](http://www.lse.co.uk)

<sup>20</sup> Unless otherwise specified this case study is based on an interview with Lionel Simons, Chairman and CEO of Kleenair Systems International plc, on 29 April 2008.

<sup>21</sup> Kleenair Systems International plc Annual Report 2007.

**Figure 4.11 Metrics Kleenair Systems plc**



In recent years Kleenair Systems has attempted to focus its activities increasingly on corporate social responsibility projects so as to be less dependent on regulatory drivers. However, Kleenair Systems had to focus much of its attention on compliance with AiM regulations. For this reason, only limited resources could be committed to business development.

#### 4.2.5 Novera Energy plc<sup>22</sup>

Novera is the second largest landfill gas operator in the UK and one of the 10 largest producers of renewable power in the UK. Operations have been scaled up recently and formal management systems such as target setting and performance management have become increasingly important. The firm aspires to market presence, a stronger position in negotiations with suppliers such as turbine manufacturers and a stronger financial position as a result of an IPO on AiM.

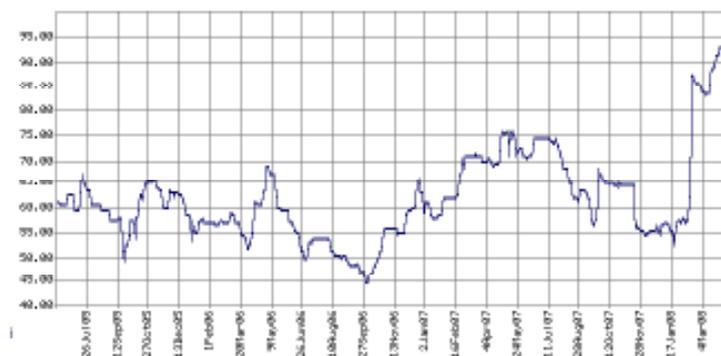
Novera Energy was founded in Australia in 1998, as Novera Energy plc, and listed on the Australian Securities Exchange (ASX) in 2002. Increasingly it shifted its focus to

<sup>22</sup> Unless otherwise specified this case study is based on an interview with David Fitzsimmons, CEO of Novera Energy plc on 17 April 2008.

the UK to improve access to business opportunities there.<sup>23</sup> In 2007 Novera was re-incorporated as Novera Energy plc in the UK and Novera Energy Limited became a subsidiary of the UK parent company. In 2005 Novera Energy listed on AIM, partly to emphasise the UK affiliation and to gain investor support to acquire the remaining 50% of their joint venture. Following this development Novera delisted from the ASX in 2006. The management of Novera Energy believes that the public listing on AiM has been beneficial in attracting high-calibre employees.

The share price of Novera Energy has been volatile but rose sharply in the first half of 2008 Novera to coincide with takeover negotiations, possible evidence of speculative activity.

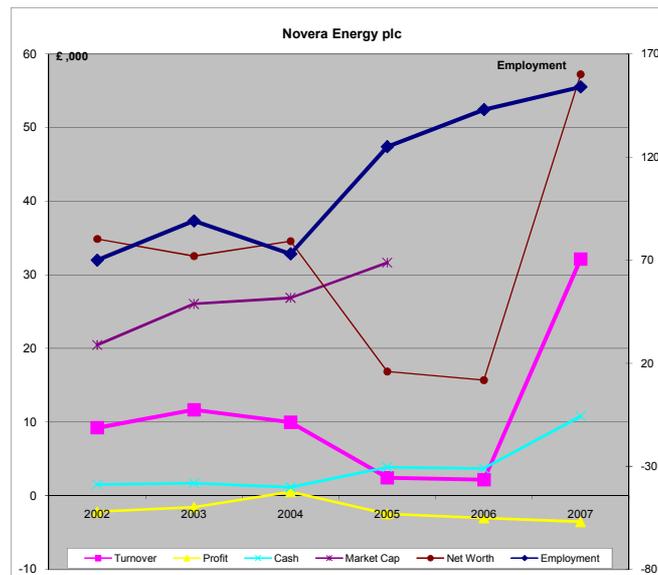
**Figure 4.12 Share price over time of Novera Energy plc**



Source: [www.lse.co.uk](http://www.lse.co.uk)

<sup>23</sup> Novera Energy Annual Report 2002.

