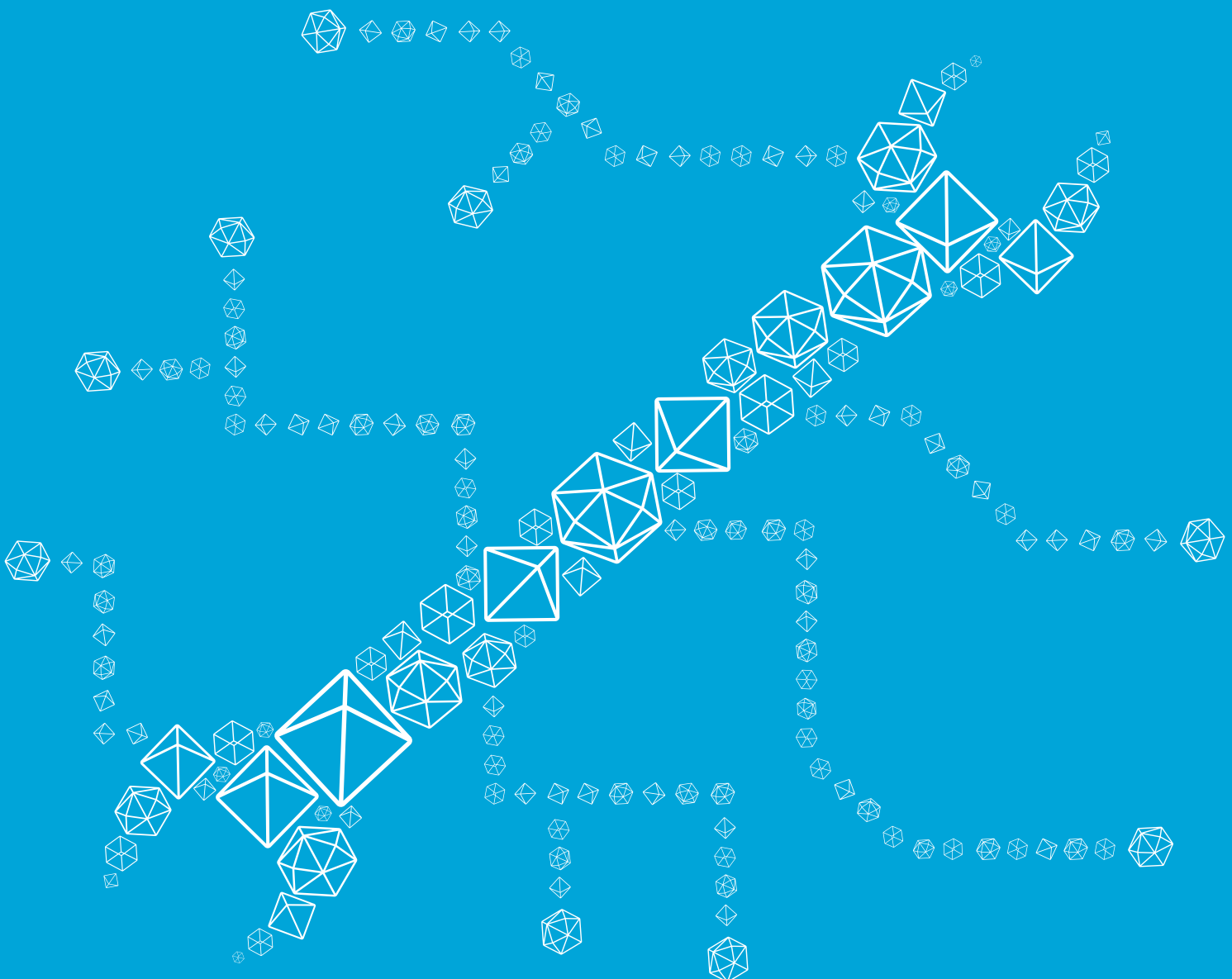


The New Inventors

How users are changing
the rules of innovation



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Foreword

There's nothing new about user-led innovation. Many of the products and technologies we now take for granted were developed by users – 'ordinary' but skilled and imaginative people who knew what they needed to do their jobs more effectively and decided to invent it themselves.

What is new in this picture are the powerful tools that users can now employ – the digital technologies and networks that they can exploit to create further innovations and to connect with each other.

To investigate this phenomenon, NESTA commissioned research from the Centre for Research in Innovation Management (CENTRIM), University of Brighton, and the Science and Technology Policy Research Unit (SPRU), University of Sussex.

This report sets out a way of understanding this 'new' phenomenon. Focusing on innovation that emerges from individual users and communities of users, it presents UK and international examples of firms that are harnessing user-led innovation – and firms that have emerged directly from communities of user innovators.

Most importantly, it asks the question: are we doing enough to encourage these forms of innovation – or simply to allow them to flourish?

Jonathan Kestenbaum

CEO, NESTA

July, 2008

NESTA is the National Endowment for Science, Technology and the Arts.

Our aim is to transform the UK's capacity for innovation. We invest in early-stage companies, inform innovation policy and encourage a culture that helps innovation to flourish.

Executive summary

User-led innovation – where users play an active part in the development of new or improved products and services – is exploding: proliferating digital technologies mean that we're all potential innovators now. New firms based on user-led innovation are being sold for hundreds of millions of dollars only a few years after being founded.

Policymakers have remained somewhat sceptical about the importance of user-led innovation. But if the UK is to harness this new wave of invention and creativity, it needs to develop world-leading policy in support of user-led innovation. This means being more aware of the impact of new legislation on user-led innovation, and establishing a forum to ensure that policymakers hear directly from these new inventors.

User-led innovation is growing in importance and creating significant commercial value

User-led innovation occurs when users play an active part in the development of new or improved products and services

New ideas do not always first appear from formal industrial research and development (R&D). Users also have innovative ideas that lead to new and improved products or services. These users are often best placed to identify what they need; they may also be able to design, build and distribute their own solutions. This is user-led innovation.

There is a long and rich tradition of user-led innovation in the UK

Writing in 1776, Adam Smith noted that many of the machines used for manufacturing were the inventions of 'common workmen'. This tradition continued into the modern era: mass computing owes its birth to a series of user-led innovations in the 1970s and 1980s that took computers out of large corporations and into homes and small businesses. More recently, Tim Berners-Lee invented the World Wide Web as a means of sharing information at his workplace at CERN, the European Organization for Nuclear Research.

Proliferating digital technologies have accelerated user-led innovation

These developments in networked information and communications technology (ICT) have in turn enabled a new wave of user-led innovation. The 'new inventors' no longer

labour alone in their workshops but belong to international communities of like-minded individuals. The internet has become a global workshop where they can share tools, techniques and ideas and work together on projects that change whole industries.

In sectors like software, music and video games there is now an expectation that users will participate in the innovation process. In many industries, the closed culture of innovation no longer applies. The clear divisions that used to exist between firms and consumers or firms and suppliers are increasingly blurred: we're all (potential) innovators now.

Many UK firms are at the forefront of this new wave of innovation

Firms like Sibelius (in music notation software), NetDoctor (in health information), and Last.fm (in online music) are successfully harnessing user-led innovation. Bebo, the UK social networking site only established in 2005, has over 42 million users.

Such firms invest huge resources in developing a better understanding of the needs of their users. For some firms, user-led innovation is a key part of their business strategy; they actively encourage users to innovate – and may even give them tools to help.

User-led innovation is generating significant commercial value

Major firms like IBM and Sun Microsystems participate in many user-led open source projects. Microsoft has created a free

development toolkit to encourage users to build new games for its games console.

American firms in particular have recognised the growth potential of user-led innovation-based firms, as witnessed in their acquisition strategies:

- Bebo was recently sold for £417 million to US internet company AOL.
- Last.fm was acquired by American broadcaster CBS in 2007 for £140 million.
- Sibelius was acquired by US-based Avid Technology in 2006 for £12.2 million.
- NetDoctor was acquired by American media conglomerate Hearst Corporation in 2006 for an undisclosed sum.

There are important differences between user-led innovation and 'traditional' innovation

User-led innovation often challenges the status quo and seeks to push the boundaries in ways that are often not possible within traditional R&D. Such activity can challenge existing intellectual property (IP) rights designed to promote innovation, but which can have a 'chilling effect' on innovative activity by users.

User-led innovation ranges from giving feedback and support, to creating entirely new products, services and systems

- **Provision of feedback**
Existing products are often served by forums where newer users can ask for advice and support from more knowledgeable users. Such knowledgeable users also probe and report the flaws and weaknesses in new products.
- **Production of content for existing products**
The business model of firms like YouTube, MySpace, Facebook, and Bebo relies on individual users generating and sharing content. Content production in some areas is more advanced, for example, creating new characters and landscapes for a video game.
- **Novel use of existing products**
Some highly skilled users recombine existing products and services to create new products. For example, users can mix two

different music tracks to create a new piece, or indeed new musical genre.

- **Modification of existing products**
'Modding' (modifying) takes two main forms: making minor adjustments to the operation of existing products; and re-engineering products to add new functions.
- **Production of novel products**
The most extensive user-led innovation occurs when individual users or user communities create their own novel systems, products or services – for example in developing major open source software systems such as Linux. Users in effect become manufacturers.

User innovators tend to be driven by their interests rather than intellectual property rights, and work within highly active communities

- **Innovative users are interest-driven**
Users often have very different motivations from those that drive commercial activity. User innovators are often passionate about their particular area of interest and prepared to devote extraordinary amounts of time and energy to developing their ideas.
- **Online communities play a major role**
User communities facilitate innovative activity between members, as well as providing education and development for newcomers.
- **Intellectual property may be viewed as less important, or set aside entirely**
Being interest-driven, users will often set aside all issues concerning IP. IP may even be viewed as an impediment to creativity and innovation. Users often freely reveal their ideas within their communities.
- **Some users and communities prevent their work from being commercialised**
There are now a series of mechanisms, sometimes referred to as copyleft, designed to prevent restrictions on copying, developing and distributing original work or later modifications, so protecting innovations from being directly appropriated by firms.
- **User communities often create 'toolkits' to enable other users to innovate**
Software tools are an important resource for users who wish to innovate. Many user communities – and firms – make a wide range of such tools freely available.

Policy needs to embrace user-led innovation and better understand its implications for the UK economy

UK policy still suffers from a linear model 'hangover' and has only just begun to recognise the importance of users in innovation

User-led innovation has emerged under the radar of government and has largely occurred despite official policy, not because of it. It has been rendered largely invisible to a policy discussion preoccupied with the 'linear' model of innovation characterised by a focus on formal R&D.

Until the *Innovation Nation* White Paper in March 2008, user-led innovation did not appear in UK innovation policy. Yet while the concept was a recurring theme within the White Paper, there is currently no policy targeted at promoting or removing barriers to user-led innovation.

There is increasing international policy activity around user-led innovation

The growing body of evidence on the economic and social importance of user-led innovation has led to increased policy interest in developed economies including Finland, Sweden and Australia.

For example, the Danish Government is targeting user-led innovation with a specific programme. Between 2007 and 2010, this is designed to support the spread of user-led innovation in both the private and public sectors. The programme includes a fund to support new projects in this area, and a new research centre. The Canadian statistical service, Statistics Canada, is also beginning to collect data on user-led innovation.

