

# **Disruptive Innovation: The Challenges for Managing Knowledge**

**Dr Fiona Lettice  
and Pete Thomond**

International Ecotechnology Research Centre, Cranfield University, Cranfield,  
Beds, MK43 0AL, UK, Email: [f.lettice@cranfield.ac.uk](mailto:f.lettice@cranfield.ac.uk)

Presented on [www.knowledgeboard.com](http://www.knowledgeboard.com) (KnowledgeBoard, 3-Nov-2003)

## **Abstract**

This paper describes what disruptive innovation is and then highlights the key barriers that established organisations face to introduce potentially disruptive products and services. The increased market, technical and environmental uncertainty surrounding the introduction of disruptive innovations increases the need for companies to extend beyond their traditional view of markets and products, which requires new approaches to managing knowledge. This paper describes how some of these issues may be overcome by describing four tools that have been developed within the EC DISRUPT IT project: the knowledge safari, the ideas workshop, the disruptive portfolio management tool and the ideas pipeline.

## **Disruptive Innovation**

Innovations can be thought of as falling onto a continuum from evolutionary to revolutionary, (Christensen, 1997; Hill and Jones 1998; Tidd et al, 1997; Trott, 1998; Veryzer, 1998) as shown in Figure 1. Evolutionary innovation is critical to sustaining and enhancing shares of mainstream markets (Baden-Fuller and Pitt, 1996; Hill and Jones 1998; Johnson and Scholes, 1997), and focuses on improving existing products and services to meet ever more demanding customer requirements. Because evolutionary innovations maintain the existing and mainstream markets and improve the performance of products and services in directions that customers desire, the market uncertainty is relatively low. Revolutionary breakthroughs lie at the core of wealth creation (Schumpeter 1975) and serve as the basis of future technologies, products, services and industries (Christensen, 1997; Christensen and Rosenbloom, 1995; Hamel, 2000; Tushman and Anderson, 1986). The term 'disruptive innovation' has been used to describe innovation that is of highly revolutionary or discontinuous nature, in which customers are provided with products or services which were not available to them before. A disruptive innovation represents a new paradigm of customer offering that can generate new net wealth whilst transforming or displacing some or all of an established market (Christensen, 1997, 2002; Overdorf, 2000), forcing established companies to lose market share and often causing the end of industries as we know them (Christensen, 1997; Foster and Kaplan, 2001). For this reason, the market and environmental uncertainty is high.

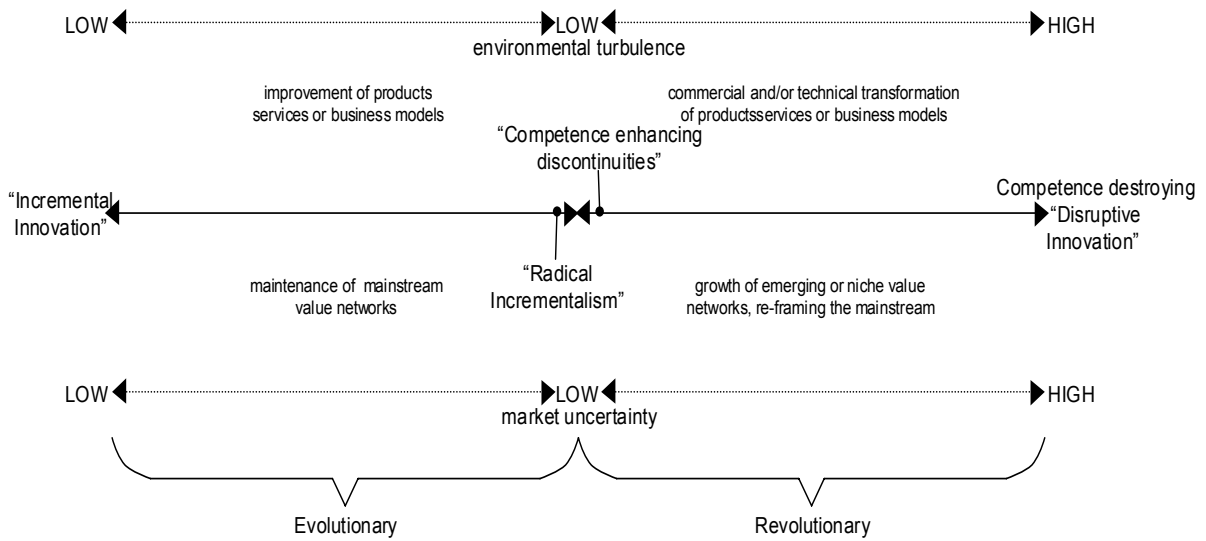


Figure 1: Innovation Continuum (Thomond and Lettice, 2002)