**Figure 4.13 Metrics for Novera Energy plc**



#### 4.2.4 Summary of case evidence

In table 4.3 we summarise evidence from our case studies in relation to key variables outlined in the conceptual model. The case studies did not show the share price clearly rising in proportion to advances in business development, any more than had the dataset evidence.

**Table 4.9 Summary of relevant case study evidence**

	Predicted impact on share price		Observed impact on share price	
<b>Value demonstration, measured by sales</b>	positive		negative	
<b>Productive base development, measured by patents and sales</b>	positive		Not available	
<b>IPO</b>	Predicted impact on business development		Observed impact on business development	
	HR	positive +	HR	positive +
	Flexibility	negative	Flexibility	negative - -
	PR	positive +	PR	negative - - -

In particular, the management of CMR and Voller Energy highlighted the difficulties of being presented with share price as “an external variable that is strongly influenced by cyclical sentiment and over which you have little control” (Michael Priestnall,

founder of CMR). The impact of the IPO on HR, management flexibility and public relations (company image) was mixed. Human Resource effects were expected and found to benefit from IPO. Modern Water and Kleenair Systems explicitly stated in their admission documents that they hoped to recruit and retain personnel through the funds obtained through IPO. Modern Water and Novera Energy have confirmed that the IPO had positive HR effects for them. For all other intervening variables, the effect on value creation and capture is not as expected from prior literature.

A listing on AiM appears to have more negative consequences than assumed in conventional analysis of the benefits of IPOs. Ultimately, value creation through business development can be unfavourably affected by inflexibility that results from regulatory and shareholder demands. All those interviewed for the case studies mentioned the costs and fees of being listed on AiM. The costs were heaviest for the smallest company, Kleenair Systems, for which AiM was described as “a straightjacket”. For Novera Energy and CMR, however, the discipline of introducing more professional management procedures as required for a public listing was found to be beneficial. This indicates the need to distinguish between those formalisation requirements that improve management efficiency, and those that impose reporting burdens unmatched by productivity improvements.

The companies reported pressure to achieve results in the short term, with ambiguous effects. For example, Voller met these demands by committing to a detailed milestone programme which limits scope for strategic flexibility and entrepreneurial problem solving. Institutional investors sold out or down despite these efforts. Although Voller avoided loss of management control to VCs, the formal procedures and metrics required by firms listed on AiM had the effect of curtailing autonomy in other ways.

It was found that regulatory compliance can distract from value creation. This was mentioned both by Kleenair Systems and by Modern Water. Kleenair acknowledged that going public shifts the priorities from creating and capturing value to compliance with regulatory requirements. Compliance did not always induce the further investments which would have compensated for the opportunity costs incurred.

Formal procedures, like formal milestones, were viewed as curbing flexibility, seen as a young firm's main advantage over established companies.

While going public has public perception effects, these were mixed. They helped some firms to attract partnerships needed for business development where these were not in place prior to IPO. But observed firms have suffered from the negative reputation effects of largely declining post IPO share prices. Instead of being able to engage discretely in early problem solving and learn from making errors, the firms had to issue news releases when problems arose. These had an unfavourable impact on investor perceptions and share price, preventing further share issues. Moreover share values did not closely reflect the firms' value creation performance. In two cases share prices fell as sales rose. The case studies revealed evidence of speculative market sentiment impacting on firms' market valuation. The cases demonstrated how some of the factors shaping shareholder value move independently of a firm's value creation activity.

Ideally the creation of shareholder value is aligned with the creation and capture of firm value through business development. However, a gap between share price trends and the business development of listed firms results from market sentiment and communication problems. This gap becomes particularly acute during a period of stock market volatility. Share price is affected by the relationship between company and its nominated advisor (NOMAD), when the latter influences investor responses to the company. Long-term support from Nomad advisors was found difficult to sustain, reflecting a principal-agent problem between the management of the listed firm and their advisors.

In addition, the evidence showed a divergence between steps taken to enhance shareholder value and those needed to improve value creation through creative matching of resource configuration to opportunities. While more efficient management procedures are beneficial formal methods introduced primarily to ensure external control may not be appropriate in young companies where strategic flexibility is needed in conditions of high uncertainty. On the basis of evidence from our inquiry, we propose a refinement to our conceptual model: the benefits of

business model flexibility are to allow “strategic realignment” between value demonstration and further value creation/capture (a feedback loop).

