

ENVIRONMENTAL INNOVATIONS ADVISORY GROUP

EIAG PAPER

Capacity of Companies in the Environmental Industries Sector to obtain Finance for Commercialisation of Environmental Technologies

Prepared for the
Environmental Innovations Advisory Group
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2005

Environmental Industries Unit
Jointly funded by DTI and DEFRA

CAPACITY OF COMPANIES IN THE ENVIRONMENTAL INDUSTRIES SECTOR TO OBTAIN FINANCE FOR COMMERCIALISATION OF ENVIRONMENTAL TECHNOLOGIES

EXECUTIVE SUMMARY

The EIU has collected and analysed evidence from more than 40 (mostly young) companies that are trying to bring environmental innovations to the market. These findings demonstrate that it is difficult for many environmental firms to raise sufficient finance to take their innovations from initial conception through to the point of commercialisation. Innovations cover one of four areas - equipment, processes, materials and services.

Using a generic 14-stage technology commercialisation process, we have seen that many environmental innovations appear to fail at Stage 7. After initial "proof of concept funding", such innovations often become stalled for a number of different reasons, which have been identified. This is a common problem for start-ups, micro-SMEs and one-man operations, with many of the same types of generic barrier applying.

Initial problems raising finance may be compounded later on in the commercialisation process by the need for further finance, for example when testing/certification or Environment Agency permit applications are required etc. These issues start to add a specific, environmental sector dimension to the whole commercialisation process which has hitherto been unexamined. With many environmental innovations, therefore, we conclude that such sector-specific barriers need to be considered and, if possible, action taken to resolve them at an early stage.

Clearly all firms have differing abilities to overcome financial pinch points during the commercialisation process. EIU's research shows that some environmental firms have been able to overcome various barriers and progress their innovation; others have decided to pursue an alternative technology in their portfolio in the hope of bringing this to market instead. We have also seen that other firms are languishing or have given up completely trying to process. Overall, one of the main conclusions from our analysis is that many young companies lack the requisite management, finance, production and marketing skills and experience to bring an environmental innovation to market.

In many cases, it appears to be the inexperience of the technology innovator that prevents sound management decisions being taken at various critical points in the commercialisation process. Poor risk assessment and management, and its impact, for example, on the financial continuity within the firm's R&D process, also plays a large part in preventing companies bringing their products to market. This is particularly the case for exchanging IP and/or a share in the company for financial backing.

Many of the investment readiness issues raised by this paper are well known both to Government and the financial community. Despite the provision of some training/mentoring programmes in UK regions to help firms recognize and overcome these difficulties, EIU feels that more could be done to ensure that environmental firms are fully prepared.

EIU's future effort will therefore be in:

- a) Better understanding how to overcome these blockages;
- b) Understanding the generic provision that is already offered and working with relevant stakeholder groups involved in the planning and delivery of new programmes that are seeking to address such blockages, e.g. the RDA-led Framework for High Growth Business Coaching; and,
- c) Raising awareness of these investment readiness to the environmental industries sector, particularly through intermediaries such as the UK Forum for Environmental Industries and regional environmental industry support bodies.

This paper continues as follows:

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| Section 2 | Case studies showing why innovative technologies have failed to make it through the commercialisation process |
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1. STAGES IN THE TECHNOLOGY COMMERCIALISATION PROCESS