Discontinuous innovations can be distinguished along two dimensions, as shown in Figure 2: (1) product capability, or the benefits that the products provide as perceived by customers and users, and (2) technological capability, the degree to which the product involves expanding capabilities beyond existing organisational competencies. The diagram shows, with examples, the three different types of discontinuous innovation that can be introduced.

		Perceived Product Capability	
		Same	Enhanced
Technological Capability	Same	<b>Continuous</b>	<b>Commercially Discontinuous</b> e.g. Sony Walkman
	Advanced	<b>Technologically Discontinuous</b> e.g. Flat Screen TV	<b>Technologically and Commercially Discontinuous</b> e.g. Compact Disks, and disk drive technology

Figure 2: Types of Discontinuous Innovations (Veryzer, 1998)

Flat screen televisions are an example of a radically different technology being used to improve a product. This provides a technological discontinuity, although it only offers customers a small or incremental improvement in

terms of product capability and features. In contrast, the Sony Walkman utilised existing technologies to introduce a commercially discontinuous product. Customers had not been able to easily walk around with music before the introduction of the walkman, and this product opened up a whole new market for portable sound systems, that had not previously existed.

Disruption has been the key driver in democratising computer technology and placing personal computing into the hands of the masses (Moore, 1995; Christensen, 1997), and has been both technologically and commercially discontinuous. Most established computing firms, no matter how well managed, have been severely damaged if not destroyed by the impact of disruptive innovations introduced by new entrants (Hamel, 2000; Christensen, 1997). Armed with this knowledge, Andy Grove, Intel's chairman and former CEO, has led his management team in using the concept of disruptive innovation to invent and launch the Celeron chip (Christensen 2002). The Celeron chip has generated a new-growth business at the 'low-end' of the personal computer (PC) processor market, thus protecting Intel's hold from a low end disruptor and ensuring longer term organisational survival (Christensen, 2003). However, the likes of Intel cannot relax as the forces of disruption look set to impact the traditional 'desktop' PC, which enabled by improvements in disk-drive technology, was itself the disruptor of the minicomputer and the traditional mainframe. The increasingly powerful personal digital assistants (PDAs) now combined with other technologies such as mobile communication and digital photography are in a prime position to offer the 'low-end' customers, who are over supplied with the traditional performance of PCs, with a different, potentially disruptive, value proposition.

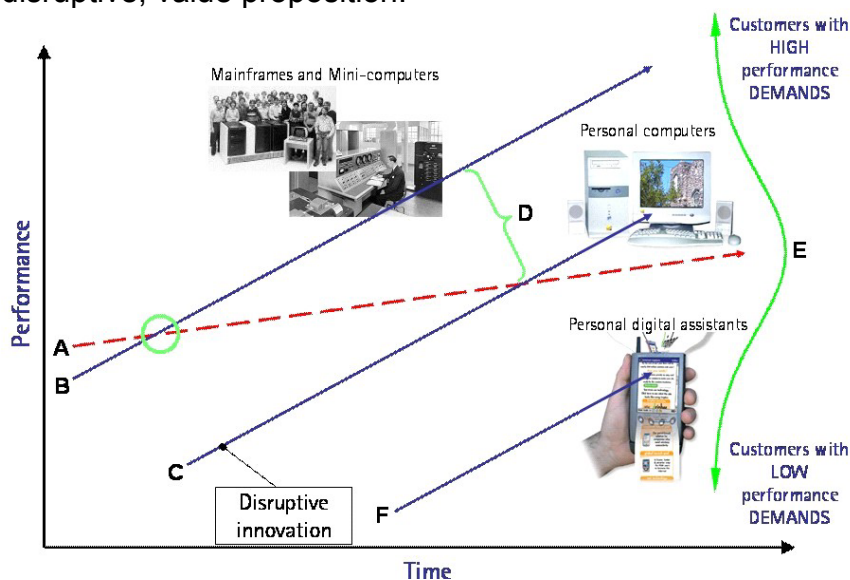
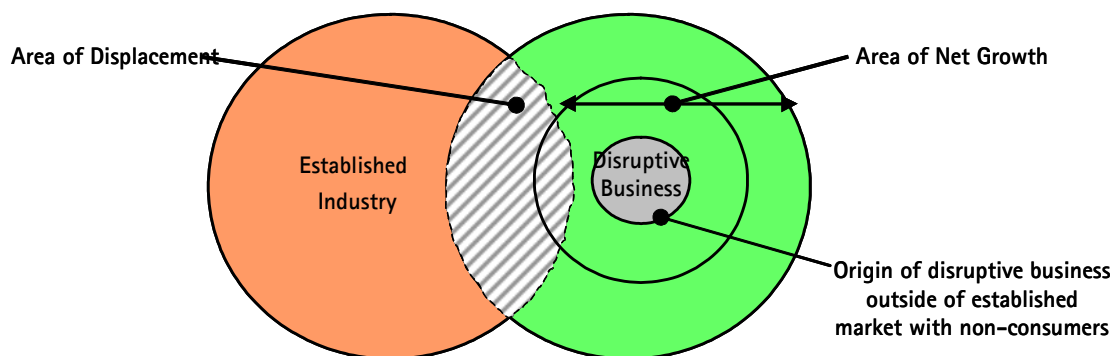