The UK has a clear opportunity to leverage earlier research in this area

Our current understanding of user-led innovation is the result of many years of work by a small group of academic researchers working in universities in the US, Denmark, Germany and more recently the UK. The UK has the chance to leverage this work and develop a more detailed and subtle policy understanding of user-led innovation.

Recommendations: The UK should develop world-leading policy for user-led innovation

Given its hidden tradition in user-led innovation, the UK has a clear opportunity

to develop a leading position among major industrial nations in developing innovation policy that recognises, promotes and supports user-led innovation.

Avoid the potential chilling effect of existing and new legislation

First, relax copyright rules: in taking forward its responses to the Gowers Review, the Government should respond by adopting the proposed looser applications of copyright. Second, allow toolkits for innovation: policy should distinguish between creative and malicious user activity and should not criminalise the possession and use of toolkits.

Establish a User Innovation Forum

There is currently no forum for firms and others to promote user-led innovation and the further development of policy and business understanding. Government should sponsor the establishment of a User Innovation Forum that would act as a space for business and government to explore the implications of user-led innovation and develop better policy.

Create a pilot scheme for funding user-led innovation projects

Government should support user-led innovation projects, primarily through the Technology Strategy Board. This should also include the public sector – government should enable public policy to draw on the benefits of user-led innovation, for example, the ideas and experiences of individual users of public services.

The R&D tax credit should explicitly encompass user-led innovation

Government and HM Revenue & Customs should clarify that relevant activities by firms that harness user-led innovation as part of their broader research and development of new products and services should be eligible for the R&D tax credit.

New metrics should be developed to measure user-led innovation

New metrics should be developed that ensure user-led innovation is better measured, particularly through NESTA's project to develop a new Innovation Index for the UK.

Benchmark the UK against its major competitors

International policy initiatives should be explored for their relevance to the UK, and, given the networked nature of much user-led innovation, their potential impact on the UK.

Acknowledgements

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The New Inventors

How users are changing the rules of innovation

1. Users play an important and sometimes leading part in innovation, yet their role has been overlooked by UK policy

1.1 User-led innovation occurs when users play an active part in the development of new or improved products and services

New ideas do not always first appear from formal industrial research and development (R&D). Sometimes, users have the innovative ideas that lead to new and improved products or services. These users are often best placed to identify what needs to be done; they may also be able to design, build and distribute their own solutions. This is user-led innovation.

Despite being ignored by UK policymakers for many years, user-led innovation is old news for many UK firms. Such firms invest huge resources in trying to develop a better understanding of the needs of their users. They analyse their behaviour, encourage their suggestions and monitor their emerging innovations. For some firms, user-led innovation forms a key part of their business strategy: they will actively encourage users to innovate – and may even give them the tools they require to do the job. In some cases, new enterprises will emerge from this user-led activity, whilst in others their innovations will take a non-commercial form.

New products or services can be given widespread application without ever having been near an R&D lab, as users lead every stage from invention to innovation. Although the internet is the catalyst for much of the current new wave of user-led innovation, such innovation has always been with us. However, until recently, user-led innovation has been rendered largely invisible to a policy discussion

preoccupied with the ‘linear’ model of innovation characterised by a focus on formal R&D.

In the linear (or ‘pipeline’) model of innovation, formal R&D leads to new discoveries that are incorporated into a new product or process before being marketed to consumers. In this model, R&D is the fundamental source of value creation, making innovation synonymous with scientific and technological invention. But user-led innovation should now be recognised as a mainstream activity alongside formal R&D, as it can also generate significant value to firms and users alike.

1.2 There is a long and rich tradition of user-led innovation in the UK

User-led innovation has been a constant feature of industrial life. The ability of users to innovate by creating or improving technologies has long been recognised and valued. Writing in 1776, the economist Adam Smith noted that many of the machines used for manufacturing were the inventions of ‘common workmen’.¹ Over 50 years later, the father of the computer, Charles Babbage, also recognised the ability of ‘operative workmen’ to innovate by creating new tools or simplifying industrial processes.²

This kind of user-led innovation is so important a feature of manufacturing that it is the central component of modern management practices like Continuous Improvement, Lean Manufacturing and Total Quality Management. All of these contemporary constructs rely on the ability of those on the front line – the individuals who use the machinery on a daily basis – to make the kind of incremental innovations that have actually been a feature of manufacturing for hundreds of years.

1. Smith, A. (1776) ‘An Inquiry into the Nature and Causes of the Wealth of Nations.’ London: Methuen and Co. Book I, Chapter 1, p.20. The full quote is: “A greater part of the machines made use of in those manufactures in which labour is most subdivided, were originally the inventions of some common workman, who, being each of them employed in some very simple operation, naturally turned their thoughts towards finding out easier and readier methods of performing it.”
2. Babbage, C. (1832) ‘On the Economy of Machinery and Manufactures.’ London: C. Knight. Chapter 19, Section 225. “When each process has been reduced to the use of some simple tool, the union of all these tools, actuated by one moving power, constitutes a machine. In contriving tools and simplifying processes, the operative workmen are, perhaps, most successful; but it requires far other habits to combine into one machine these scattered arts.”

There are many other examples where innovations have been developed by individual users who have modified existing products or even created entirely new ones. For example, in the early days of the Model T Ford, farmers routinely changed its intended initial application, using it as a stationary power source to shell corn, saw wood and pump water, converting it into an agricultural transport vehicle or even using it for ploughing.³ This user-led activity was highly inventive and helped create the modern agricultural machinery industry.

More recently, the Brompton folding bike has been a good example of user-led activity. The most popular bicycle in use today – the mountain bike – evolved from the activities of a group of cycling enthusiasts. Their determination to race downhill off the road let them repeatedly to modify their traditional bikes until they became the heavy-duty variant we know today.⁴

Some forms of user-led innovation are more revolutionary. They often appear to epitomise the classic British inventor who labours for years before unveiling his or her new device to the world. For example, business and home computing owe their birth to a series of user-led innovations which took computers out of R&D labs and applied them to wholly new applications.⁵ Business computing transformed the commercial world, with its continual development relying on similar user-led innovations to those noted by Smith and Babbage.

Video games also have their origins in user-led innovation – the UK video game industry was built by a host of ‘bedroom coders’ (amateur games developers).⁶ The rapid development of the internet has been a result of the work of Tim Berners-Lee, who invented the World Wide Web as a means of sharing information between researchers at CERN (the European Organization for Nuclear Research), the world’s largest particle physics laboratory located near Geneva. This led, in turn, to the widespread adoption of the internet and enabled a new wave of user-led innovation to emerge, driving the often bewildering flurry of innovation flowing from the user-inventors of the 21st century.

1.3 UK policy still suffers from a linear-model ‘hangover’ and has only just begun to recognise the importance of users in innovation

Despite the long heritage and obvious financial impact of user-led innovation, UK policy has remained focused on a relatively narrow segment of innovation activity. Though important in itself, this focus clearly misses what has been a central feature of the UK’s industrial and commercial life for hundreds of years.

However, recent research has started to shift these assumptions. It is now more widely recognised that traditional indicators like R&D expenditure and patenting do not reflect the true scale of innovative activity, and that much innovation remains ‘hidden’.⁷ For example, existing innovation surveys do not capture user-led innovation and we need to develop a range of measures to better understand the scale, scope and limits of this phenomenon.

Until the *Innovation Nation* White Paper in March 2008, user-led innovation did not appear in UK innovation policy. Yet while the concept was a recurring theme within the White Paper, UK policy continues to suffer from a linear model hangover and much work remains to be done. Despite an emerging research agenda, there is no policy framework specifically targeted at promoting or removing barriers to user-led innovation. Much UK policy reflects the interests of intellectual property rights holders, which may discourage or criminalise some innovative use of that property. An implicit bias in favour of traditional producers may disadvantage valuable user activity within the innovation system. Until UK innovation policy is reformed, these biases may chill this vital source of new ideas.

1.4 There is increasing international policy activity around user-led innovation

The Danish Government targets user-led innovation with a specific programme. Between 2007 and 2010, the programme has an annual budget of DKK 100 million (£10 million).⁸ It is designed to strengthen methods for diffusion of user-driven innovation in both the private and public sector. The programme includes a fund to support new projects in this area, and a new research centre. The Nordic Innovation Centre,⁹ an inter-governmental group operated by the Nordic Council of Ministers,¹⁰ has also sponsored a series of policy initiatives around user-led innovation.

3. Kline, R. and Pinch, T. (1996) Users as Agents of Technological Change: The Social Construction of the Automobile in the Rural United States. *Technology and Culture*. 37 (4), pp.763-795.
4. For example, see Lütjhe, C., Herstatt, C. and von Hippel, E. (2002) ‘The Dominant Role of Local Information in User Innovation: The Case of Mountain Biking.’ Working Paper. Cambridge, MA: MIT Sloan School of Management.
5. The first commercial computer, LEO 1, was designed by the British firm Lyons for its own use; the Homebrew Computer Club in the US was instrumental in creating what we now call the ‘home computer’.
6. For one example – the development of the game *Elite* – see Chapter Three, *The Universe in a Bottle*, in Spufford, F. (2003) *Backroom Boys. The Secret Return of the British Boffin*. London: Faber and Faber.
7. See National Endowment for Science, Technology and the Arts (2006) ‘The Innovation Gap.’ London: NESTA; also National Endowment for Science, Technology and the Arts (2007) ‘Hidden Innovation.’ London: NESTA; National Endowment for Science, Technology and the Arts (2008) ‘Taking Services Seriously.’ London: NESTA; National Endowment for Science, Technology and the Arts (2008) ‘Total Innovation.’ London: NESTA.
8. For more information on the Danish Programme for User-Driven Innovation, see www.deaca.dk/userdriveninnovation
9. See www.nordicinnovation.net/index.cfm?id=3-0-0
10. The Nordic Council of Ministers, formed in 1971, is the forum for Nordic governmental co-operation. It includes ministers from Denmark, Greenland, Faroe Islands, Finland, Åland, Iceland, Norway and Sweden.

The growing body of evidence on the economic and welfare effects of user-led innovation has led to increased policy interest in developed economies including Finland, Sweden and Australia. The Canadian statistical service, Statistics Canada, is also beginning to collect data on user-led innovation. A recent study of advanced manufacturing technology use within Canadian firms showed a high level of user-led innovation, with over 50 per cent of respondents either customising or developing their own technologies.¹¹

2. User-led innovation is growing in importance and creating significant value

2.1 User-led innovation has been around for a long time, but continues to evolve

People have modified existing products and invented new ones for a very long time, and this activity is so widespread that it has become almost invisible in modern economies. Mass produced items are such a part of our lives that, until recently, the role of the individual in initiating or shaping innovations in ideas, behaviours, products and services has been largely overlooked.

For example, the custom car scene emerged in the US nearly 50 years ago; today a whole sub-industry supplies custom parts for many popular mass-produced cars.¹² A contemporary variation may be found in the emergence of computer case 'modding' (from 'modifying'), where individuals customise their home computers in often outlandish ways,¹³ with a minor industry growing up around this activity. A few minutes on the internet will reveal a whole world of user-led innovation, with people altering everything from USB flash drives to toasters and espresso machines. A slightly longer look will reveal a thriving and innovative sub-culture around the creation of content for sites like YouTube, Facebook and MySpace. Go deeper still and user-led

innovation becomes apparent around video games and other software-intensive products and systems. Look far enough and you can begin to discern the presence of a parallel, entirely user-led, system of innovation that operates by its own rules and produces its own products and services.

