Crisis-driven innovation

JOHN BESSANT
Managing Innovation

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Social innovations often arise out of a combination of widespread and often urgent need *and* severe resource limitations; they represent the preconditions for what can be termed 'crisis driven innovation' (CDI). Existing solutions may not be viable in such situations for a number of reasons including (relatively) high cost, lack of entrepreneurial return, technological inappropriateness (e.g. lack of skills base to support and maintain), etc. Instead new solutions emerge which are better suited to the extreme conditions; the process requires rethinking and recombination in creative ways and can be the crucible out of which novel innovation trajectories emerge.

Meeting the needs of a different group with very different characteristics to those of the mainstream population corresponds to what von Hippel terms 'extreme user' innovation. He sees this space as providing a laboratory for the emergence of innovations which may well diffuse later to the wider population. Extreme users in his terms are active experimenters, tolerant of failure because of the learning implicit in the experimental process. Learning under these conditions provides opportunities for the emergence of novel innovation trajectories; significantly these may develop to become disruptive innovations as they begin to challenge mainstream dominant models.

In this process what starts as a set of experiments at the fringe can evolve into new pathways which eventually become a new dominant logic or dominant design. For example, the emergence of what has come to be known as 'lean ' thinking applied in manufacturing and services goes back to crisis conditions within post-war Japanese industry. Faced with serious resource limitations in energy, raw materials and crucially human capital, factories were unable to exploit the dominant trajectory of mass production. Instead they experimented around low resource usage models – lean is essentially a systematic attack on waste reduction in its many forms – and evolved over several years an alternative approach.

Significantly this was not a single radical breakthrough but rather a reconfiguration of existing elements and their assembly into an alternative manufacturing *system* which delivered significant productivity gains whilst operating on a much lower resource utilization basis. Constituent tools like 'just-in-time' logistics, set-up time reduction, kanban inventory management systems, total quality management and total preventive maintenance were all different resources brought into play to deliver the compelling vision of a low waste approach necessitated by crisis. The subsequent diffusion of these ideas beyond their original birthplace highlights a key aspect of CDI; it often involves innovation at a system level and has widespread application potential as a result.

[1] For more on this theme see Bessant, J, Trifilova, A. and Rush, H., (2012), 'Jumping the tracks': Crisis-driven social innovation and the development of novel trajectories, Die Unternehmung, Swiss Journal of Business Research and Practice, Vol 66,(3), pp217-225

Examples of the conditions under (CDI) emerges include the need to meet widespread demand for healthcare, education, sanitation, energy and food across populations which do not have the disposable income to purchase these goods and services via conventional routes. As Christensen and colleagues have shown, working with unserved or underserved markets provides a crucible from which radically different solutions can emerge. These are not necessarily pushing the technological frontier – in many cases they represent a simplification, a 'no frills' variant of an existing offer – but they have radically different price/performance characteristics which make them attractive not only in their original context but in the wider mainstream population. The so-called 'bottom of the pyramid' challenge is increasingly seen as a significant innovation opportunity of this kind, driving radically different approaches to meeting social needs. Examples include Grameen Bank (banking productivity CLIC) and Visionspring (retail productivity/supply chain).

Humanitarian emergencies – such as earthquakes, tsunami, flood and drought, or man-made crises such as war and the consequent refugee problems – provide another example of urgent and widespread need which cannot be met through conventional routes. Instead agencies working in this space are characterized by high rates of innovation, often improvising solutions which can then be shared across other agencies and provide radically different routes to innovation in logistics, communication and healthcare.

Some examples of CDI

Under extreme conditions – such as in the immediate aftermath of a disaster like an earthquake or tsunami – there is an urgent need to establish robust and reliable communication networks. Gathering information, processing it and making it available to those who need it to shape decisions about resource allocation, prioritising logistics and real-time status reporting are all key needs towards which innovation is targeted. Significant progress has been made by humanitarian agencies in learning to deal with this challenge by deploying information and communication technologies.

One of the powerful and high impact innovations in delivering aid in recent years has been the idea of providing cash to distressed populations rather than trying to distribute food aid. This has the advantage of providing relief whilst reducing transportation and distribution costs and also offers significant empowerment to recipient populations, reducing their sense of dependency. Whilst simple in concept it presents significant logistical and security issues but the use of mobile phone technology opens up major new opportunities in this space. For example, the aid agency Concern Worldwide (CW) pioneered the use of 'mobile money' to develop an emergency response programme in the post-election violence in Kenya in 2007. It included the distribution of mobile phones as enabling devices and was able to succeed because of a partnership with M-PESA, a powerful and robust platform which had been developed in Kenya to enable what is effectively mobile banking amongst low income groups.