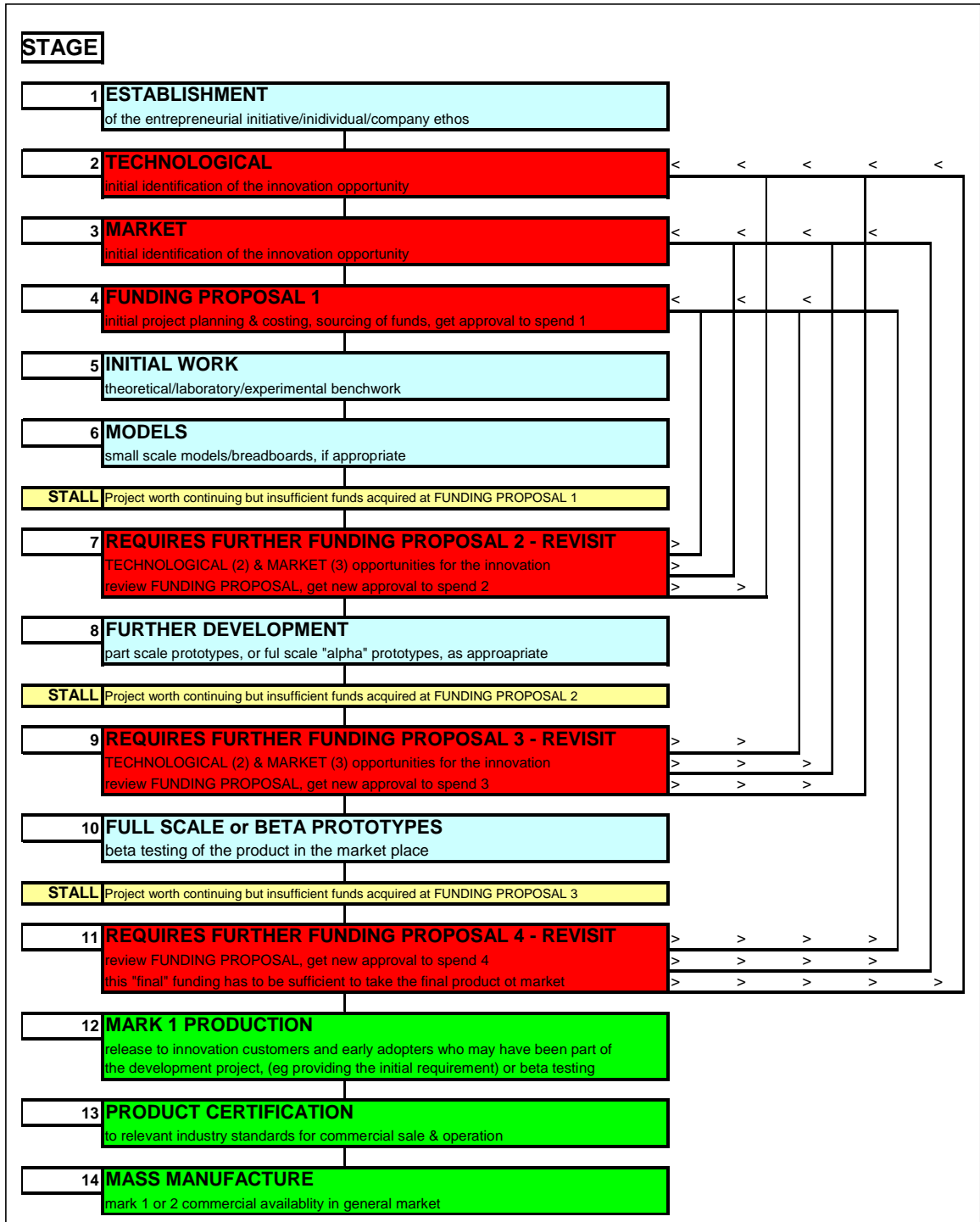
Generally, the stages through which any new developing technology will pass before it can be considered truly commercial and available in the market place at a commercial price can be summarised in the following generic, 14 stage model which assumes a linearity in progress. We have used this in order to see where companies are generally having difficulties in bringing products to market.

We recognise that the development of a new business is iterative (reflected to some degree in the model) and necessarily explorative and will include more varied routes to market than this 14 stage model implies. Hence, any specific project may not include certain stages and may run some stages in parallel with others.

Some general points to note in this process are that

- Initial Stages (2), (3) and (4) are often done on a shoestring, either by very small companies, individuals or universities, with limited commercial clout or insight.
- Therefore Stages (4), (5) & (6) tend to be limited, and the data may be more or less complete or convincing to others, especially from outside.
- Therefore **most innovations will fail at Stage (7)**; this critical problem being caused by the deficiencies at (4), (5) and (6).
- If the innovation can be taken past (7) and achieve at (8), there is a better chance of getting through (9).
- If the innovation can be taken past (9), and achieve at (10), it should generally be plain sailing from then on.

Note that innovating in environmental market areas is generally perceived to be more difficult than, for example, the aerospace or pharmaceuticals sector. This is because in the former, demand is mostly generated through regulations. In the latter the innovator tends to be more experienced/better resourced, or receive a different industry response. This paper does not address this issue further.



2. WHY INNOVATIVE TECHNOLOGIES HAVE FAILED TO MAKE IT THROUGH THE COMMERCIALISATION PROCESS

In our analysis of examples, we have focussed on innovations which have stalled at Stage 7 and above in the technology commercialisation process. Our analysis of “project stall” is necessarily subjective, based on the information supplied by firms. Case studies have been categorised under the following themes, although some firms fall into several categories:

- Voluntary restrictions or unwillingness to trade a part of the IPR for funding
- Costs too great – or rewards too little - to take forward the technology beyond prototype stage
- Bad company balance sheet
- Bank issues
- Lack of knowledge of appropriate sources of funding
- Poor market awareness
- Apathy/poor understanding of product benefits prevents finance
- Reliance/over dependence on public sector funding for demonstration plants
- Patents
- Environment sector-specific funding issues
- Multiple barriers

2.1 Voluntary restrictions or unwillingness to trade a part of the IPR for funding

Some firms appear to hold out and see whether they can “go it alone”. They might try to fund the commercialisation solely from company funds or postpone the R&D until a later date. Such approaches are clearly more viable if the company has established revenues from another product. However, some case studies demonstrate that firms may have a lack of awareness and experience of how to negotiate with financing firms. For example, they might well have unrealistic expectations of the level of IP they might retain from early stage financing.