2.2 User-led activity has changed the rules of innovation

Just as the custom car scene drew on a growing number of automotive engineers, the growth in highly skilled computer programmers has meant that there are now large numbers of users able to innovate across many industries.

Significantly, in areas like video games, software and music there is now a tradition of user-led innovation and an expectation that users will be able to participate in the innovation process. Many products have either emerged as a result, or are designed to be modified with users welcomed as part of the new and evolving relationship from which further innovations emerge. In many industries the closed culture of innovation no longer applies, and it is users who have broken down the barriers. Some firms are now closer to their customers than ever before.

Many of today's user innovators have the capability to modify existing products and services and to create new ones. The growth of the internet means that they are also now connected into online communities that enable ideas to be shared, developed and disseminated very rapidly. Twenty-first century user-innovators no longer labour alone in their workshops but belong to an international community of like-minded individuals. The internet has become a global workshop where they can share tools, techniques and ideas and work together on projects that change industries.

The growth of open source software is one highly visible manifestation of this shift; collaborative work now underpins many

11. Sabourin, D. and Beckstead, D. (1999) 'Technology Adoption in Canadian Manufacturing, Survey of Advanced Technology in Canadian Manufacturing,' August. Ottawa: Statistics Canada.
12. See for example Wolfe, T. (1965) 'The Kandy-Kolored Tangerine-Flake Streamline Baby.' New York: Farrar, Straus and Giroux.
13. For example, <http://gadgets.fosfor.se/the-top-10-weirdest-case-mods/>

PC case modding

Case modding is the practice of modifying the chassis (or case) of a home PC or video game console. Case mods can involve adding lighting, custom paint jobs, building the PC

into another device (for example, a coffee machine, microwave or toaster) or even the creation of an entirely new custom-designed chassis. An active subculture exists around case modding and an industry has grown up around this activity.

user-led innovations.¹⁴ Open source has also provided an organising structure for many user-led projects together with a set of guiding principles and a descriptive language. Some projects, like the Linux operating system and the Apache web server, have helped to re-shape the global IT industry; others have had a similar effect on areas as diverse as music, video games, education and health.

The scale of this activity is truly breathtaking. But, impressive as it is, it is simply one indicator of a wider social and economic change that has seen the innovation process open up to many more participants. It is a rejection of the closed ethos that dominated much of the latter half of the 20th century.

2.3 We're all users now

Firms and individuals can both be users and innovators. The user of a mass-produced manufactured consumer good is likely to be an individual. But a firm acquiring a specialist or high-performance business product will also be a user. Given the right circumstances, individual users will innovate around their mass-produced consumer product just as a firm will innovate around a business product. The term 'user-led innovation' is intended to indicate the source from which the innovation has emerged: user-led innovation comes from the individual or firm that has acquired a product in order to use it rather than the firm that has supplied it.¹⁸

Firms like IBM and Sun Microsystems participate in many user-led open source projects, while firms like Apple build products around user-led open source systems. Valve Software and Sibelius Software rely on users to develop new ideas that can be incorporated into their products, and also encourage their users to build their own innovative systems. The clear divisions that used to exist between

suppliers and users, firms and consumers, or firms and their suppliers are becoming increasingly blurred: we're all (potential) innovators now.

2.4 Many firms are creating value from different forms of user-led innovation

The modern video games industry has its roots in user-led innovation, and the creation of modified versions of games by users has become a significant source of innovation within the industry. The scale of such modding activity is huge. A single internet site devoted to modding (Mod DB) has over 220,000 members. The site makes available over 500 user-created games, nearly 4,000 user-created major game modifications ('mods') and over 1,200 user-created minor game ones.¹⁹

Firms have changed how they develop and publish games in order to harness this source of innovation. The relationship between the firm and the user community continues to develop as individual mods and entire versions of games developed by users are adopted by firms. Individual users also find employment within the games development industry on the back of their modding work.

More recently, other firms have followed suit. Microsoft now runs competitions for user-created games for its Xbox 360 video game console and has created a free game development toolkit to encourage users to build new games. The toolkit has been downloaded over 400,000 times. Microsoft plans to launch a new open distribution service for user games in late 2008 as part of its strategy to add user-generated value to its Xbox console.

Lego Mindstorms illustrates how a traditional toy manufacturer reshaped its business model

14. Open source software is built on the principle that the source code of a program should be readily accessible, so that users have the right to copy, modify, maintain and redistribute, without paying royalties or fees.

15. See <http://sourceforge.net/>

16. See <http://siteanalytics.compete.com/sourceforge.net/?metric=uv#>

17. See <http://sourceforge.net/>, figures as of 29th May 2008.

18. This report focuses on innovation that emerges from individual users and user communities.

19. See www.moddb.com

Sourceforge.net

Sourceforge.net is the world's largest repository of open source software projects. With over 170,000 registered projects,¹⁵ the site enables users to manage open source developments. It also acts as a clearing house for tools and other facilities and has around two and a half million visitors a month.¹⁶ Projects are categorised across 14 classes, including database, financial,

games, security and desktop. In 2008, the three most active projects were OpenBravo ERP (a web-based enterprise Resource Planning system for SMEs), Notepad++ (a source code editor), and AnimeVision (an anime management system). Meanwhile, the three most downloaded pieces of software, eMule, Azureus and BitTorrent (with 414 million, 173 million, and 155 million downloads respectively) were all concerned with filesharing.¹⁷

Counter-Strike

An example of integration between user-innovators and firms is the computer game *Counter-Strike*. This multi-user online counter-terrorism game has been recognised as one of the most popular games of its type.²⁰ The game was originally launched in 1999 as a user-developed mod to the game *Half-Life* created by the firm Valve Software a few years earlier. *Counter-*

Strike was developed by a small group of users, but the rights to the game were later acquired by Valve Software, who also employed the lead modder. Valve Software also moved further to include user-created video game mods within its business model by creating an online distribution network for mods (the Steam system) which includes licensing and payment mechanisms for modders who wish to release their games commercially.

around user-led innovation. Lego Mindstorms was launched in 1998 as a programmable toy that could be used to build simple robots and other devices. Although the product was designed for Lego's core children's market, it quickly became clear that it was being purchased by technically gifted adults, an entirely different demographic, who were able fully to exploit and extend Mindstorm's capabilities.

Within a short time, Mindstorms became a cult item within user communities. They reverse-engineered and dramatically extended the original designer's specifications. Lego was faced with a choice: to try and prevent this activity (much of it breaching copyright) or to embrace and work with it. Ultimately, Lego chose the latter course. The firm encouraged users to innovate with its product, with the result that sales continued for far longer than would normally be the case. Lego took this a stage further when it recruited a series of leading users to participate in the design of the next generation of the product, Lego Mindstorms NXT, released in 2006.

Many firms now routinely encourage their users to create and share small pieces of software that add a new function or facility to an existing product. This phenomenon is most obvious in software, with Apple making available over 4,000 user-developed applications or widgets that can be downloaded and used for free. Apple has also released a free Software Development Kit (SDK) for the iPhone.

The web-based social networking site Facebook also enables users to make available applications that work within a system, with over 26,000 being available for download.²¹ The search engine and internet site Yahoo! makes available over 4,000 small-scale applications (called widgets) designed to work

on both Microsoft Windows and the Apple Mac operating systems, noting:

*"Almost all Yahoo! widgets were dreamt, designed, and built by members of our bustling developer community. Our authors range from professional software designers and developers, to hobbyists, to major media outlets, to Madison Avenue ad agencies."*²²

Despite a vibrant digital scene in the UK, it is sometimes harder for firms that have managed to build a business model around user activity and innovation to remain in UK ownership. For example, Bebo, the UK social network site that was set up in 2005 and has over 42 million users who provide content, was recently sold for £417 million to US internet company AOL.²³ Similarly, Last.fm, the UK social music site based around user activity, was acquired in 2007 by CBS for £140 million, and Sibelius, the UK-based music notation software firm, was sold to the US firm Avid for £12.2 million in 2006. NetDoctor, the UK-based health social network that combines specialist health information with user content, was acquired by Hearst media in 2006.²⁴ Although these are a small number of examples, there is the sense that the UK business and policy community do not recognise the value that is being generated in these new and innovative business models.

3. User innovators tend to be driven by their interests, less by intellectual property rights, and work within highly active communities

3.1 Innovative users will often be interest-driven

Users often have very different motivations from those which drive and circumscribe

20. For example, see the games website GameSpy's 2004 list of the 25 most memorable games of the past five years, at www.gamespy.com/articles/552/552075p1.html

21. As of May 2008.

22. See <http://widgets.yahoo.com/about/>

23. Johnson, B. (2008) Bebo Sale Nets Founders a Fortune in 3 Years. *The Guardian*. Friday 14th March.

24. See www.guardian.co.uk/media/2006/oct/11/nationalmagazinecompany.pressandpublishing

Lego Mindstorms

At the heart of Lego's original Mindstorms robotic kit is a programmable brick called the RCX. Within weeks of the product's release in 1998, this had been hacked, reverse-engineered and its code and design published on the web. A community quickly

emerged around Mindstorms, with users sharing their insights into how best to hack the RCX and developing toolkits that enabled it to be reprogrammed. The huge interest around Mindstorms led to sales being much higher than originally expected. After a short period, Lego embraced the user communities driving these activities.²⁶

25. For example, see Lakhani, K. and Wolf, B. (2005) *Why Hackers Do What They Do: Understanding Motivation and Effort in Free/Open Source Software Projects*. In Feller, J. 'Perspectives on Free and Open Source Software.' Cambridge, MA: MIT Press.
26. For a useful summary of the role of users in both the original Mindstorms and the Mindstorms NXT, see Koerner, I. (2006) *Geeks in Toyland*. 'Wired.' 14 (2).
27. Saturation is a pleasing, gently compressing and slightly distorting audio effect produced by reel-to-reel tape machines. Hysteresis refers to a type of system whose current state depends on the history of its state. For example, the magnetisation of materials such as iron depends not only on the magnetic field it is exposed to but on previous exposures to magnetic fields.
28. For more information, see www.jeroenbreebaart.com
29. Harhoff, D., Henkel, J., and von Hippel, E. (2003) *Profiting from Voluntary Information Spillovers: How Users Benefit by Freely Revealing their Innovations*. 'Research Policy.' 32 (10), pp.1753-1769.

commercial activities.²⁵ User innovators are often passionate about their particular area of interest and prepared to devote extraordinary amounts of time and energy to developing their ideas. They are able to deploy a high level of skill and resource to their activities, often outside work or other activities. User-innovators may obtain huge reputational and other benefits from their innovation but do not tend primarily to seek financial return. Such users are often acutely aware both of their debt to the community within which they exist and their place within it.

3.2 Intellectual property may be viewed by users as less important, or set aside entirely

Being interest-driven and supported within their community, users will often set aside all issues concerning intellectual property (IP). IP may even be viewed as an impediment to creativity and innovation. In certain cases – including copyright protection of digital media like films and music – IP may itself become the primary focus of user activity.

In industries like video games and music production, some firms have begun to adopt a lighter touch in reacting to breaches of copyright, as the valuable innovations that emerge are often both highly creative and easily appropriable.

3.3 Online communities often play an important part in user-led innovation

User communities will often facilitate a huge amount of innovative activity among their most skilled members, as well as providing education and development routes for newcomers. Such communities have become the crucible within which the ideas and constructs of many user-led innovations are forged. The highly networked nature of internet communities not only means that successful innovations can spread very rapidly, but that user communities are often hugely influential in this process.