Figure 3: Disruptive Innovation Model (adapted from Christensen, 1997)

Figure 3 shows Christensen's (1997) model of disruptive innovation. This shows that organisations often over-supply their customers' needs with excess technological functionality or services that customers do not actually require. Line A shows the trajectory of increasing customer requirements for a given product or service, while Line B is the increasing performance offered

by the product or service, which is far steeper than Line A. For example, mainframe and mini-computers in the late 1980s offered many customers higher levels of performance, features and capability than they could use. This oversupply left a vacuum at the low-end of the market for a “simpler” product offering: the personal computer. When this was introduced, its performance characteristics (represented by the beginning of Line C) were perceived as lower and seemed to offer worse performance to the mainstream mainframe/mini-computer customers and users. However, a niche of consumers valued the performance characteristics of the personal computer, and with time, the technological performance improved along the trajectory of Line C. At point D, the technological performance of the PC equalled that demanded by the average mainstream customers of mainframes/mini-computers and they started to switch, causing the widespread disruption of the established mainframe/mini-computer market and causing many of these incumbent organisations to go out of business. Again, these new products and services will continually improve, usually faster than the average customer’s requirements, leaving space for new waves of disruption (Line F – showing the potential for Personal Digital Assistants to disrupt the PC market in the near future). This model best describes what has been termed “low-end” market disruption.

Gilbert (2003) has identified what have been termed “new market” disruptive



innovations, as shown in Figure 4.

**Figure 4: Model of New-market Disruptive Innovations (adapted from Gilbert, 2003)**

These occur when “non-consumers” are offered a simple, convenient product or service that allows them to do things that they would not have otherwise been able to do. Often, the growth of the new market is ignored by established companies as it is considered too small and low margin for them to consider. Just as for “low-end” disruptors, as the offerings improve, customers are attracted away from established products and services. By the time the incumbents begin to notice the defection, it is often too late for them to respond effectively, and the disruptive products and services permanently reshape the existing markets. Companies introducing these new-market disruptions need to follow a strategy of being “patient for growth, but impatient for profitability” (Christensen, 1997).

In the early 1990s, major airlines such as British Airways decided that the opportunities afforded by a low-cost, point-to point no frills strategy such as that introduced by the newly formed Ryanair was an unlikely threat to their established high-revenue market of regular business flyers. By the mid-1990's, other newcomers such as easyJet had followed Ryanair's example. The 'low cost' approach had captured a large segment of a new market; customers who had not been regular flyers before. The low-cost, no frills approach proved a hit with European travellers, but it took a while before increasing numbers of business travellers started to switch from the high-cost airlines to the rapidly improving services provided by the low-cost airlines. Now, the older airlines are trying to fight back with their own low-cost services or are having to downsize their operations as they continue to lose market share.