- SMART¹ award winner (ESM010) reports that it has significant interest from a very large Japanese firm who are being very pushy in trying to take a 51% stake in their company, over 3 years (dependent on proven sales). The firm wants to resist since they think they have almost reached the point of commercialisation. (STALLED at Stage [11])
- This established plc (E0140), with 30 employees, >£30m market cap and an existing product range, is trying to sell their first significant order of biodegradable packaging. This would allow them to invest in equipment and

¹ SMART has now been renamed the Grant for Research & Development

also conduct “more aggressive marketing” of their new innovation. (STALLED at Stage [8])

- Company ESM027, an early stage company with a turnover of around £100k, said it had “no plans to develop the technology until the company is in a position to fund the development”. This reflected the firms’ inability to obtain commercial support and funding. It was focusing instead on its core (non-environmental) product. (STALLED at Stage [8])
- Company ESM011, before obtaining a SMART award, this firm tried WRAP funding to help finance some board recycling R&D. However, they were not prepared to lose some of the IP. The firm only became aware of this fact at the contract signing stage, whilst WRAP assumed the firm was aware from the outset. The firm is currently trying to advance its manufacturing process through Mark I product sales. However, this is proving very slow and with an estimated £600k of capital costs, might prove impossible to achieve. The firm has applied for further R&D funding. (STALLED at Stage [12])
- Company ESM084 has developed a thermostat to test rig scale. They made initial contact with a potential commercial developer (providing developed products into the heating control market) but were concerned about the risk of handing over commercial benefits at too early a stage in the commercialisation process. (STALLED at Stage [7])
- This company’s application to the Carbon Trust for funds for an energy efficient lighting design fell at the 11th hour because of the tight constraints on IP ownership. According to the design consultancy (E0119), there were “massive legal issues surrounding the offer of a contract” particularly if the firm had subsequently failed to commercialise the technology. As a design consultancy, typically around 97% of the total commercial benefit goes to the manufacturer. The firm therefore felt it was too risky to take that kind of binding contractual term at the front end of a project. The firm subsequently searched for a UK company to commit to the tooling and production costs for the technology. Luckily, it is now trying to pursue a partnership with a manufacturer who has expressed an interest in the innovation. (STALLED at Stage [7])
- ESM025, who have developed an efficient chemical dosing system, recognize that they’re “in the classic equity gap”. This one-man operation requires around £30k to set up tooling and production equipment plus around £2k/month to fund an employee so that they can start assembly. The owner is now faced with either remortgaging his house (which he is reluctant to do) or working with firms like Cannon Hygiene who could license his technology. However, he has an issue over how exclusive the licensing arrangement might be. (STALLED at Stage [10])
- This two-man operation (ESM044) won SMART funding to conduct applied R&D on an accelerated and sanitized compost production process. The

technology requires next stage funding to get it to ~1/10th scale demonstration. One of the Directors is very disillusioned with the finance community and has spent considerable time trying to access finance. He complained that "banks take no risk; VC will put money in but want the lion's share of the equity and the innovator to put everything on the line too; and Business Angels are hit and miss." He noted that "the whole funding regime is stacked against innovators." One possible route forward that he might explore is Finance South East (www.financesoutheast.co.uk) but he said this was slow to get off the ground. (STALLED at Stage [7])

- Many individual investors in the queue to be the second but not lead investor – this appears to be a common problem which revolves more around risk/return. ESM022, trying to commercializing an innovative waste treatment process, is one example of this (STALLED at Stage [7]).

2.2 Costs too great – or rewards too little - to take forward the technology beyond prototype stage

- This SMART award winner (ESM047) developed a successful prototype of a flexible flood protection container. However, it found that the tooling costs required to scale it up to full demonstration were very expensive. The large manufacturer collaborating on the project was unwilling to invest the capital required. The firm is close to being wound up as no progress has been made since SMART funding ended a year ago. (STALLED at Stage [8])
- E0100 has five prototype technologies, at varying stages of commercialisation, but lacks funds to develop these further. (STALLED at various stages)
- This established design consultancy (E0120) has spent 4 years and £0.5m developing an innovative anaerobic digestion system. Funded solely from in-house resources, it now desperately wants to commercialise the system. It instigated R&D on the basis of the Energy White Paper 2003 which highlighted the benefits of anaerobic digestion. The firm tried to advance the project with a large food manufacturer through a collaborative R&D bid into DTI's Technology Programme in November 2004. The bid was unsuccessful. (STALLED at Stage [7])
- This firm (E0141) has developed a prototype hot water soluble bag that is now at supported commercial stage. Further development is in hand. Resistance to change by customers is proving a major obstacle, as are limited financial resources to invest in new equipment to produce commercial quantities of the bag. A first significant order would allow the firm to invest in equipment and to do more aggressive marketing. (STALLED at Stage [10])