3.4 Innovative users will possess high-level skills and may be highly educated

Users who are able to innovate at the highest level tend to possess high-level skills in their chosen domain. They may also be highly educated from a traditional background (for example in science or mathematics), with skills often supplemented by the user-generated education and training generated within user communities.

3.5 Users will often freely reveal their ideas within user communities

Open sharing is widespread in user communities, many of which are characterised by an open sharing of ideas and innovations, termed 'free revealing'.²⁹ Free revealing has been observed in a range of traditional

Jeroen Breebaart

Jeroen Breebaart is active in the remix and plug-in developer communities and has developed a series of free plug-ins to provide additional effects for digital music systems. One of his plug-ins, called *Ferox*, reproduces on a digital system the

saturation and hysteresis effects that come from recordings made on magnetic tape.²⁷ Breebaart was awarded his PhD for his work on the mathematical modelling of the human perception of spatial sound, and is employed as a senior scientist with the Digital Signal Processing Group at Philips Research in the Netherlands.²⁸

Creative Commons

Creative Commons (CC) is a US-based charitable corporation aiming to change aspects of the current system of copyright that act against creativity and innovation. Creative Commons enables authors and creators to set rights between full copyright where all rights are reserved, and the public domain, where no rights are reserved.

The organisation has created a series of model licences that enable authors,

scientists, artists, educators and other creatives clearly to identify the rights they wish their work to carry. The intention is to increase the number of creative works that are available for others legally to share, remix and reuse.

An indication of how widespread this approach has become is that a web search for individual works related to 'innovation' that have been specifically identified as being able to be modified, adapted or built upon yielded over 320,000 results.³⁵

industrial settings including mining,³⁰ the iron and steel industry,³¹ and more recently open source software.³² Although this behaviour may appear to go against much received wisdom surrounding IP, it is often a practical response to factors like uncertainty or the difficulty of protecting a particular innovation.

3.6 Some users and communities may seek to prevent their work from being directly commercialised

There are now a series of mechanisms designed to protect innovations that emerge from user communities and prevent them from being directly appropriated by firms. These mechanisms, sometimes referred to as copyleft, are based on copyright law but are designed to remove restrictions on copying, modifying and distributing the original work. A key feature of the copyleft approach is that the same freedoms to copy and distribute will also apply to modifications, thereby ensuring continued protection from direct commercial exploitation.

Examples of the copyleft approach include the General Public License (GPL) and the Creative Commons (CC) licence. The GPL permits unrestricted use of software for non-commercial purposes and is widely used within Free Software and open source projects.³³ The Creative Commons licence is designed to work around problems with current copyright laws, providing a means for copyright holders to release their work on the internet whilst still protecting their rights. Many books are now both published conventionally whilst also released on the web under a CC licence.³⁴

3.7 User communities often create their own systems of education and training

Such communities will often create and maintain huge archives of information for their members and advice for novices. They will also have formalised systems for posting and resolving issues new to the community. Innovative users will often have donated these educational resources (and may have helped to

30. Nuvolari, A. (2004) Collective Invention During the British Industrial Revolution: The Case of the Cornish Pumping Engine. 'Cambridge Journal of Economics.' 28 (3), pp.347-363.
31. Allen, R. C. (1983) Collective Invention. 'Journal of Economic Behaviour and Organization.' 4, pp.1-24.
32. For example, see Meyer, P. B. (2003) 'Episodes of Collective Invention.' BLS Working Papers. Washington D.C.: Office of Productivity and Technology, U.S. Department of Labor.
33. 'Free software', according to the dominant definition, denotes users' freedom to run, copy, distribute, study, change and improve a piece of software; see www.fsf.org/licensing/essays/free-sw.html
34. For example, Von Hippel, E. (2005) 'Democratizing Innovation.' Cambridge, MA: The MIT Press.
35. See <http://search.creativecommons.org/>

Sibelius

Sibelius Software is a world leader in music notation software. Together with its extensive user communities, a series of guides, tutorials and software toolkits have been created for users wishing to develop their knowledge of Sibelius software. These resources are supplemented by an active expert user community which supports less skilled individual users who wish to develop their knowledge.

Founded by Ben and Jonathan Finn in 1993 to sell music notation software for the Acorn computer, Sibelius Group now has customers in over 100 countries. It is the world market leader in software for writing, teaching and publishing music. In 2006 Sibelius was acquired by Avid Technology, an international company specialising in digital media founded in a Massachusetts garage in 1987.

GBADev (Game Boy Advanced Development)

GBADev.org is a community website serving a network of 'homebrew' games developers that is centred on the popular portable Nintendo gaming device, Game Boy Advance (now replaced by the DS). Homebrew refers to video games produced by consumers on proprietary

game platforms (such as consoles) that are not typically user-programmable or that use proprietary hardware for storage. The GBADev.org website has a highly active developer community that has made available some 70 user-developed software development tools and over 600 demos or user-developed games.

create them) and are likely to be active within this aspect of the community. These systems for advice and education play an important role in developing, maintaining and disseminating user skills and knowledge. This learning and resource may also be applied in formal professional work, supplementing conventional education and training systems.

3.8 User communities will often create toolkits to enable other users to innovate

Software tools are often an important resource for users who wish to innovate. Many user communities will make a wide range freely available, varying between generic tools applicable within a wide range of contexts (for example, a text editor) and tools designed for a specific purpose within a particular area of application (for example, music composition or video games). Such software tools are generally protected by the GPL and are routinely modified and extended within their user communities. Tools are a hugely important resource within and between user innovator communities; they will often embody a huge amount of knowledge concerning the state of the art within their domain of use. Many firms will also make software tools available to their user communities as part of a strategy to encourage user participation and innovation.

3.9 Innovative users can be highly entrepreneurial and business start-ups will often emerge from user communities

User communities are populated by individuals passionate about their particular interest. Some also have the skills and abilities to develop new systems, products or services as well as the entrepreneurial drive to start a business from their activities. Firms like Splash and FXpansion Damage have emerged from user communities (see Appendix A on the video games sector and Appendix D on music software respectively). Firms that have emerged from online activity often have an almost intimate interaction with their user communities. Such firms are often very close to the needs and wants of their customers and will often maintain and develop this interaction over time. Some firms will encourage entrepreneurialism amongst their user base and build a network of user start-ups around them.

4. User-led innovation ranges from giving feedback and support, to creating entirely new products, services and systems

Users and user communities can be involved both in the initial invention of a new system,

Lego – encouraging user entrepreneurialism

Following the success of its Mindstorms product, Lego recruited leading adult users to help design the second generation of the toy, the Mindstorms NXT robot. Lego is now developing a systematic strategy of user involvement, including the creation

of the Lego Factory website to link young fans who wish to share their designs.

The firm also markets innovative models and specialist Lego bricks that have been designed by large numbers of innovative users. Lego is actively working with a user who has developed a highly innovative educational application.

product, process or service and at all stages of the innovation process that will bring the invention into widespread application. Innovative users and user communities are active in both the 'R' and the 'D' of research and development for many goods and services. Innovative activity is an important part of the life of many user communities (indeed, it may even be their *raison d'être*). As we have seen, numerous firms have developed mechanisms for harnessing users within their innovation processes.

However, innovative users do not arrive fully-formed. There is often a slow process of knowledge and skills development before they are able to innovate. The degree, intensity and quality of user participation in a community will increase as the novice becomes integrated. Over time, an individual user's commitment and skills will develop and his or her effective participation in the six forms of innovative user activity described below will grow.

4.1 Provision of feedback and support

Existing products will often have forums where users can ask for advice and support from more knowledgeable users. The development of new or improved versions of products will also rely on the active participation of such knowledgeable users to probe and accurately report their flaws and weaknesses. Such active participation requires significant skills and experience. These activities will often be the source of many innovative ideas for new or improved products and form an important part of a community's or firm's product development activities – the 'D' in R&D. They are also likely to help develop the next generation of innovative users.

4.2 Production of content for existing products

This very broad category includes both the production of user content that requires little technical expertise (for example, uploading a video on YouTube) and that which requires a high level of technical ability (for example, the creation of new levels, landscapes or characters for a video game). At its simplest, user-generated content is highly mediated and structured with few opportunities for innovation. However, the most sophisticated content will require a high degree of technical skill. Both forms challenge the individual user to produce something new that is interesting to a large number of other people – in other words they draw users into the process of innovation.

The production of content by innovative users for inclusion within existing products or systems is now commonplace; indeed, much of the hype around Web 2.0 arose from the recognition that this activity was now widespread.³⁶ The business model for systems like MySpace, Facebook, Bebo and YouTube explicitly relies on individual users generating and sharing content, and their product architecture reflects this model.

Another form of user-generated content relies upon users developing graphics, logic structures and other material for use within products like video games. This activity will require a fairly high level of technical ability, relying on software tools to support this process from user communities and firms.

4.3 Novel use of existing products

The ability of some highly skilled users to recombine existing products and services to create entirely new forms is a hallmark of user-led innovation in the digital industries. This activity can take many different forms. Innovative users can re-mix music to produce new versions of an existing piece of music, or mix two different tracks to create a new musical piece within a completely new musical genre.

Another form of this activity is found in a new form of film-making that employs multi-user games and consoles to create user-generated productions. Such 'films' are scripted and directed in the normal way but the action is captured and recorded within the context of a multi-user game played by the 'actors' on a games console. This is an entirely novel genre called machinima (a portmanteau of machine cinema). There are many machinima 'production companies' developing this new genre of film.³⁷

4.4 Minor modification of existing products

The skills required to modify many high technology products and services are now widespread and many user communities have developed around this activity. Modding can be divided into two main forms: the ability to make minor adjustments to the operation of existing products; and the ability to re-programme products and add entirely new levels of functionality to their operation. Both forms of modding require considerable technical understanding and ability.

The key feature of low-level modding is that it largely works within the product's existing parameters. It does not attempt to re-engineer the functionality of the product in a major way.

36. 'Web 2.0' is a general term for web technologies and design – including wiki, video-sharing, blogging and consumer feedback sites – which aim to facilitate information-sharing, collaboration and creativity among users.

37. For example *Red vs Blue*, a machinima series based on the video game *Halo*. See <http://rvb.roosterteeth.com/home.php>

This is perhaps most common with PC-based video games, but has also been observed in Apple and PC-based computer systems, video games consoles and the over-clocking of microprocessors.³⁸ Communities have also grown up around changing the performance characteristics of cars by modifying their computer-controlled engine management units – sometimes termed ‘chipping’. The modification of existing products and services is such a widespread and potentially beneficial activity that some firms sanction and encourage modders. Minor industries are also emerging to cater for their specialist needs.

4.5 Major modification of existing products

This form of modding involves users redefining the functionality and operation of a product and adding or redefining the way it works and its capabilities. Such major modifications involve advanced technical capability. Examples can be found in the re-programming of Personal Video Recorders, the reprogramming of robotic toys (for example, Aibo, Furby, Robosapien, Lego Mindstorms), and the creation of new features or levels within existing music or video game software. The key feature of such major modification is that it significantly extends the product’s existing performance; in some cases, it may result in the product’s functionality being massively extended or entirely re-engineered.

Firms may recognise the potential benefits of this activity and re-shape their products and services accordingly (see music software and video game case studies below). As we have seen, firms like Lego include such innovative users within their new product development process.