In the chaos following the election 'normal' communication and information networks were disrupted which made it difficult for aid agencies to identify where their help might be needed – and when they arrived at a location their ability to co-ordinate logistics etc. was seriously compromised. CW identified a problem area in the remote Kerio valley area and began developing an emergency food programme working with local partners from the Catholic Diocese of Eldoret. However it quickly became clear that the remoteness of the location would make distributing food expensive – and there was a continuing

security risk. Consequently the team began exploring an alternative cash distribution programme using M-PESA as an enabling platform.

The process involved distributing mobile phones and also working with M-PESA to facilitate the transfer of large amounts of money (M-PESA normally has a limit on size of transaction to prevent money laundering). Importantly it empowered local recipients to solve their own problems locally rather than encouraging dependence on traditional aid distribution. It proved successful according to independent evaluations which suggested around 70% of the money transferred to the region was spent on food and the remainder on transport and other non-food essentials. Whilst the programme was expensive in terms of the initial cost of the phones it provided a downstream and sustainable framework on which the supported communities could build.

Similar models for emergency aid have been used in other regions; for example CW used the approach in Niger where it was possible to conduct a randomized evaluation of the mobile-phone cash transfer programme compared with other options. One third of the targeted villages received monthly cash transfers via Zap (the name given to the mobile phone approach), one third received manual transfers and one third received manual transfers and were also given a mobile phone. The results indicated that the Zap delivery mechanism strongly reduced the variable distribution costs for CW and also cut the costs for the recipients in obtaining the money. There were additional benefits; *' households in Zap villages had higher diet diversity, depleted fewer assets and grew more types of crops, especially marginal cash crops grown by women'.*

The availability of an alternative communications platform based around mobile phones offers other opportunities in the humanitarian aid space. For example it can be used in crisis mapping – quickly collecting and collating diverse information to provide an accurate picture of what is happening and allow for co-coordinated responses. Again in the context of post-election violence in Kenya a scheme called Ushahidi (a word which means 'testimony' in Swahili) was developed which effectively mobilized a 'crowdsourcing' approach to collect and collate such information across various channels – Twitter, email, SMS and voice traffic. www.ushahidi.com It enabled users to identify and provide alerts about specific problems and collated data allowed aid agencies to visualize a rapidly changing situation. Importantly such a model differs from conventional centralized collection and collation by deploying a decentralized network approach; variants on this have been used in many trouble spots around the world; the Ushahidi platform is easily transferable and allows aid agencies and others to set up fast and robust crisis mapping.

The original platform was developed by a group of Kenyan citizen journalists to map incidents of violence; it quickly grew to around 45,000 users and the team realized there was demand for this kind of tool in other applications. Ushahidi has been streamlined and simplified such that it can run on many devices and can be set up in minutes, accepting data submitted via phone, SMS, email, twitter, etc.; the 'Crowdmap' application allows users to set up a system within two minutes. Since 2008 it has been used widely, supported by a largely volunteer workforce, in contexts as varied as snow clearing after the Washington snow, emergency support after the Australian floods and disaster relief after the Haiti earthquake. Within two hours of the Japanese earthquake and tsunami a version of the platform was available to help locate where people were trapped, where food and water supplies were available, where transportation links were working or had been damaged, etc. (Other non-emergency

applications are now emerging – for example a Canadian site is using a version to crowdsource information about heritage buildings https://thisplacematters.ca/).

Another innovative application of mobile communications has been to create employment opportunities for disadvantaged groups using 'micro work' principles. 'Impact sourcing' is the term increasingly used to describe the use of advanced communication technologies to permit participation in global labour markets by disadvantaged groups. Increasingly many tasks – such as translation, proofreading, optical character recognition (OCR) cleanup or data entry– can be carried out using crowd-sourcing approaches; Amazon's Mechanical Turk is extensively used in this fashion. Social entrepreneurs like Leila Janah saw the potential for applying this approach and her Samasource organization now provides employment for around 2000 people on very low incomes in rural areas[2]. The increasing availability of mobile communications allows for mobilizing and empowering this group and an increasing number of US high tech companies are sourcing work through her organization.