2.3 Bad Company Balance Sheet

A firm may be too debt laden for a financing body to be interested. Joe Dwek, a member of the Environmental Innovations Advisory Group, reports that his firm is asked to consider many companies for funding. However, many of these firms are heavily debt laden. This point was also made during the Environmental Innovation & Growth Team.

2.4 Bank issues

This firm (E0106) reported difficulty with Barclays Bank releasing to them the full Small Business Loan (possibly because the bank did not think the loan was viable). The firm changed banks to HSBC who subsequently released the funds, enabling construction of the pre-commercial demonstration unit (i.e. scale up and demonstration following successful prototyping). At this point they were informed that Barclays had in fact drawn the money from the DTI but were not releasing it to them. This firm is now trying to negotiate permitting requirements with the Environmental Agency – a further barrier which they have encountered. (STALLED at Stage [13])

2.5 Lack of Knowledge of Appropriate Sources of Funding

“There is an art in raising finance. It requires dedicated market research into which sources have an appetite for what you are trying to achieve. We have found that most entrepreneurs just do not spend enough time researching or getting advice on the financing market.” Rob Wylie, WHEB Ventures

- A young firm (ESM010) with <£250k turnover has produced a novel air filtration system but said that “it is disappointing after putting much work into making a SMART award successful that we have found it difficult to get the product to market. Lack of finance to move forward is the major problem. We have been trying to raise additional finance for 6 months so far without success.” One problem was the amount of time it took for the firm to understand possible financing routes. Fortunately both Business Link Hampshire and Finance SE were both very helpful in this regard. The firm now has a letter of intent from a company willing both to trial their technology and, if successful, to pay for it at the end. (STALLED at Stage [11])
- This firm (ESM071) would like to see easier access to seedcorn funding for established, credible companies (e.g. a fast-track funding method for clever, cheap R&D proposals). The firm has been pursuing five ‘sustainable development’ technology projects over the past 2-3 years at considerable cost. They have financed these from their profits and accumulated capital reserves. They believe that “there is a lack of seedcorn funding at £10k, £20k and £50k, which is a massive break on progress.” They claim that “the balance of risk and reward vis a vis UK innovations funding is madness.”

- A very small firm (ESM072) which has developed an energy recovery transfer system from refrigeration, noted its lack of business knowledge (e.g. business plans etc.) as a major barrier to growth and hoped to partner with a national firm to overcome this.

2.6 Poor market awareness

Firms spend insufficient resources on investigating environmental markets as they develop their innovations. Many firms have little idea of the end user markets which they could sell their products into. Business skills around marketing appear to be limited with some firms eager to buy in such skills. The following examples illustrate some of these issues; some solutions taken and, in other cases, outstanding needs for firms:

- ESM012 had developed an airbrick which can shut itself off when in contact with water, thus ensuring a house is unaffected by rising flood waters. Having developed a prototype, the company only then decided to investigate the routes to market. They sought support from Sussex Enterprise – the Sussex Chamber of Commerce - who placed the business on a High Growth Start-up programme and provided them with independent marketing advice.
- A lack of commercial awareness and customer focus was evident from one developer consulted by EIU. The firm (ESM064) had developed a micro-wind turbine and was starting to think about a site for manufacturing as well as striking a deal with a possible manufacturer. However, it had not fully considered what was their most promising end-user market. This might well lie in a developing economy, not the UK as originally envisaged, where off-grid market opportunities are more abundant. Following advice from EIU, the firm raised this issue at their next management meeting.
- A developer of an aqueous phase sensor (ESM033) required “funding to assist and lead a planned market penetration campaign, and availability of specialists with industry knowledge and network contacts.” They saw these two issues as “significant barriers to the successful commercial objective of the project and business.”
- This company (ESM067) has developed an induction charging device for electric vehicles. They believe they know the market and the competition very well. Their only real barrier is a “marketing hurdle”.
- A one-man, SMART award winner (ESM050), who has spent considerable time and money developing an innovative leak detection system, believed

that an increased percentage of the SMART award for marketing would greatly help firms as well as raise importance to firms of this crucial element.