There are limits to what cross sectional data can reveal of the challenges and opportunities facing such companies. Explanatory power is strengthened by a control group in this type of analysis, but it would not be possible to provide precisely matched cases of firms that have not launched on AiM for this purpose. Richer longitudinal evidence from case histories should, however, aid understanding. Four case studies have been found by authorities in research methods to provide revealing evidence (Eisenhardt 1989), but even five such cases provides a small research base. Many environmental technology companies have only recently listed on AiM and their development record should be followed up. Future research should be based on more interviews with more companies from different sectors and in different countries. While this research has concentrated on the perspective of the firms undertaking an IPO, it would also be relevant to study investor and stakeholder perspectives more fully.

## **5. Conclusion**

The number of enterprises launching environmental technologies through a listing on AiM indicates strong investor interest in environmental innovations, despite the high level of technology, market and regulatory risk reported by the firms in the study. Congruent with the prediction that an IPO can improve business development, the database companies as a whole reported higher revenues and profits three years after IPO than at IPO and performed better than firms in many other sectors in terms of growth. However 60% of the analysed companies were not in profit three years after IPO. Case findings showed that the costs of complying with required regulations and reporting controls proved to be a constraint on value creation by such firms.

Quantitative data of this kind cannot fully reveal the impact of IPOs on business development, a central issue in our conceptual model. To elucidate these issues we obtained observations from case evidence. Change in governance to favour shareholder value should in theory improve value creation and capture. Short termism is a known investment problem that AiM was designed to reduce. The lifting of

standard requirements for a trading record before IPO opened the capital markets to new ventures. However our evidence revealed that short term pressures reduced decision-making autonomy for young environmental innovators. Emerging technology companies operating under conditions of high uncertainty had to standardize their procedures and measures; they had to show evidence of strategic consistency on milestone programmes. The pursuit of shareholder value on these terms, together with pressure to meet investor expectations for rapid returns, curtailed decision making autonomy and flexibility for the case study firms. History shows that the entrepreneurial mode of innovation requires scope for creative solutions (Miller and Garnsey 2000). More efficient management practices should not be confused with standardised management and reporting procedures that are aimed primarily at facilitating external control. During early business development controls of this kind may inhibit creative solutions that are to the long term benefit of investors in emerging technologies.

Some young firms have a mature productive base and proven market focus and can usefully introduce the formal procedures required by official stock markets. But more often young ventures succeed by experimenting with opportunities and the way they configure resources (Hugo and Garnsey 2004). Successful entrepreneurs since the time Edison and Ford have broken with convention. Young firms with emerging technologies often benefit by differentiating themselves from competitors through innovative ways of proceeding, rather than by standardising to conventional business practice. Case evidence shows that formal management systems and investor expectations impede entrepreneurs' ability to undertake the strategic realignment which enables enterprises to realise opportunities in unexpected ways.<sup>24</sup>

Long term investment could receive more fiscal incentives since informed investors would benefit from young firms' ability to create and capture a higher level of value over a longer period, while the costs of environmental problems to the government would be thereby reduced. An IPO on AiM was chosen by many environmental enterprises as the best source of funding available to them, and this may have been the case during the boom. But other innovative investment vehicles are needed. A wider

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<sup>24</sup> Interview with Kleenair Systems, op. cit. p.22.

portfolio of investment alternatives could provide more support to ventures with environmental innovations.<sup>25</sup> These could protect companies launching new environmental technologies from some of the ill effects of volatile market sentiment, of heavy penalties for inevitable errors and the need to commit in advance to specific market objectives under conditions of uncertainty. Investment instruments that allow entrepreneurial firms the autonomy to experiment and the flexibility to change strategic direction are needed if effective environmental technologies are to be launched and diffused.

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<sup>25</sup>For example, in the Netherlands an alternative investment vehicle can be found in the form of a government-supported green investment scheme the management of which is devolved to independent banks. ('Groen Beleggen, <http://www.vrom.nl/pagina.html?id=8350>). To compensate for lower than average returns to investors from pioneering environmental enterprises, fiscal advantages are provided to their investors, (as for an ISA in the UK). Selected environmental companies are screened by banks for business potential and are allocated capital while they are still private companies.

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