**Figure 5: Disruption in the Airline Industry**

If an organisation manages to foster a potentially disruptive idea, not only does it often face problems getting internal support (Rice et al, 2001), but there are problems to overcome to get it adopted by the mass market. Moore (1995) discusses the difficulties faced by companies trying to 'cross the chasm' from early market acceptance to gain the support of the 'early majority' and how to deal with the problems that occur when the early majority begins to rapidly adopt the new technology or change. Disruptive innovation only begins to be truly realised when the marketplace shifts to adopt a new paradigm in what he calls the "tornado" of adoption. Once the tornado begins, it is not long before the majority of potential customers in the marketplace have undergone dramatic change in their past behaviour with the promise of gaining equally dramatic benefits from the new paradigm. For disruptive innovations to successfully cross the chasm, an initial niche market needs to be found, from which other segments of the market can be conquered, avoiding the mistake that many companies make of trying to take disruptive products straight to the mainstream market, where they are likely to fail as they will be perceived as being poorer products and services. If Ryanair and easyJet had tried to target regular business travellers first, it is unlikely that they would have been able to attract these customers away from the established airlines. By establishing their reputation in the non-consumption and low-ends of the market, they have been able to successfully cross the chasm and now are able to compete successfully against the established airlines.

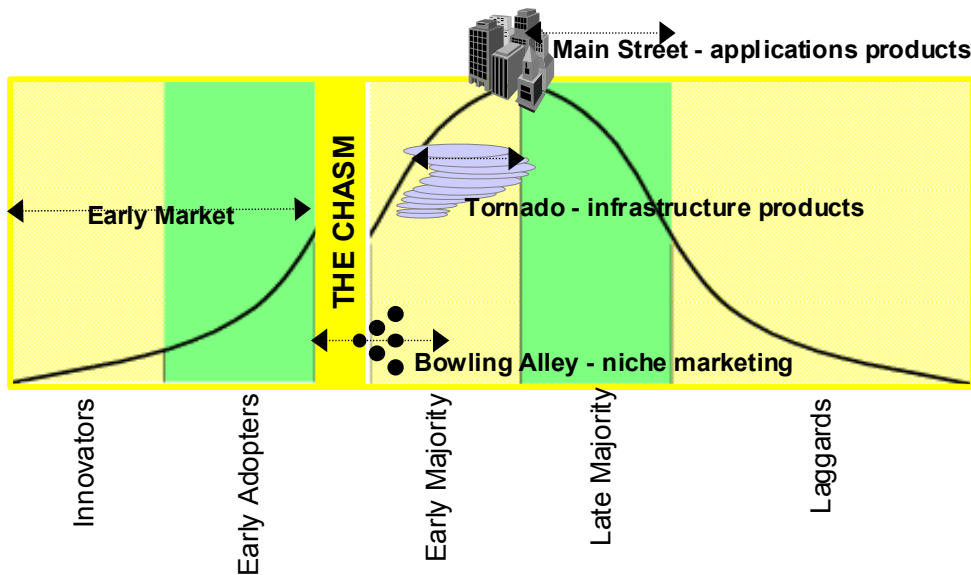


Figure 6: Crossing the Chasm: the technology adoption curve (Moore, 1995)

### Challenges of Disruptive Innovation and the DISRUPT IT Solutions

By reviewing the literature and working with the industrial partners in the EC IST programme DISRUPT IT project, the key barriers and challenges to developing and commercialising disruptive ideas and innovations have been identified and are shown in Figure 7. The DISRUPT IT project has developed tools and methods to help to overcome these barriers and these will be briefly described.