4.6 Production of novel products

The highest level of innovative user-led innovation activity occurs when individual users or user communities create their own novel systems, products or services. In this context users become a manufacturer in their own right. Many major open source systems (for example, Apache, Linux, OpenOffice) fall into this category, though systems produced by innovative users may also be much smaller in size and scope. For example, firms like Google and Facebook have made available the technical information required by developers to help users create small-scale software applications. Apple also encourages the creation of widgets by users and others, acting as a hub for their distribution to their user base. At its most extreme, video game modding

can help create entirely new games, as with *Counter-Strike*.

Some user-led innovation can create new classes of product with a revolutionary impact on firms and users alike. For example, the creation in 1999 of a system for easily sharing music and other files across networks (Napster) has started to transform the recorded music industry. A more recent user-led innovation, BitTorrent, has also had a major impact on the sharing of very large data files across the internet.

5. Firms are embracing user-led innovation in many different ways, from commercialising user inventions to providing users with ‘toolkits’ for innovation

Many firms now see user-led innovation as a valuable resource and have either included it in their business strategy, R&D process or product offering. Such reactions provide compelling evidence of the growing importance of user-led innovation to firms. User-led innovation now represents an important source of new ideas and a precious complementary asset that firms can use to increase the value generated by their products.

5.1 Firms are commercialising user inventions and innovations

Firms may either seek to acquire IP from users or simply develop products inspired by user-led innovations. For example, social networking grew from user-led innovations in the early days of the internet. Highly valued firms like Facebook and Bebo have built their business models around user behaviour and ideas rather than user IP. Apple’s iTunes store is a highly successful commercialisation of an idea – file downloading – that was first brought into widespread use by Napster. In contrast, firms like Lego and Sibelius enter into more structured relationships that enable user-led innovations to be commercialised.

5.2 Firms are building products around user content

Many products and systems have emerged that explicitly depend on users uploading and sharing their own content. Systems such as Facebook, MySpace, Bebo, YouTube and *Second Life* all provide an architecture into which users load their content and provide much of the interaction and added value. In such systems, users provide the product or

38. Over-clocking refers to forcing computer components to run at higher clock rates (the speed at which a computer performs its most basic operations) than they were designed to or were designated for by the manufacturer, in order to increase the performance of a computer.

service, the community, and the data and interactions that deliver much of their value.

The latest generation of video consoles (Xbox 360, PS3) has also included features that enable users to upload their data – for example, successful video games like the quiz game *Buzz!* have been redesigned to enable users to share their content.

5.3 Firms are providing users with toolkits

Toolkits containing a range of software tools are now routinely made available by many firms wishing to promote user-led innovation.³⁹ Toolkits are an important mechanism for broadening the numbers of users able to engage in innovative activity. Firms may release tools directly linked to a particular product (see Appendix D on the music software sector) or they may release more general purpose tools with the intention of building up user-led innovation capability over the longer term (see Appendix A on the video games sector). Apple recently released a free Software Development Kit (SDK) for the iPhone, with some 100,000 copies downloaded within the first four days of release.⁴⁰

5.4 Firms are providing users with product ‘components’

In areas with high barriers preventing users from engaging in more advanced forms of user-led innovation, firms have begun to provide users with the components required to make their own versions of their products. This is particularly true of the music industry where bands may now make their music available as a series of musical elements that can be re-mixed to create new versions of their music. This also taps into an active re-mix subculture within music fan communities facilitated by the ready availability of commercial and open source music mixing software. The BBC backstage project opened up its content feeds to encourage innovation and support new talent, enabling users to build new services on a non-commercial basis.⁴¹

5.5 Firms are opening product architecture to users

Opening up product architecture to users has proved a potent means of encouraging the more advanced forms of user-led innovation. This can take the form of simply publishing technical information about the structure of the product, releasing the Application Programming Interface (API)⁴² or redesigning the product specifically to encourage user-led innovation. This has now become common in social networking systems (for example,

Facebook, Last.fm, Bebo and MySpace have all released their APIs), certain types of video game (for example, *Half-Life*) and some music software (for example, Sibelius).

5.6 Firms are recruiting innovative users to help develop new products

Users often now inform the development or testing of new products, either by participating in a user community or by becoming named product testers. In some cases innovative users will be individually recruited to participate in the design and development of a new product. Lego, for example, recruited a few adult fans to help design the second generation of their Mindstorms robot toy.

5.7 Firms are engaging with user communities

It is increasingly important for firms to have an active and engaged user community as innovative users play such a vital part in R&D through their comments, suggestions and feedback. Such user communities are not just a wellspring of inventive ideas, they can also help develop the next generation of innovative users. They may even be a source of future employees. Such communities may be supported either directly within some form of corporate web presence, or indirectly via sponsorship of user-led communities, by providing software tools or product ‘components’, or the staging of events or competitions.

6. Policy needs to embrace user-led innovation and better understand its implications for the UK economy

6.1 The UK has an opportunity to lead international policy in this area

Our understanding of innovation has changed: we now recognise that innovation may be a more open and collaborative process than the traditional closed model; one that includes users, customers and firms. This report has explored how one group within this wider definition of innovation – users – has had a significant effect on many industries and become a valuable and potent source of innovative ideas.

User-led innovation has been a constant feature of industrial life for hundreds of years and is a core element in many management practices, yet has remained largely invisible to policymaking. The growth and widespread adoption of the internet exposed the user-

39. For example, Von Hippel, E. and Katz, R. (2002) Shifting Innovation to Users via Toolkits. ‘Management Science.’ 48 (7). July. pp.821-833.

40. Apple (2008) ‘iPhone SDK downloads top 100,000.’ Press release. 12th March. Cupertino, California: Apple.

41. See <http://backstage.bbc.co.uk/prototypes/>

42. An API is the technical information required to enable third parties to develop compatible software applications.

led innovation in our daily lives, enabling us to see it afresh and recognise its scale and impact. User-led innovation is now recognised as an important phenomenon that forms a valuable part of the innovation landscape. There is a large and growing body of work that documents user-led innovation,⁴³ subsequent collaborative innovation⁴⁴ and the issues that it raises for our current models of innovation.⁴⁵ The phenomenon raises many questions about our current policy structures and mechanisms, which often seem more suited to 19th century industrial structures than 21st century models of innovation.

The many examples of user-led innovation documented in this report emerged under the radar of government and largely occurred despite official policy. User-led innovation often challenges the status quo and seeks to push the boundaries in a way that is often not possible within traditional R&D. Such activity often challenges the systems of IP and copyright designed to protect and promote innovation, but which now act as a brake on innovative activity. Many firms have learnt how to build systems of innovation that include and value user activity and have evolved new business models in response.

Active and engaged users who innovate look likely to be a central feature of the 21st century knowledge economy, with a number of important factors suggesting that user-led innovation is likely to be a persistent feature of UK innovation: the growth in the numbers of highly skilled users; the ubiquity of broadband; more IT-intensive products and services; the increasing availability of firm and user-produced toolkits; and the continued willingness of users to set aside the rules in pursuit of creative goals.

Our current understanding of user-led innovation, and the insights outlined in this report, are the result of many years of work by a small group of academic researchers. These researchers, working in universities in the US, Denmark, Germany and more recently the UK, have provided the foundation for early policy responses in this area. The UK has the chance to leverage this work and develop a more detailed and subtle policy understanding of user-led innovation.

UK policy needs to learn how to benefit from this phenomenon. The UK has a clear opportunity to develop a leading position among major industrial nations in framing an

innovation policy that recognises, promotes and supports user-led innovation.

While it is for individual firms and organisations to consider how best to harness user-led innovation, government also has a role to play in creating the optimal conditions for user-led innovation to flourish. These recommendations are a first step towards repositioning UK policy so that it recognises and learns more about user-led innovation and supports the efforts made by firms in this new and emerging relationship.

6.2 Recommendations

6.2.1 Government should assess, and avoid, the potential chilling effect of existing and new legislation on user-led innovation

1. Relax copyright rules: The current interpretation of intellectual property may be an impediment to user-led innovation. In taking forward its responses to the Gowers Review, the Government should respond by adopting the proposed looser applications of copyright.
2. Toolkits for innovation: Much user-led innovation relies upon the availability of software tools which may be user-developed or provided by firms. UK policy should distinguish between creative and malicious user activity and should not criminalise the possession and use of toolkits as this may act to chill innovative activity and criminalise innovative and creative user activity.

6.2.2 Government should establish a User Innovation Forum

Despite recognising the importance of user-led innovation in the *Innovation Nation* White Paper, much UK innovation policy is built around the 'closed' innovation model. The legal, commercial and policy context tends to act against user-led innovation. There is currently no forum for firms and others to promote user-led innovation and the further development of policy and business understanding. Government should sponsor the establishment of a User Innovation Forum that would act as a space for business and government to explore the implications of user-led innovation and develop policy in this area. The structure of the User Innovation Forum should ensure that it acts as a clearing house for policy and practice in this area and becomes the policy and business voice for user-led innovation.

43. For example, Von Hippel, E. (2005) 'Democratizing Innovation.' Cambridge, MA: The MIT Press; also Leadbeater, C. (2008) 'We-think, The Power of Mass Creativity.' London: Profile Books.

44. For example, Shirky, C. (2008) 'Here Comes Everybody, The Power of Organizing Without Organizations.' London: Allen Lane; also Benkler, Y. (2006) 'The Wealth of Networks, How Social Production Transforms Markets and Freedom.' New Haven, Connecticut: Yale University Press.

45. For example, Lessig, L. (2005) 'Free Culture, The Nature and Future of Creativity.' London: Penguin; also Mason, M. (2008) 'The Pirate's Dilemma, How Hackers, Punk Capitalists, Graffiti Millionaires and Other Youth Movements are Remixing our Culture and Changing our World.' New York: Free Press.

6.2.3 Government should create a pilot scheme for funding user-led innovation projects

Government should support user-led innovation projects, primarily through the Technology Strategy Board. The scheme should promote user-led innovation in both the private and public sector by funding projects with clear user-led activity. Government should enable public policy to draw on the benefits of user-led innovation, for example, the ideas and experiences of individual users of public services.

6.2.4 Government should ensure that the R&D tax credit explicitly encompasses user-led innovation

Many firms may be unsure as to whether the R&D tax credit encompasses activities that represent a form of extended or distributed research and development that engages users and user communities. Current guidelines for firms do not mention users as potential innovators. Government and HM Revenue & Customs should clarify that relevant activities (those that seek to 'resolve scientific or technological uncertainty') involving users – or supporting users to innovate – are eligible for the R&D tax credit.

6.2.5 New metrics should be developed to measure user-led innovation and begin to model the creation and distribution of its value within the UK economy

Current innovation metrics largely ignore the role of users and much activity is largely hidden. New metrics should be developed that ensure user-led innovation is better measured, particularly through NESTA's project to develop a new Innovation Index for the UK. More broadly, user-led innovation needs to become a major focus in innovation research, in particular there is a need for greater evidence to model the dynamics of user-led innovation within the UK economy (the value created and how value is distributed), and the social dynamics of user communities (especially participation and exclusion in user-led innovation).

6.2.6 Government should benchmark the UK against its major competitors in order to assess its preparedness to support and encourage user-led innovation

This should be achieved by benchmarking the UK's position against international policy initiatives in this area (for example, Scandinavian countries). International policy initiatives should be explored for their relevance to the UK context, and given the

networked nature of much user-led innovation, their potential impact on the UK.