The model is not simply low cost outsourcing; through a network of local agencies Samasource not only provides direct employment opportunities but also training and development such that workers become better able to participate in the growing network of online knowledge work. Organizations like Samasource recognize the risk that the model could simply be used to exploit very low wage rate workers; their business model requires that partners employ people earning less than $3/day and reinvest 40% of revenues in training, salaries and community programmes.

There are similarities to microfinance; the underlying business model is essentially extending a well-known principle (business process outsourcing) to a new context – educated but marginalized people on low incomes who could play a role as knowledge workers. Samasource mobilizes people in a variety of countries and contexts include rural villages, urban slums and even refugee camps. The model is diffusing widely – other organizations such as DigitalDivideData[3] (originally established in S.E Asia in 2001 and now employing nearly 1000 people in Cambodia, Laos and Kenya) and Crowdflower perform similar integrating roles, bringing disadvantaged groups into the online workforce[4].

Key features of case studies

These cases share a number of features beyond their being impressive solutions to social and humanitarian needs. In particular they reinforce the view that such situations can provide a powerful learning laboratory for innovation and allow experimentation towards radical solutions. Importantly the crisis conditions mean that the repertoire of 'conventional' solutions is not viable and so a search for new solutions is triggered – essentially recreating the kind of 'fluid state' characterized by early stages of the innovation life cycle. Within this space entrepreneurial behaviour is important, experimenting and learning fast through failure and setback as much as success. It also places emphasis

[2] http://samasource.org/
[3] http://www.digitaldividedata.org/
[4] http://crowdflower.com/

on the role of users in context who can help shape and configure innovations so that they are suitable for wider diffusion; the process is essentially one of co-evolution.

Solving problems within this context requires a wider search because conventional ones by definition are not appropriate. In this way CDI forces a high level of 'open innovation; exploration of new insights and ideas across sectors is a key feature but the central theme in all of the above examples is one of what Hargadon calls 'recombinant' innovation. That is, solutions and techniques were widely available and proven in other contexts; the key contribution of the entrepreneurs was to bring them together in a new setting.

For example the core ideas underpinning the significant productivity gains in the Indian healthcare cases are essentially using core principles of the Ford/Taylor mass production system which were developed in the early part of the 20th century. In its turn this model was created by a synthesis of multiple and proven practices from several different industrial sectors – standardization of parts came from the gun industry, scientific method from the steel industry and the assembly line from ideas around disassembly in Chicago abattoirs. The principles of open innovation can be seen clearly in the development of mass production – and similarly in the emergence of lean thinking. In each case the process involves significant learning from different worlds and assimilation into an effective new an effective new *system* – and the role of entrepreneurs as brokers is critical to this.

Working in this way requires a reframing – redefining in context what is needed rather than making prior assumptions. By abstracting to the basics of the problem new insights about potential solutions emerge from other sectors – it can trigger novel search behaviour and cue attention to new stimuli. This process of reframing and abstraction also allows for a powerful rearrangement of the underlying *system*; and corresponds to what Henderson and Clark call 'architectural innovation'.

It is also important to recognize the process of learning and continuous improvement within this new architecture. In each case – as with earlier examples of system innovation like Ford's mass production factory or Toyota's lean model – the overarching vision provides the framework within which a process of continued and sustained incremental improvement can take place, mobilizing high levels of participation in the innovation process. Central to this is the principle of 'policy deployment' – hoshin kanri – which breaks down high level strategic targets into local level problems which can be solved by continuous incremental innovation.

Putting in place robust mechanisms to enable experimentation and subsequent capture and sharing of learning is central to the development of a system which can be replicated. The underlying process is one which relies heavily on converting tacit knowledge to formally codified forms which become available for others to sue in what become standard operating procedures and eventually a standard operating model. [5]

[5] (The UK supermarket chain Tesco uses a similar principle; it captures learning about supermarket operations and codifies them into a standard operating model (SOM)informally referred to as 'Tesco in a box'; this package can then be used to transfer to new locations in a 'drag and drop' manner. New learning from the new site is then developed and assimilated back into the SOM). REF Michelle Lowe

This codification into standard operating models is of key importance in allowing replication, diffusion and scaling of the new system. In similar fashion the focus on innovation in humanitarian agencies involves a growing recognition of the need to share and capture lessons learning so that they are available as part of an emerging 'best practice' repertoire. Learning and sharing about common problems and solutions allows for the building up of long-term capacity to deal with future problems – through institutionalizing lessons learned such as stockpiling, scenarios, rehearsal, etc.