The following **Business Links guides** show but a small amount of what is on offer to firms:

- Create your marketing strategy: guide which helps firms to identify which customers to focus on and key objectives in reaching them. Explains what to include in a marketing strategy and how it can be used as the basis for effective action.

www.businesslink.gov.uk/bdotg/action/layer?r.l2=1073858842&r.l1=1073861169&r.s=tl&topicId=1073900352

- Write a marketing plan

www.businesslink.gov.uk/bdotg/action/layer?r.l2=1073858842&r.l1=1073861169&r.s=tl&topicId=1073869186

- Market research and market reports

www.businesslink.gov.uk/bdotg/action/layer?r.l2=1073858842&r.l1=1073861169&r.s=tl&topicId=1073901910

Benchmarking pdf relating to product development/marketing:

www.benchmarkindex.com/articles/CTMG.pdf

2.7 Apathy/poor understanding of product benefits prevents finance

This one-man firm (ESM066) commented that "there's a big gap after you get a [SMART] award - they seem to leave you hanging." Whilst this points to a rather naïve viewpoint about how much help a young company can expect to receive, it is currently awaiting a response from NStar (North East VC fund) on its application for a £60k proof of concept grant award. Current blockages are finance (he remortgaged his house 2 years ago) – which he attributes to lack of understanding in the marketplace about his product's benefits - and lack of knowledge of how he can get his product manufactured [Stage 7 blockage & management capability] (STALLED at Stage [7])

2.8 Reliance/over dependence on public sector funding for demonstration plants

[N.B. Many SMART award holders demonstrate the ability to access further funding] [strong university funding dimension here]

Engineering consultancy (E0148) is currently finalising a bid to DTI for grant funding of a biodiesel pilot production plant to demonstrate the overall technology. Adapting US technology for the plant, they point out that “the single most important barrier is that both UK and EU customers wish to see an operating plant.”

Firm (E0136) is trying to produce a product from sustainable composite materials, is awaiting submission and outcome of a grant application to Defra under its non-fuel crops research programme. The firm previously had a SMART feasibility award.

University run project (ESM029) has already received two public grants - from Landfill tax credits (ENTRUST - now superseded by BREW), then SMART. However, it still requires further large funding due to the significant duration of the field trial which is required to demonstrate its safety to the EA. The innovation involves mixing concrete with waste materials and using the material as a ‘reactive’ landfill liner. They are currently negotiating with a large waste management company to secure funding. An EU bid for demonstration funding failed because “the EU does not like landfill [R&D].”

A similar situation has arisen for E0002, a university-driven R&D project linked to an aggregates company, which is thermally treating solid waste to form aggregate. The project requires funds to complete the installation of a small pre-commercial unit and make it operational, as it “needs to be seen to be in continuous operation for at least a period of six months.” Funding from both Defra’s New Technologies Development Fund and private investors have failed. Discussions with EIU left us with the impression that the project manager lacked a commercial ‘mindset’.

Innovative product (E0153), which is focused on reusing waste tyres for road surfaces, has reached a funding blockage after completing a successful three year EPSRC waste minimisation grant. Despite having strong industry connections and a potential benefit for those concerned, industry has been reluctant, on purely economic grounds, to commit money for R&D. Substantive R&D is required to refine the product including conducting more extensive field trials and further product testing at the university.

2.9 Patents

Cost of patents is too expensive – E0126 reported that patent costs were a "nightmare without backing, support or money". ESM072 noted that besides 'lack of business knowledge', the cost of establishing a good patent (£4-5k) and defending one if needed, was a major obstacle. A design consultancy (ESM032) asked why copyright is free but patent applications are not. They felt that this was stifling UK innovation. Apparently James Dyson is taking this up with the ECJ.

Patent protection - E0120, an established consultancy, is concerned that their IP for an innovative anaerobic digestion system could be threatened by insistence from a potential financial backer that they get a due diligence audit from a 3rd party (consultancy). ESM033, a firm that grew from a university research group and which has developed an innovative ammonia sensor, has now received its patent. However, it is concerned about its ability to protect it. This is also true for ESM008, an established company with a £0.5m turnover. Despite holding a US and EU patent for a radically new method of aerating sewage, they noted the "significant danger that the concept will be copied as we do not have the funding to fight a patent case." Apparently patent insurance schemes are now emerging, though this market is still "flakey" and, according to one company, "the detail is in the small print."