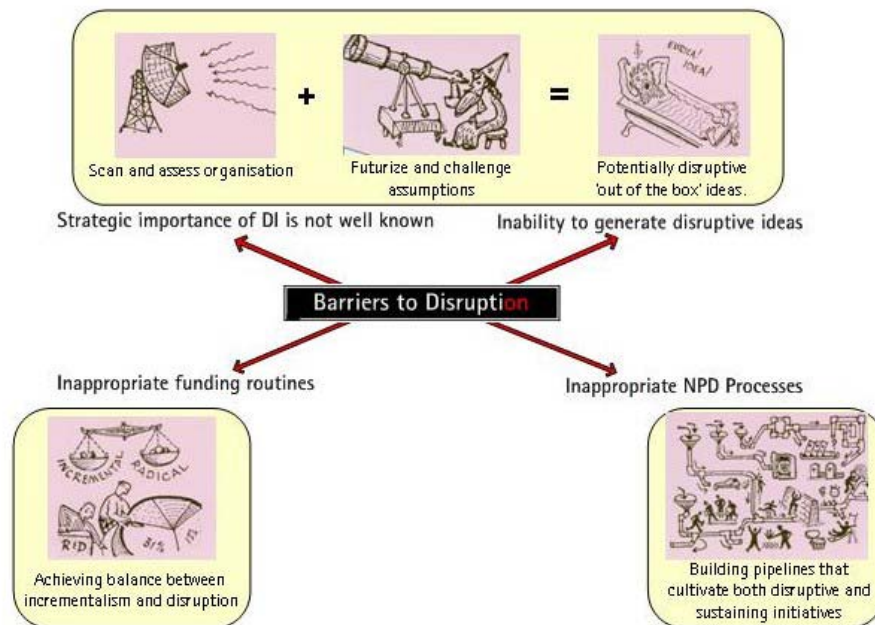


Figure 7: Barriers to Disruption

1. The strategic importance of disruptive innovation is not well known

There is generally a lack of knowledge about the theory of disruptive innovation within organisations, which prevents them from developing strategies to systematically introduce potentially disruptive products and services to the customers who value them (Christensen and Raynor, 2003; Moore, 1995).

To overcome this barrier, the DISRUPT IT Consortium has developed a Knowledge Safari. A Knowledge Safari distils a large amount of theory and information onto graphical templates, which are placed around a room. These templates are large hand-drawn posters, which include Figures 1 to 6 as presented in this paper, and can be seen in use in a workshop in Figure 8. Participants can then be led through each of the templates by a DISRUPT IT facilitator. This process allows the participants to gain a visual and holistic view of the principles of disruptive innovation and to see the interrelationships between the key concepts presented. The Knowledge Safari uses lots of examples which can be discussed in depth, so that disruptive innovation can be more easily understood.



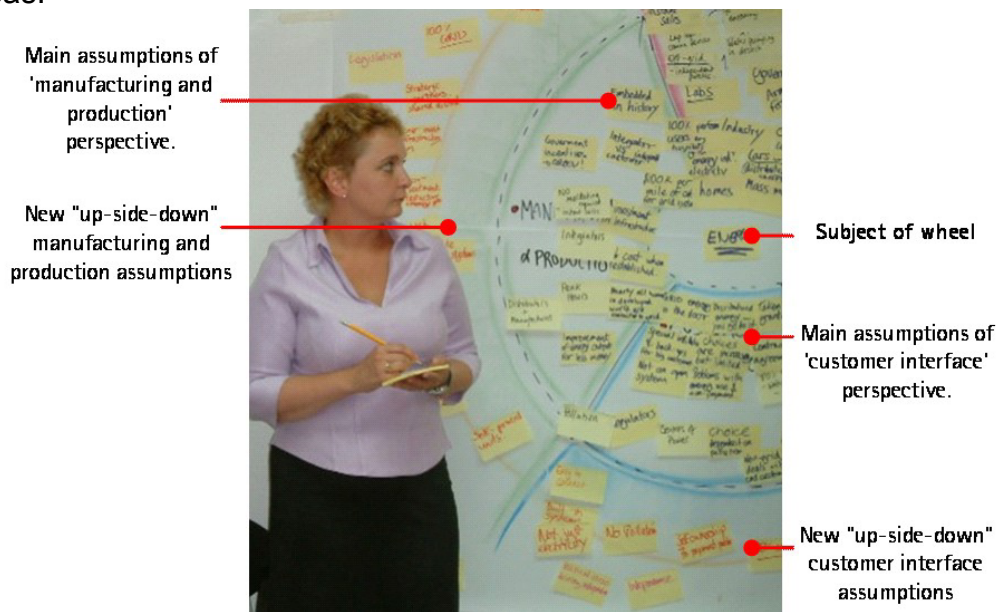
**Figure 8: Workshop discussion on Disruptive Innovation Knowledge Safari (part of the Knowledge Safari can be seen on the walls behind the participants)**

## 2. Inability to generate disruptive ideas

Generating potentially disruptive ideas requires organisational resources to be freed up to understand where customers are not consuming products and why this might be so and to understand the needs of low-end customers, who are getting increasingly frustrated with paying for additional performance that they do not need. It requires thinking about markets and customers in non-traditional ways and for exploring the intersections of technologies which make new potentially disruptive ideas feasible.