Appendix A: Video games

1. The video game industry is a leading knowledge economy sector

Over some 30 years, video games have become a mainstream form of entertainment rivalling film and music. Video games are the fastest growing segment within the creative sector, expanding by 11.4 per cent a year, from a global turnover of \$27 billion in 2005 to a projected \$46 billion in 2010.⁴⁶ The UK is the third biggest video games market in the world after the US and Japan⁴⁷ and the domestic video game industry employs around 22,000 people and has a value of \$2 billion.⁴⁸

2. Users and user communities play an important role in this sector

Users were instrumental in the birth of the video game industry. Many early exemplars of the medium, such as *Spacewar!* or *Tennis for Two*, were created by users for their own entertainment, or to test the capabilities of their hardware. They were given away for free, enabling later users to build on their openly available source code.

Although the commercial success of video games has created a highly competitive industry which exercises strong intellectual property rights over its products, the hobbyist underground scene has also survived, remaining 'under the radar' until recently. Homebrew coders create small games without the capital investment or large team sizes necessary to participate in mainstream markets. This makes it possible for them to take creative risks that would be difficult to accept in larger organisations, and has resulted in an explosion of innovativeness which global corporations

such as Microsoft or Sony are attempting to harness.

Users have concentrated their innovative activities on open standard platforms such as the PC, and cheap and easy to programme proprietary platforms, particularly handheld devices. When creating games for handheld devices, which are 'closed', developers often need to engage in reverse engineering of uncertain legality. For example, GBADev.org, a community helping to create homebrew games for Nintendo's Game Boy has faced complaints from Nintendo, which accused its members of condoning piracy by publicising techniques and tools to reverse engineer its device.

The growth of the internet has enabled talented homebrew developers to reach broader 'casual' audiences with their games, as well as tapping into the resources of burgeoning online communities of like-minded individuals who provide feedback, advice and tools.

The growth of the modding movement demonstrates the important role that user-led innovation plays in the evolution of the video game sector. Modding communities are groups of technically proficient hobbyists who engage in the customisation of games, creating additional content, or implementing new features into existing products. These activities require access to the game's underlying technical infrastructure, its 'engine'.

Many prominent video game studios including id Software, Epic or Valve Software make their engines openly available to modding communities, relinquishing control over valuable intellectual assets in the process. Most of these firms were started by individuals with

46. PricewaterhouseCoopers (2006) 'Global Entertainment and Media Outlook 2006-2010.' London: PWC.

47. The Entertainment & Leisure Software Publishers Association (2005) 'The Games Industry: A UK Success Story – Call to Government for More Support for One of the UK's Most Successful Industries.' London: ELSPA.

48. Ibid.

a modding background for whom openness and reciprocity are intrinsic. Important commercial benefits have also been realised by adopting modder-friendly strategies. For example, Valve Software's highly successful online game *Counter-Strike* started as a user mod developed by hobbyists using the firm's proprietary Source engine.

Although most user-developed games are distributed free, their creators can derive income through sponsored revenue models which have become commonplace in the online environment. Homebrew developers David Scott and Paul Preece have established a firm, NovelConcept, and an advertisement-funded online community called Casual Collective to promote their games including the award-winning *Desktop Tower Defence Force*.

Video game development by users has key collective dimensions: communities are essential sources of advice, tools, feedback and opportunities for collaboration; and behaviour inside them is regulated by unwritten institutional regimes based on reciprocity and sharing.

The two founding members of NovelConcepts met playing games in one of these communities, and have designed the Casual Collective site to foster communication and social networking between members. David Johnston from Smudged Cat recruits collaborators and co-ordinates his development activities through the community sites of Microsoft's XNA Creators Club.

Splash Damage, a high profile game studio started by members of a *Quake* mod-team, engages its users through a multi-channel communication strategy including Internet Relay Chat,⁴⁹ internet forums and blog affiliation rings and fan-sites. According to Splash Damage's founder, Paul Wedgewood, the studio's close relationship with its community of users gives access to valuable feedback while increasing the profile and shelf-life of its products. This relationship also follows in a long-established tradition of reciprocity from which they themselves benefited as modders.

3. User-led innovation takes a variety of forms

3.1 Provision of feedback and support by users

User feedback about product quality is a key element of the Quality Assurance function of video game studios. Gameplay testing, particularly on multiplayer environments, requires large numbers of testers, usually recruited from user communities whose members see the right to play the game before its release as a privilege. Splash Damage carries out closed and open 'beta testing' at the later stages of product development with 2,000 and 80,000 participants, respectively.

This studio encourages its users to say what they want in the community forums. In addition to gathering and analysing this feedback systematically, members of Splash Damage participate actively in the ongoing discussions. Paul Wedgewood states that in this context:

"All negative feedback should be taken as constructive criticism because if the player didn't care about the game he wouldn't be there complaining, he's only complaining because he wants a problem fixed."

Firms that originated in modding communities enjoy an important advantage over their corporate counterparts in their first-hand knowledge of the social dynamics and customs inside these groups. Wedgewood argues that firms from mod cultures have a 'thick skin' and are able to deal better with community members who are very passionate about the products being developed.

Users are also sources of innovative ideas which can be leveraged by perceptive video game developers. NovelConcepts has created a section in the Casual Collective website forum devoted to discussing users' new game ideas. This allows the company to gauge demand for features before incorporating them into its products.

Users are also important sources of support, advice and help. For example, Smudged Cat's David Johnston writes tutorials for other members of the XNA Creators Club. He does so from a sense of duty, a feeling also present in GBADev.org, where discussions are archived and documented for new participants to access. The site's administrator, Peter Lemon, emphasises the educational role of user communities: they provide participants with practical skills to complement the theoretical

49. A form of real-time internet synchronous audio conferencing mainly designed for group communication in web discussion forums.

knowledge acquired in formal programming degrees.

3.2 Production of content by users for existing products

The exercise and sharing of user creativity inside video games, broadly classified inside what the former President of Sony's Worldwide Studios, Phil Harrison, defined as 'Gaming 3.0', are becoming growingly important in the video games sector.⁵⁰

User participation in content creation ranges from the uploading of images for avatar customisation to the design of highly sophisticated virtual artefacts in *Second Life*. The availability of tools and the degree of openness implemented by a game's designers determine how and whether users can exercise their creativity. For example, Relentless Software's MyBuzz! feature for their new *Buzz!* quiz show game in PlayStation 3 (PS3) allows users to create new quizzes that can be downloaded and played inside the game, but restricts available media by excluding images and sound. This is justified by copyright concerns.

The founders of Splash Damage began their career as the modding team Q3F, creating new maps for *Quake*. They could only do so because both the game's engine and a wide range of level-editing tools were openly available. The popularity of Q3F's maps eventually brought the team to the attention of *Quake* developers, id Software.

The creation of more powerful and easy-to-use tools, and of online platforms for the uploading and distribution of user-generated content (following YouTube's model), have recently become key elements in the competitive strategies of large video game console manufacturers Microsoft and Sony. We examine the rationale underlying these activities and emerging issues in Section 4.

3.3 Novel use of combinations of existing products or services by users

The use of video game engines to create films and short clips is an unexpected outcome of user-centric innovation activities. Many video games, including *Halo* or *World of Warcraft*, allow users to record their actions in the game world, and share them outside. Some users edit these videos by adding music or dialogue, and post them on sites like YouTube. It was the presence of a large number of clips from Sony's *SingStar* karaoke game in YouTube that prompted the company to set-up its

MySingStar community in PlayStation Network. MySingStar enables users of this game to make their performances available online, and comment on each other's content.

An emerging art form, 'machinima' takes such user creativity even further. In this case, a game engine is used to create films starring avatars manipulated by participants according to a prewritten script. The popular comedy series *Red vs. Blue*, created using Bungie's *Halo* engine, or the short films contributed by the community of UK developer Lionhead's *The Movies*, are two examples of this innovative approach.

3.4 Modification by users of existing products

Open game engines are the starting point of mods which range from minor alterations in a game's visual style (such as changes in the look and feel of characters and weapons, or customisation of the user interface) to the implementation of wholly new features. These activities require access to a game's engine, sophisticated tools and a high degree of skill on the part of the modder.

Modding communities create such tools and advise novice participants. Many studios that originated inside these communities have continued to make their game engines publicly available for others to improve and build upon. The best example is id Software, which released its highly innovative *Doom* and *Quake* engines under the General Public License (GPL). This led to the development of a myriad of modified engines powering numerous games. Valve Software's Source engine, used for the popular *Half-Life* franchise, included elements from the *Quake* engine. The firm eventually made the Source engine publicly available giving rise to many hobbyist modifications including *Counter-Strike*. This process of cumulative innovation has spawned a highly profitable and popular multiplayer gaming genre.

Major modifications of game engines are usually dubbed 'conversions'. In this case, essential components of the engine are redesigned or created from scratch, to provide new gaming experiences. Splash Damage's conversions of the *Quake* engine (which the studio optimises for online multiplayer gaming) have resulted in two highly successful products, *Wolfenstein: Enemy Territory* and *Quake Wars: Enemy Territory*.

Although modding has been mostly confined to open PC platforms, console-focused video

50. See www.businessweek.com/innovate/content/mar2007/id20070309_764852.htm

game studios such as Epic Software have started adopting modder-friendly strategies which are examined in further detail in Section 4.

3.5 Production of novel products by users

Some commentators and industry insiders contrast the thriving homebrew scene with risk-averse large mainstream publishers who, they argue, are afraid of stepping beyond well-established genres and franchises.

David Johnston argues that in homebrew development "...you [do not] need to work your way through marketing, who will filter out things they haven't seen before". The low level of investment required to create these games, and the availability of well-established mechanisms to generate revenues through website advertising, have produced an avalanche of user-generated games, also exemplified by the case studies of NovelConcepts and GBADev.org. This fertile environment of experimentation and creativity, supported by strong communities, has garnered the attention of commercial companies who have started community initiatives to marshal the creativity of homebrew developers.

4. Firms have embraced user-led innovation in many different ways

User-centric innovation has not created the same feeling of crisis in the video game industry as it has in the music sector. Gaming firms, both large and small, are incorporating it into their strategies in a diversity of ways described in this section. Having considered user-led innovation, and the communities responsible for it, we now focus on the strategies deployed by firms to harness it; and some of the issues they face while interacting with communities of user innovators.

4.1 Firms are engaging with user communities

All the activities described above require companies to engage with user communities, and provide support for their activities.

Microsoft's sponsorship of the XNA Creators Club has led to the emergence of a healthy, thriving community. The XNA Creators Club gives subscribing XNA homebrew developers access to advanced features and community resources for advice and feedback. According to David Johnston, Microsoft's devotion to the community has created a positive, collaborative atmosphere in the XNA Creators Club. There

are 50 community sites associated with the XNA tools, including one in the UK. Microsoft is working with the user group to build a community with an online support system and to promote activities like match-making between developers. The Club also hopes to reach out to academics and students.

Microsoft also sought to raise the profile of its community and motivate its members with its Dream-Build-Play Competition, for which users submitted games developed using Games Studio Express (GSE) – a tool made freely available for download. The prize was the release of the winning games through the Xbox Live Arcade online platform. Dream-Build-Play was announced in August 2006 with a December launch and there were 150–160,000 downloads of GSE in those four months. There were 4,500 registrations for entry to the competition and 200 actual entries of finished, working games, including Johnston's *Shuggy*, which was shortlisted and earned this homebrew developer a contract with Microsoft.