2.10 Environment Sector-Specific Funding Issues

a) Lack of R&D budgets in utilities make it harder for firms to obtain finance

- This small company (ESM001), run by a former employee of Anglian Water Group, is currently trialling his innovative compact wastewater treatment system with Yorkshire Water. The firm is very receptive to the technology and their R&D Department is reportedly very helpful. They have also provided invaluable resourcing which would have cost >£35k, for example, at Cranfield University). Project is now up against a funding gap, lacking the necessary funds to refine the system to prevent system blockages and provide adequate test demonstration data to ensure it can be taken to the next marketing stage. [Note: recently won a DTI Technology Programme Collaborative R&D grant]
- This firm (E0121) has developed a novel and generic technology for the measurement of oestrogen endocrine disruptors in raw and treated sewage as well as in the aqueous environment. While successful feasibility studies have been carried out by a team with a great deal of experience and expertise in this area, the market demands fully developed products which meet its needs reliably and reproducibly. Focussed funding is required to achieve this. The firm needs to work closely with water utilities and the Environment Agency to maximise the likelihood of producing technically and commercially viable products.

b) Financing of technologies becomes more favourable with onset of regulations or other critical factors

- With WEEE now in force, this firm (ESM022) reported more financial interest in their cathode ray tube waste treatment (encapsulation) process. However, there has been "no interest in financing from waste companies because the technology is non-core".
- Another firm (ESM002) has just installed its first solar powered CHP plant in the USA and reported high oil prices "assisting in potential additional private sector funding in next weeks."

c) Uncertainty of tax regime deters investment

- Despite managing to raise initial finance from Business Angels and then winning the Green Fuels Challenge zero tax rebate for a limited amount of fuel (but worth several £m in avoided tax), which investors were impressed with, the firm (ESM026) noted that "the biggest barrier to commercial exploitation is the risk perceived by potential investors that the Government will change its mind on the tax status of the fuel, or delay formal establishment of a genuinely workable tax rate and thus destroy the value of the investment." Withdrawal of rebates on PV systems and LPG fuels both quoted as examples. This "lack of certainty...becomes a serious issue of difficulty in funding. Lending or investing institutions do not take any risk at all if they can help it." Fortunately the firm reports that the government is serious on this issue and recently passed a statutory instrument to enable the present tax break to continue (?). The firm is currently very close to securing loans for demonstration.

d) Credibility of technology amongst the science community or within the market place

- SMART project (ESM033) has developed a functioning hand-held ammonium ion sensor demonstrator device. However, they note that a potential barrier to successful product commercialisation is "a perceived reluctance of customers to move away from familiar, but inferior, present methods of analysis and measurement." This is compounded by the need for funding for marketing (see Section 2.3 above).
- This SMART project (ESM028) is run by a professional engineer who previously designed and brought to market horticultural structures. He believes both his scientific and commercial skills are sufficient to take his novel approach to wave energy extraction to market, and is under no illusions that it is a long hard slog and an "enormous barrier for companies to take the first step in technology commercialisation". However, he did not reckon on hitting a 'credibility' issue with his technology. His SMART

feasibility award showed "pretty conclusive test results" and as the outline design appears robust, he believes it could quite possibly go to full scale with little modification. His problem is obtaining backing from large engineering firms who he knows, by providing their specialist, 3rd party expertise, can make or break a financial deal. He currently needs a positive second opinion from a top scientist to secure approximately £630k in further financing. He has also been discussing his innovation with NaREC – the New and Renewable Energy Centre in Blyth.

- SMART research project (ESM035) looked to increase plant yields, making alternative plant sources more economically favourable than those derived from oil. Increasing yields would also avoid the need to change tax regimes for environmental fuels since the economics of production would improve dramatically. Whilst the company is being kept within the university in order to reduce cash burn and tap into the knowledge base, they have found it difficult to convince Defra and The Carbon Trust of the long-term value from their R&D.

e) Applicability to commercial markets - i.e. ability to address real, perceived, future or developing market need?

A waste company is currently trialling, with great success, a waste oil treatment process which has been developed by a research body (E0159). However, they are reluctant to commit funding for a full scale, demonstration plant. This would also make it acceptable to the wider waste industry, as it would involve the build of a full-scale, dedicated batch plant. Apparently the major barrier is acceptance by the technical community of this innovative technique. They believe that there is inertia because industry, driven by the USA market, is pushing bio-augmentation (growing bacteria in labs) rather than use of nutrients within the waste. The problem is that bacteria are susceptible to temperature fluctuations which can kill them, causing instabilities in that process. An additional problem encountered is that oily sludges that have been separated and mixed with ash to reduce their pH (so called pre-treatment under the Landfill Directive) are allowed to be landfilled. This greatly reduces the market potential because other companies can charge lower disposal fees. If the landfill route was more restricted then a larger market would be created.

2.11 Multiple barriers

Many of the examples above illustrate individual barriers which if resolved can unlock the commercialisation potential for the firm. Some examples, however, demonstrate a variety of barriers which may add up to a difficult set of issues for the firm to resolve. One example includes:

Investment, Marketing and Product Credibility Barriers - This firm is manufacturing a composite drainage matrix manufactured from reprocessed mixed polymer thermoplastic waste (E0004). It primarily needs capital assistance to enable it to scale up its production process. However, it also needs to improve the marketing of its product and is seeking "support for the marketing of the material or potential joint ventures with potential customers or waste producers." An additional barrier cited was the need to obtain scientific verification of its product's capabilities in order to demonstrate superlative performance against traditional materials. . (STALLED at Stage [12])

3.0 GOOD PRACTICE CASE STUDIES

The following examples illustrate good management capability, funding routes etc.