To overcome this barrier, the DISRUPT IT consortium have developed an ideas workshop. This workshop uses creativity techniques to guide the participants through a structured one or two-day process to help them to identify and explore unserved or overserved market segments in which there are non-consumers or low-end consumers ready for building a path to disruption. It helps the participants to discover disruptive applications for their existing technologies and competences and to identify threats and opportunities for disruption in their current markets. Figure 9 shows one of the creativity techniques, The Wheel, used to challenge the assumptions

about current markets and to generate and identify potentially disruptive ideas.



**Figure 9: Ideas Workshop: The Wheel Creativity Technique**

### 3. Inappropriate funding routines

The fundamental nature of disruptive innovation necessitates organisations to lead and not follow and an organisation’s long-term competitive strength lies in its capacity to be corporately entrepreneurial (Baden-Fuller and Pitt, 1996). Tidd et al (1997) state that most companies’ organisational routines struggle to lead transformational change at any level of the organisation. Instead companies choose to focus on incremental and occasionally mildly radical innovation, as organisational development is mostly path dependent with the past and current knowledge dictating, or at least significantly influencing, the future. Many organisations, therefore, have an unbalanced portfolio of R&D which does not balance between evolutionary and revolutionary change in their portfolio of ideas, their portfolio of projects and their portfolio of products and business units (Cooper, 1980; Cooper et al, 2001). For organisations to survive long term, they must select, initiate and capitalise on disruptive projects. However, the “theory called resource dependence... posits that companies’ freedom of action is limited to satisfying the needs of those entities outside the firm (customers and investors, primarily) that give it the resources it needs to survive.” (Christensen, p101, 1997). This can cause huge difficulties with funding potentially disruptive projects.

Mitigating this problem, the DISRUPT IT consortium has developed a Disruptive Portfolio Management (DPM) tool. Financial tools for portfolio management are favoured by industry, even though these are shown to be the worst performing (Cooper et al, 2001). A hybrid approach, or multiple portfolio method, has been used by the DPM tool to deliver the best results, by providing a holistic view and ensuring a balanced approach. A combination of Strategic approaches (business strategy determines “buckets” of money or resources and projects are selected because of their strategic



importance), Scoring Models (where projects are rated on multiple criteria), and Bubble Diagrams (where projects are plotted on various X-Y axis on a variety of parameters) have been used, as shown in Figure 10. This graphic representation of the organisation’s portfolio of projects avoids a narrow, project-by-project decision making approach and allows a broadening of investment options with fewer missed opportunities. Unlike other portfolio approaches, it enables a more easily justifiable investment into potentially disruptive projects. The tool is deployed through an interactive workshop with senior managers responsible for innovation strategy and is supported by a software tool.