Relentless Software also intends to use competitions as a way of keeping the community of users of MyBuzz! software attached to its product.

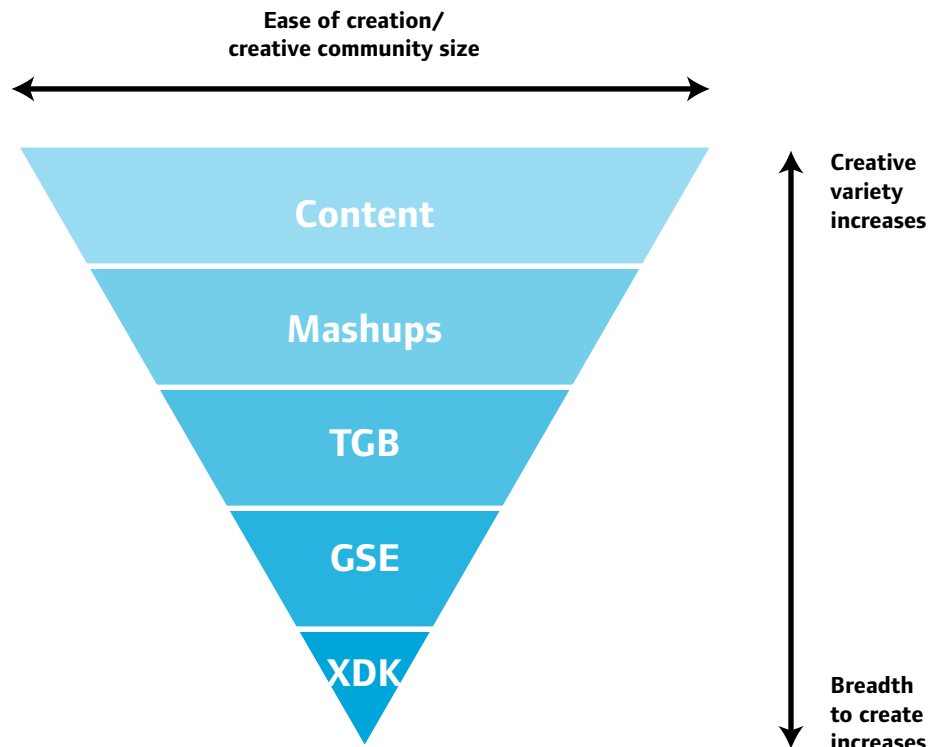
All the interviewees point out that a key element of community design is to provide infrastructures that promote interactions between members (for peer advice, support and collaboration), and between members and community sponsors (in order to make it possible for them to provide feedback). The features of social networking sites such as MySpace and Facebook are becoming growingly influential in the design of video game user community sites.

4.2 Firms are recruiting innovative users to design new products

The popularity of video games created by users raises the visibility of their developers, leading in some cases to a publishing contract, or a job in a professional studio. This was the case with David Johnston who was hired by Rare Software because of the success of his game *Time Slip* for Sony's Net Yaroze. More recently, Johnston's Dream-Build-Play runner-up *Shuggy* resulted in a publishing contract allowing him to become a full-time developer.

It is also very common for professional studios in certain genres to recruit talented modders. Splash Damage, for example, recruits most of its developers from modding communities.

Figure 1: Games freedom triangle



Source: Microsoft.

4.3 Firms are opening product architecture to users

Many successful studios developing games for PC platforms have opened their product architecture to innovative communities of users. This creates numerous beneficial effects, such as community goodwill, the identification of budding talent, innovative ideas and the promotion of their technologies as industry standards.

By making its game engine architecture openly available, id Software created a community of hobbyists familiar with its techniques and tools, who shared a passion for its products. Some hobbyists, such as Splash Damage, would eventually become commercial partners (id Software is the publisher of Splash Damage's products). The use of id Software's engine to create a competing product is deterred by fear of the potential backlash where community reciprocity norms are violated. Paul Wedgewood points out how the effort that his Q3F team put into converting *Quake* generated strong criticisms inside the community, who felt that Q3F was 'stealing the game'.

The video games console market, which has been traditionally dominated by closed architectures, is also shifting towards enhanced access and creative freedom for users. For example, Epic Games' *Unreal Tournament 3* (UT3) allows users to import professionally produced assets, models and new features into the game. These mods are programmed on a PC before being transferred to the PS3 on PlayStation Network, where others can download them. Although the licence agreement prohibits the commercial sale of UT3-derived mods, Epic's CEO Mark Rein suggests that a platform allowing users to make money selling their mods (with Epic benefiting through royalties or transaction fees) might be introduced in the future.

Microsoft recently opened Xbox Live to the unmoderated distribution of user-generated content. The company has established a peer-review system to prevent the uploading of copyrighted, offensive or low-quality material, which might decrease its value for mainstream consumers looking for a simple family-friendly experience. Chris Satchell, manager of the XNA initiative, targeted at the promotion of homebrew development for the Xbox 360

console, says that the company faces technical hurdles that will be eventually solved, as well as policy barriers related to intellectual property and offensive content, which might be more difficult to negotiate.

4.4 Firms are providing users with product 'components'

Several firms enable their users to recombine game components to create new experiences inside a game. *Little Big Planet*, currently being developed by Guildford-based studio Media Molecule, has a creative editor interface allowing users to create objects and import images for sharing on PlayStation Network. It is also possible to carry out creative activities with online collaborators. The user-creation is integral to the game – the tool must be used to progress through the levels, although content uploading is constrained to elements fitting with the game's rag-doll cartoon aesthetic.

Halo 3 also contains a real-time editing tool called Forge which enables users to 'create levels' as they play by moving content around the game environment. These levels can be shared later with other gamers. The use of Forge together with *Halo 3*'s content recording features has become a popular source of user-generated machinima videos.

In these cases, platform owners' loss of control over the quality of the content being uploaded by users is reduced to the extent to which the actual components that users reconfigure are vetted by the developers. However, this also constrains user creativity.

4.5 Firms are providing users with toolkits

Some of the activities described above require firms to design and develop tools that users can deploy to exercise their creativity by producing or rearranging content, or implementing innovative features in existing commercial products. Striking the right balance between ease-of-use and functionality is a key aspect of tool creation, as exemplified by Microsoft's efforts.

Microsoft's XNA framework has been designed to assist homebrew developers with some of the most arduous, least creative aspects of video game development. The resulting code can be moved transparently from a PC to the Xbox 360 platform.

Microsoft has produced a 'Games Freedom Triangle' framework to guide thinking on user engagement (Figure 1). The triangle shows a hierarchy where the creative community

size corresponds to ease of creation, which is strongly linked to the availability of suitable tools. This model is seen as a 'pathway to engagement' along which there is a collection of available tools addressing the needs of different creative communities.

In this triangle, the largest community is engaged in producing 'content' (such as videos on the *Halo 3* game), while the smallest comprises professional game developers using the official Xbox Development Kit (XDK). Several tool kits are targeted at the creative spaces and communities located in between these two extremes. At an easier level, there is an area for mashups (hybrid web applications which typically combine different types of content) for which Microsoft currently has no model or tool. Following this is the Torque Game Builder (TGB) assisting people at varying levels of programming capability develop games for PC/Mac and Xbox. Next in sophistication lies Game Studio Express (GSE), a free-to-download 'starter kit' aimed at hobbyists and homebrew developers.

Microsoft's strategy increases the competitiveness of its console and online platform in several ways. For a start, the availability of a broad range of user-generated video games that can be easily transferred from the PC to the Xbox 360 makes the Xbox more competitive with PlayStation 3, while early exposure of novice programmers to Microsoft's tools enhances the firm's 'developer mindshare'. As part of this strategy, Microsoft is promoting the integration of the XNA framework and development tools into a broad range of university game design and programming degree courses.

4.6 Firms are building products around user content

Many firms are creating game architectures that enable them to leverage the creativity of their user communities or to promote new communities.

We have seen how MyBuzz! allows users to design and share quizzes on PlayStation 3. Similarly, MySingStar members share footage of their karaoke performances. It is early days for both initiatives and there is uncertainty about their revenue generation potential. However, both Relentless and Sony see this as a highly valuable trend. They expect such activities to lead to enhanced brand loyalty (particularly with younger users accustomed to the high levels of interactivity in popular social

networking sites) and greater visibility for their products.

Again, both firms face a problem controlling the quality of the content uploaded by users, which might be copyrighted or offensive. Relentless has limited the types of content that can be used to create quizzes to text. Sony's MySingStar deploys moderators who remove content deemed to be inappropriate as reported by the user community. However, according to Paulina Bosek, Director of MySingStar, only around 2 per cent of the content uploaded in the platform has to be removed on these grounds.

The best-known paradigm of user-generated content in video games is that of *Second Life*. In this online environment, users are the essential source of content. *Second Life's* developers, Linden Lab, grant users complete intellectual property rights over the artefacts they design as a way of incentivising creativity. The firm generate its revenues from the rental of virtual space (where this creativity is exercised) and advertising. This constitutes an important example of the emergence of innovative business models enabled by users' creative engagement.

Appendix B: Music industry

1. The music industry a leading creative economy sector

The music industry is an important part of the UK's creative economy and is being radically transformed by user-led innovation. The industry generates nearly 130,000 jobs and contributes around £5 billion to the economy⁵¹ and is a recognised world leader. The UK is the third largest market in the world for music after the US and Japan⁵² and has a vibrant and growing live music scene. The UK is home to one of the four 'major' record companies, EMI, and also hosts many 'indie' (independent) record companies.

The emergence and growth of legal and illegal music downloading has had a huge impact on the industry. The industry's recent performance has been partly driven by the adoption on new digital formats like MP3 and Advanced Audio Coding (for iPods) which have enabled music to be distributed over the internet. This has led to a series of interlinked trends: falling sales of CDs; growing digital sales over systems like iTunes Store; the unbundling of the album format enabling consumers to acquire individual tracks; and the growth and persistence of illegal downloading. At the same time, the entry of supermarkets into music retailing has also led to a strong downward pressure on price in the traditional music retail market.

Despite these trends, the UK market remains strong. Recent British Phonographic Industry (BPI)⁵³ figures show that 86.6 million singles were sold in 2007, including downloads, a 29.3 per cent increase on the previous year. By contrast, album sales declined by nearly 11 per cent, although with over 138 million albums sold, the year was still one of the ten biggest

years for album sales ever. Historically sales remain high, with album volumes growing 34.4 per cent between 2000 and 2004, and sales are still 26 per cent higher than ten years ago.⁵⁴ A clear format split emerged, with around 90 per cent of all singles now sold through online and mobile channels, and over 95 per cent of albums being sold as CD or vinyl.⁵⁵

2. Users and user communities play an important role in this sector

The music industry presents a cautionary tale on the dangers of failing to react appropriately to user-led innovation. Recorded music 'use' has historically been synonymous with purchase and consumption. The traditional user was a consumer whose use of music simply involved listening to the music. This has now radically changed; users now sample, mix and re-mix music, as well as creating custom compilations.