3.1 Hard slog, personal sacrifice and good business support yields success for one fledgling company

This firm (E0126), established in 1997, consists of a team of six which together have self-financed their R&D. They are currently installing development prototypes to provide efficient, renewable energy sourced, grid-independent power and heat. It has made “numerous applications for funding and grant support at times with inexplicable negative results.” It reports being “badly let down by The Carbon Trust”. Since then Business Link Norfolk & IP21 have helped them obtain a DTI research grant which will facilitate development of their micro-CHP system. The firm is also winning support from interested SME’s, which is helping support their R&D programme. Several leading energy companies have also now become interested in backing the further development of their technology.

3.2 Good management capabilities and experience propels fuel cell developer into a new market

This portable fuel cells firm (ESM059), founded in 2002 by two individuals with previous careers in multinationals, aims to design, develop, manufacture and market a range of portable fuel cells for use as power packs, battery rechargers and mobile generators. According to DGI, the worldwide portable fuel cell adoption will be approximately 650 million units by 2009, representing a market value of around \$6 billion. The firm’s success to date shows that risk, coupled with astute market research and marketing, might enable a foothold to be obtained in a new market area, winning important initial orders.

Getting to their current position has involved remortgaging their houses, then obtaining Business Angel funding of £350k. This was followed by a LIFE-IC grant award of £30k (backed by the Carbon Trust) to conduct market research. To penetrate the hire market, they deliberately courted FTSE 500 firm Speedy Hire plc, as it is the UK’s leading supplier of off-mains generators. They also convinced the CEO of Speedy Hire to be their Chairman alongside one of their Business Angels. With initial orders now starting – including from the US Department of Defence – they are looking at new market areas. Most recently, the firm has been in discussions with Yorkshire Forward about establishing a new manufacturing facility in South Yorkshire, an area entitled to European assistance for small companies.

3.3 Good industry connections facilitates success

This one-man operation firm has developed, with SMART funding, an acoustic backscatter system for the detection of leaks from subsea pipelines and installations. The main problem in bringing the technology to the point of commercial exploitation is cost. The SMART project finished in April 2004 and they were extremely pleased with the whole process and results. Given the innovators' links to the oil industry, this enabled them to develop the technology on an oil field in South America. He then subsequently talked with a major oil company who have a new technologies unit who may be interested in providing capital funding. The firm also established relationships with another oil major and other companies are now also starting to approach them. The technology looks likely to succeed.

3.4 Exploration of all financing avenues could prove the winning formula

The Director of this fledgling firm (ESM022) has a good grasp of the difficult world of financing and has been exploring every avenue in order to raise £6m. They "find VC's unwilling to enter into anything other than MBO's and individual investors unwilling to be first. AIM flotation has also been suggested but it is prohibitively expensive and complicated and it will only raise 50-70% of our capital. There is no interest in financing from UK waste companies because the technology is non-core, although a couple of US firms are interested." The firm is also seeking Regional Selective Assistance because they are in an Objective 2 area and could use 70% of the funding towards capital. Asset finance companies are also interested in financing the equipment. This leaves little money remaining to find for operating costs. They are also considering adopting a limited company model.

3.5 Management ability takes company forward

An established company (ESM008) reports that their aeration technology is not yet fully demonstrated, although they appear to be almost over that hurdle. If the trial is successful with a water company they say they will go into overdrive with marketing it to utilities.

3.6 Apparent success for public funding

This enzyme-based ammonia biosensor (E0138) was taken to demonstrator stage with BioWise funding. Whilst only given 25% funding, this was "good for bridging the gap between R&D and demonstration". Further development and commercialisation is now being undertaken by an SME in a collaborative university/commercial venture.

This firm (ESM036) used SMART feasibility funding to develop an innovative membrane bioreactor (MBR) technology for wastewater treatment. They are now involved in a consortium of EU companies that are applying for EU (STREP)

funding to demonstrate a reduced cost biological treatment system based on a 'submerged' MBR. "The results of [SMART funding] have led to selection here as the SME of choice for the collaboration." The firm believes that if the project is successful the knowledge will quickly be disseminated in Europe and that will lead to market penetration of the technology.

3.7 Benefit of European Structural Funds

Funding under Objective 1 was a major factor for this firm (E0106) in moving its facility to Cornwall. They have developed an electro-chemical wastewater treatment system.