Enabling radical innovation – a process model for CDI

Table 1 draws together some of these core themes and suggests an emergent process model for enabling CDI with at least five key stages.

The crisis stage involves articulating a clear and focused vision which demands a novel response; existing trajectories are unable to deliver performance changes on the scale required. Examples of such high level vision include the US 'man on the moon', Henry Ford's idea of 'a car for Everyman at a price Everyman can afford', or the 'invisible aeroplane' which led Lockheed-Martin to develop stealth technology through its 'skunk works' team. Such visions set stretch targets and force search behaviour in new directions; they also cue attentional responses to new signals rather than filtering them out. In the cases the ability to find a passionate entrepreneur at the centre may not be coincidence – their role is to have the vision but also the passion to infect others and bring them into the vision. [6]

Exploration of potential new directions involves the *observatory* stage, in which search behaviour is enabled in novel ways. This corresponds to open innovation search patterns and may well require brokerage, cross-sector linkages, working with users, foresight, ethnography and multiple other approaches. It often involves deliberate recruitment of 'outsiders' to bring alternative experience and perspectives; for example much of the later success of the Aravind model came through the engagement of David Green who brought considerable experience of low cost manufacturing models and helped establish the Aurolab network. [7]

It also requires the ability to abstract the core problem to a higher level such that potential solutions in other sectors/worlds can be perceived as relevant. For example the significant productivity improvements in machinery set-up in Japanese factories came in part from learning about pit stops in motor racing; in turn these ideas were adopted by low cost airlines seeking to reduce turnaround times at terminals, and hospitals looking to optimize operating theatre usage. Although very different in sectoral context the underlying process of changeover is the same.

[6] It is perhaps fanciful but interesting to note that the Chinese character for 'crisis' is a juxtaposition of the two characters representing 'threat' and 'opportunity'

[7] David Green's approach provides a system level example of low cost manufacturing and micro-franchsiing which enables employment at the bottom of the pyramid whilst also offering low cost solutons to key product and process needs like eyecare, hearing care or clean water.

The *laboratory* stage involves experimentation with the original idea to adapt it to the new context. By its nature this process involves failure and fast learning and user input is critical in shaping and configuring a robust solution. Whilst the initial idea may be radical its shaping and development involves integrating a wide range of small scale incremental improvements in a process of experimentation, learning, capture and codification. Within the framework of a core vision such incremental experimentation can engage a large number of people in a process of policy deployment driven innovation – hoshin kanri.[8]

In the prototype stage there is further evidence of high user engagement and development of robust configurations which will actually work and be accepted. At this stage it is important to have a working model of the system level innovation which can act as a 'boundary object' demonstrating the operation and advantages f the new approach but also allowing input from potential adopters in further shaping and developing the ideas. For example Devi Shetty's first hospital in Bangalore allowed a wide variety of people to see the potential and to add their insights into shaping the 'standard model' which was then replicated widely. In similar fashion the first Aravind eye clinic allowed for prototyping and learning but also provided a vehicle for engaging key players who could help in scaling up and diffusion. (See case studies of Aravind and NHL on the Portal)

Finally widespread diffusion depends on the codification of the new system into a transferable model – a 'standard package'. This does not mean that further innovation will not take place; indeed it is characteristic of the examples given that continuous improvement is embedded in their design. But the basic model has become standardized and codified to the point that it can be handed on to others who have not had direct experience and sufficient detail of the 'standard operating model' is available to enable them to set up and operate in a different context. This part of the process is assisted by the fact that users and players have been involved in co-creating and especially configuring the model.

Stage	***Characteristic activity***
Crisis	*Creation of a driving entrepreneurial vision which simultaneously articulates the need for change and for radically different solution involving a new trajectory.*
Observatory	*Extensive search in novel directions to find relevant approaches which could be adapted – requires ability to abstract problem and solution thinking to a higher level and brokerage mechanisms to make connections*
Laboratory	*Experimentation around core ideas and creating in context a new system through recombination of proven elements from elsewhere*

[8] Similar patterns of shared experimentation can be seen in the activities of online user communities – see von Hippel, Fredriksen and Dahlander, Habicht et al….

Prototyping	*Development of a scale version of the system which allows for testing and configuration in context with users. Also provides a 'boundary object' which can demonstrate potential and engage key agents in further development and diffusion*
Scaling and diffusion	*Codification of core model into a 'standard' transferable package which can be replicated. Importantly this allows for further innovation and continuous improvement via channels which integrate emerging ideas into the 'standard operating model'*