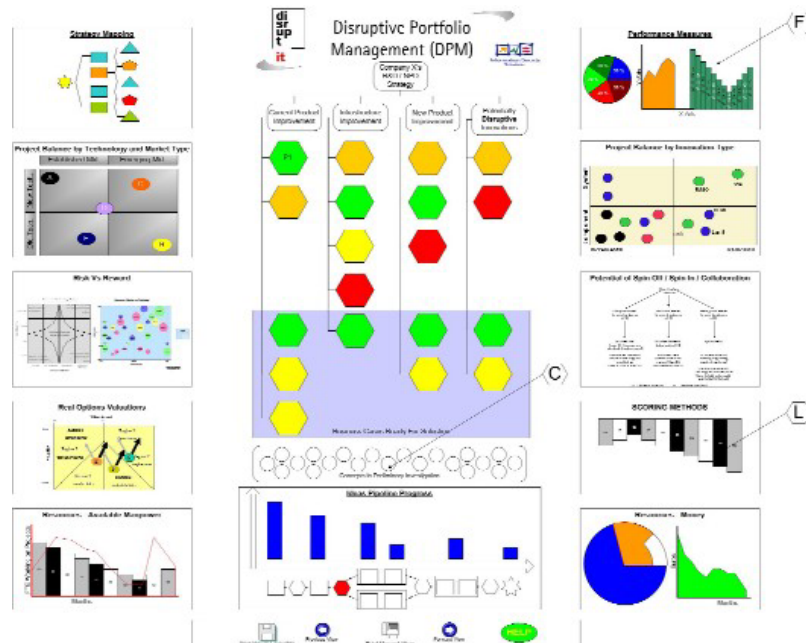


Figure 10: The Disruptive Portfolio Management Tool

#### 4. Inappropriate New Product Development (NPD) Processes

It is a common failure in organisations to capture the ideas and knowledge of its employees. The problem is particularly acute for radical and potentially disruptive ideas. A process is required which is far beyond a simple “suggestions box”. O’Connor and Rice (2001) show that the recognition of a commercial opportunity is a creative act, which many of those involved in technological and scientific development are unable to master. They show that typically people with a potentially disruptive discovery or insight are frequently not prepared, either through training or life experience, to make the cognitive leap from idea to envisioned and articulated business opportunity. Markets might not yet exist and would have to be imagined, or current markets might be transformed to such an extent by the innovation that it is too difficult to discern the business model that might emerge.

The DISRUPT IT consortium has developed an Ideas Pipeline (IPL) Tool, a screenshot of which is shown in Figure 11, which enables employees to register new ideas and build simple but effective business plans for new commercial concepts. The IPL provides simple checklists to ensure that a

business plan can be developed to demonstrate the disruptive potential of the idea. This software tool is integrated with the DPM tool. The process and tool encourage the transparency of ideas at their various lifecycle phases and facilitates the cooperation of all stakeholders, who can add additional contributions to the original idea. This process exploits the potential synergies between ideas and people. When ideas and resources are matched, a new project can be launched.

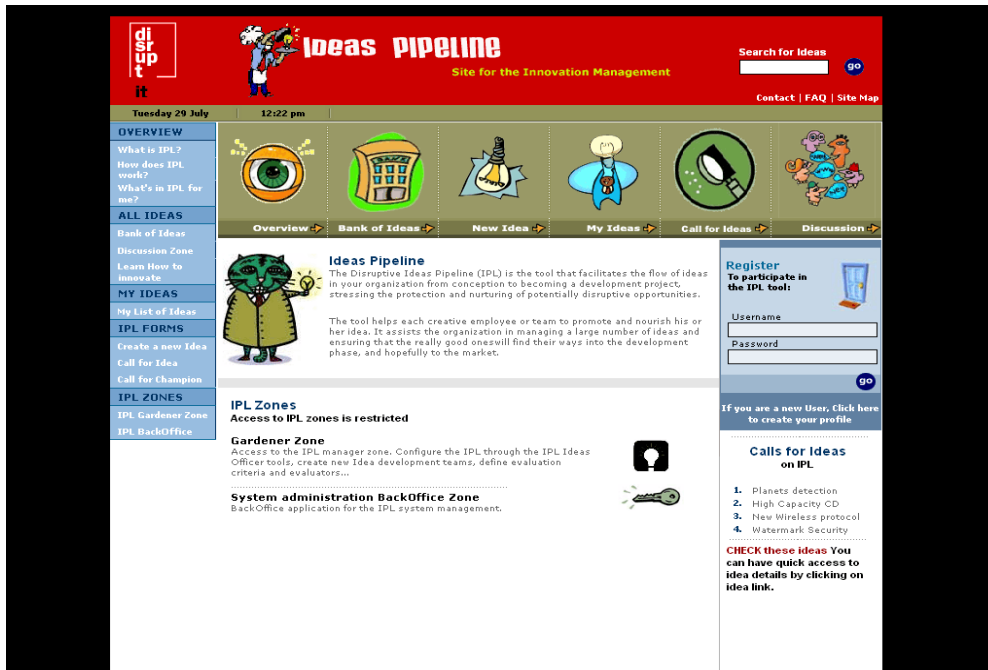


Figure 11: Screenshot of the Ideas Pipeline Tool

## Conclusions

Disruptive innovations pose several knowledge management problems to organisations because they have a high degree of market, technological and environmental uncertainty. Potentially disruptive ideas for low end and non-consumers are difficult to identify and the organisation's past and current knowledge and routines act as barriers to the successful development and commercialisation of disruptive projects. The DISRUPT IT consortium has identified four tools to help companies to overcome these challenges: the Knowledge Safari, the ideas workshop, the disruptive portfolio management tool and the ideas pipeline. These address the most common barriers identified by companies and provide structured processes and methods to foster disruptive innovation.

## Acknowledgements

Thanks to the DISRUPT IT project team, whose enthusiasm and vision have made the creation and validation of these tools possible and to the EC IST Programme for funding the work. Please see the website: [www.disruptit.org](http://www.disruptit.org) for more information on the project and partners.

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