3.8 Collaboration with engineering consultancy produces possible route forward for university spin-out

SMART funded a pilot-scale plant for a technology which enables the nitrification of ammonia-containing wastewaters (ESM007). The plant in its current state could serve up to 400 people (i.e. it is full scale in certain applications). The spin-out's technology is simpler, smaller and more energy efficient than its competitors. The problem is that water companies are highly conservative and unlikely to invest if they have not seen a working plant. Hence, they have partnered with Atkins Water who has advised that they focus on a few key water companies across England and Wales and apply for funding for a plant-scale demonstration. The firm is awaiting the outcome of that and are pleased that AMP4 announced an increase in spending by utilities. If their application is unsuccessful they will be forced to look to Business Angels for money, in the range of several £100k.

3.9 Recruitment of marketing professional could achieve product commercialisation

This established company and SMART award winner (ESM013) has developed a newly configured ozone generator for tackling bacterial contamination and odours. They are at the prototype testing stage [8] and seeking potential field partners. One manufacturer is already testing the technology and this providing valuable 'real life' demonstration feedback. Whilst technical barriers caused initial hurdles, the main barrier remains funding. This is especially in terms of "having the resources to go and drive the individual markets, and to fund the development of the project specifically to different applications." With a background in marketing consumer goods, the CEO joined in early 2004 with the remit to turn the company round, as a number of clients had been lost. Since then it has been a bumpy ride, and the firm is still making a loss, "because we don't have the breadth of desired customers." Consequently, they find it difficult to keep driving the R&D spend. However, they are now beginning to sell another ozone generator product to a large end user. They hope this will build into a solid revenue stream which can generate sufficient funds to bring their SMART product to market. With the potential for numerous applications. they are well aware that they need to refine what it is they should sell and focus on a

particular application. They will be looking at raising further external investment
in late 2005.

4.0 CONCLUSIONS

One of the main conclusions from this analysis is that many young companies lack the requisite management, finance, production and marketing skills and experience to bring an environmental innovation to market.

In many cases, it appears to be the inexperience of the technology innovator that prevents sound management decisions being taken at various critical points in the commercialisation process.

Poor risk assessment and management, and its impact, for example, on the financial continuity within the firm's R&D process, also plays a large part in preventing companies bringing their products to market. This is particularly the case for exchanging IP and/or a share in the company for financial backing.

The various case studies in this paper enable various non-financial related skills gaps or deficiencies in companies to be collated. These relate both to generic and sector-specific skills:

Generic skills issues for SMEs wishing to commercialise innovations

Young firms lack an understanding & experience of the following:

- Sources of finance
- Raising finance
- What investors are seeking (e.g. level of IPR exchange, management capacity)
- Market strategy for their technology, particularly which market to choose
- Testing/certification requirements
- Connections at right level to large end users/collaborators
- Production skills (e.g. tooling, cost reduction etc.)
- Liability management (i.e. technical, financial, environmental, legal risks surrounding the implementation of a product/process)

Sector-specific knowledge and skills which are required by SMEs

Young environmental technology firms often lack an understanding & experience of:

- Environmental markets – size, growth rates, drivers, competition
- Environmental regulations and their future development
- Enforcement practices, including permitting

Box 1 below, adapted from the Environmental IGT report (2002), demonstrates the importance of good management skills and the ability to understand environmental markets when it comes to decisions by financing companies:

Box 1 : 3i receives a fairly continuous stream of opportunities to invest in companies offering, or proposing to offer, new environmental processes or equipment. The company has looked

seriously in recent years at a variety of innovative alternative energy opportunities and environmental processes and products. In many cases 3i decided not to invest (although in some cases other investors have, often business angels) and many companies have struggled to find investment. The reasons for 3i not investing fell into the following broad categories:

- Management not felt able to deliver the proposed plans
- Lack of focus on a particular market or application.
- Too early stage in terms of technology and market development

Source: IGT main report, p.73

5.0 RECOMMENDATIONS

Many of the investment readiness issues raised by this paper are well known both to Government and the financial community. However, despite the provision of some training/mentoring programmes in UK regions to help firms recognize and overcome these difficulties, EIU feels that more could be done to ensure that environmental firms are fully prepared.

EIU's future effort will therefore be in:

- d) Better understanding how firms may overcome these blockages;
- e) Understanding the generic provision that is already offered and working with relevant stakeholder groups involved in the planning and delivery of new programmes that are seeking to address such blockages, e.g. the RDA-led Framework for High Growth Business Coaching; and,
- f) Raising awareness of these investment readiness issues to the environmental industries sector, particularly through intermediaries such as the UK Forum for Environmental Industries and regional environmental industry support bodies.

EIU would like to thank all the firms who contributed to our analysis.

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September 2005

URN: 06/2103