Crucially, 'use' may no longer be associated with purchase. The death of the traditional definition can be traced to the launch of Napster in 1999. Until then, users were expected simply to play the records, tapes or CDs they had purchased. Record firms controlled the means of production and distribution and users were confined to the formats produced by the industry. The innovative user Shawn Fanning and his creation Napster changed all that. Drawing on a series of technological innovations including widespread internet use, mass PC ownership and the development of systems for file compression like MP3, Napster helped redefine the distribution and consumption of music.

51. Figures taken from a speech by Patricia Hewitt, 'Creativity in the Knowledge Economy.' Citigroup, 29th June 2004.

52. BPI, 'Key Facts – A Statistical Snapshot of the UK's Music Industry.' Available at: www.bpi.co.uk/

53. BPI (2007) 'BPI Releases 2007 Sales Figures.' London: BPI.

54. IFPI (2008) 'Market Research, Music Market Data 2007.' London: IFPI.

55. BPI (2007) 'Rise of Digital Helps Album Sales Top 60 Million in First Half of 2007.' Press Release. London: BPI.

The shift to the digital consumption of music pioneered by Napster enabled users to acquire single tracks rather than an entire album, create custom compilations and browse music in a way that had been previously impossible. This proved wildly popular and, despite its obvious illegality, attracted a huge following with over 26 million users around the world at its peak in February 2001.⁵⁶

Individual users and user communities continue to play a significant role in redefining the consumption and distribution of music. Following the closure of Napster in July 2001, other illegal distribution systems have been launched and shut down after legal action from the music industry, only to be replaced by further file sharing services. The post-Napster era has seen the development and growth of a global user community around file sharing. Significant innovations in the form of ever more sophisticated file sharing protocols and ways of using music continue to flow from this user community, with new business models based on their ideas beginning to emerge.

Users and user communities are driving innovation both around file sharing and around the way in which music is consumed or 'used'. Many of their innovations – including music remixing, music sharing and recommending – have made their way into mainstream use. The initial trajectory of user-led innovation around music file sharing (speed, ease of access, no restrictions, free) has created a context within which the industry must innovate, and many business models have been developed around these user-defined limitations. But attempts at such innovation present huge problems for an industry that has grown by managing its market, tightly controlling music formats, largely determining how its output is consumed, managing its distribution chain and charging premium prices for its products.

Although illegal file sharing is clearly an issue, the reality is that innovation in the music industry has largely been driven by users rather than the industry itself.

Following an initial reluctance to embrace this new form of music consumption, the music industry is rapidly developing more open offerings and adapting its business model to reflect the new market reality. Writing in 2007, Eric Nicoli, then CEO of the EMI Group, captured this new attitude well:⁵⁷

"In this internet age, the consumer is using music content more than ever before –

whether that's playlisting, podcasting, personalising, sharing, downloading or just simply enjoying it. The digital revolution has caused a complete change to the culture, operations and attitude of music companies everywhere. It hasn't been easy, and we must certainly continue to fight piracy in all its forms. But there can be no doubt that with even greater commitment to innovation, and a true focus on the consumer, digital distribution is becoming the best thing that ever happened to the music business and the music fan."

3. User-led innovation takes a variety of forms

User-led innovation in the music industry can be divided into two main forms: innovations around musical genres and forms (making new music) and innovations in music distribution.

Until recently, the opportunity for users to innovate around music has been quite limited as the product (music) has been traditionally supplied in finished form and locked in a format like vinyl or CD. User-led innovation around the music product was often confined to unauthorised 'bootleg' recordings, but improvements in technology have enabled entirely new genres of music created by sampling and looping earlier recordings. Individual artists like Moby, Fatboy Slim⁵⁸ and The Go! Team have drawn heavily on the work of earlier musicians, sampling and remixing them into entirely new musical compositions. *The Grey Album* is a very good example of this form of innovation.

Released in 2004 by DJ Danger Mouse, *The Grey Album* mixed the vocal tracks from the rapper Jay-Z's *Black Album* with a series of unauthorised samples from the Beatles' *White Album* – hence *The Grey Album*. The album was widely distributed over the internet, prompting a strong reaction from EMI, The Beatles' copyright holder. *The Grey Album* has subsequently become a cultural icon, breeding a whole host of similar mashups. It is now available commercially.

The wide availability of low-cost toolkits⁵⁹ has allowed many users to sample, loop, remix and mashup music. They can now 'mod' music just like gamers. Users now have the tools to develop everything from minor mods or remixes of music to entirely novel combinations or mashups of different genres of music along

56. Comscore (2001) 'Global Napster Usage Plummetts, but New File-sharing Alternatives Gaining Ground, Reports Jupiter Media Matrix.' Press release. 20th July.

57. Eric Nicoli, quoted in IFPI (2007) 'Digital Music Report 2007.' London: IFPI. p.9.

58. An early proponent of the 'big beat' sound, he is well known for his retro samples and funk-laden grooves. (Big beat, or chemical breaks, denotes the drum-heavy mixes of bands such as The Chemical Brothers, The Crystal Method, Propellerheads and The Prodigy.)

59. For example Cubase, Logic, Audacity, Ableton Live.

BitTorrent protocol

BitTorrent is a revolutionary peer-to-peer (P2P) file sharing protocol created by Bram Cohen. Since its launch in 2001, BitTorrent has become the global standard for delivering large files over the internet. BitTorrent has an installed base of over 160 million clients worldwide and offers

a solution to the sharing of large files.

By co-opting its users' computers to help share the file, the more popular a large video, audio or software file, the faster and cheaper it can be transferred. BitTorrent has been rapidly adopted by mainstream firms and partners include 20th Century Fox, MGM, Paramount Pictures and Warner Bros.

the lines of *The Grey Album*, and firms are just beginning to embrace this activity (see below).

Distribution is a more problematic aspect of user-led innovation. Users created a parallel system for distributing music that bypassed traditional retail channels, embodied a series of highly innovative technologies and was truly revolutionary in nature. However, this system also ignored commercial and artistic rights and was illegal.

File sharing has developed a hidden user industry that creates the tools to rip, copy and share music and other digital content. Although illegal file sharing has been rightly condemned for its impact on music creators, it has also led directly or indirectly to the development of fundamental innovations in this area, including the BitTorrent protocol.

4. Firms have embraced user-led innovation in many different ways

4.1 Firms are engaging with user communities

The emergence of file sharing and social networking sites like MySpace has enabled the music industry to engage with their users in an entirely different way. There are now millions of bands registered on MySpace, many of whom are happy to give their music away for nothing.⁶⁰ Artists like Arctic Monkeys developed their following by giving away their music for fans to share online, and established bands like Manic Street Preachers and Ash have given away tracks to promote new albums.

Similarly, the early release of tracks from Radiohead's album *Kid A* onto Napster before its official launch in 2000 has been credited with the album going to number one in its first week in the US charts. The feat was repeated with the band's recent album, *In Rainbows*,

which charted at number one in the US and the UK in January 2008, having previously been released by the band on the internet at whatever price users wished to pay.

Social networking has also become a new and effective way for the music industry to engage with its fan base. For example, Lily Allen was launched with a multi-channel web presence including a website, blog, MySpace and a WAP site, with her first album being previewed on MySpace the week before the release. A more radical approach to user involvement through social networking has been taken by Last.fm.

Last.fm is a music community website and internet radio station platform that allows users to compare their music tastes and form online social networks with like-minded people. The platform monitors users' listening behaviour with a technology called Audioscrobbler that gathers information on listeners' listening habits. This information is used to produce a dynamic profile of their preferences that can be used to customise their internet radio listening and provide social networking links to users with similar tastes.

4.2 Firms are opening product architecture to users

The initial industry response to the creation of commercial music downloading services was to insist that tracks be protected by Digital Rights Management (DRM) systems. However, in the face of consumer resistance, this position has proved hard to sustain. Although commercial DRM has yet to be abandoned, commercial DRM-free music is now available. Steve Jobs, CEO of Apple, captured the problem with DRM very well:

"No one has ever implemented a DRM system that does not depend on...secrets for its operation. The problem, of course, is that there are many smart people in the world, some with a lot of time on

60. The true number is hard to establish, but in a recent editorial Victor Keegan of *The Guardian* estimates that there are now seven million bands. See Keegan, V. (2008) We'll Pay the Piper if We Like the Tune. *The Guardian*. 31st January.

Last.fm

Last.fm believes that people with similar tastes are likely to enjoy similar music. By finding people with similar music tastes, and then finding music that they each like, it is possible to provide intelligent recommendations. The larger the installed base of users is on the site, the more data is available to make matches and the more specialised the music recommendation.

Last.fm provides free weekly airplay statistics that have been used by other firms to provide more accurate charting of music tastes. The BBC uses Last.fm technology to produce its own music radio charts. Last.fm also has relationships with firms that exploit its dataset more deeply including EMI whose 'tuneglue-audiomap' (<http://audiomap.tuneglue.net/>) exploits

Last.fm's data on user connections to map out similar artists on an online visual display. When customers enter the names of their favourite artists, the website generates a graphical network of connected artists that users can expand and explore. The website allows users to buy the albums online through a third party site such as Amazon.com.

American and European visitors can stream entire songs from a catalogue of thousands of independent labels, unsigned bands and the back catalogues of the big four major record labels – Universal Music, Sony BMG, Warner Music and EMI. Currently, users have access to over 3.5 million tracks including many specialist tracks that are difficult to find elsewhere. In May 2007, Last.fm was acquired by CBS for \$280 million.

61. See www.apple.com/hotnews/thoughtsonmusic/

62. See <http://remix.nin.com>

63. Y34RZ3R0R3M1X3D, the Year Zero remix album.

64. EMI Preliminary Results 2006/07, presentation by Alain Levy, Chairman and CEO EMI Music.

their hands, who love to discover such secrets and publish a way for everyone to get free (and stolen) music. They are often successful in doing just that, so any company trying to protect content using a DRM must frequently update it with new and harder to discover secrets.

Why would the big four music companies agree to let Apple and others distribute their music without using DRM systems to protect it? The simplest answer is because DRMs haven't worked, and may never work, to halt music piracy.⁶¹

In April 2007, EMI launched a DRM-free premium download service and Amazon's US service, amazonmp3, now also offers music downloads that are free of DRM, although it has yet to launch a similar service in Europe.

4.3 Firms are providing users with product 'components'

In 2001, Skint Records, a Brighton-based indie record company, released a promotional CD, *Halfway Between The Gutter and The Guardian*, which was given away free with *The Guardian*. The CD, with seven tracks and two videos, was designed to promote Fatboy Slim's new album *Halfway Between The Gutter and the Stars*. It also included a remix game with a simple mixer and a series of Fatboy Slim's loops and beats. Originally developed for a Radio 1 competition,

the game was effectively a simple remix tutorial that allowed users to loop and mix their own music from the material provided, enabling them to engage on a different level with Fatboy Slim's own compositions. Since then, however, it has not been uncommon for bands to release the full tracks for their songs from their website, specifically set up so that users can remix them using widely available music software like GarageBand, Cubase or Logic.

There is a large and active subculture of remixing around such initiatives, with users being encouraged to upload their remixes back onto the band's website. Users can enter unofficial and official remix competitions, and have the chance that their winning remixes will be officially released. For example, the band Nine Inch Nails (NIN) initially released a small number of tracks for remixing, and has since created a website that enables fans to download, remix, rate and discuss fan-created NIN remixes.⁶² The CD version of a recent NIN album included the multi-track files for the entire album on a DVD-ROM for fans to remix, as well as a demo version of the popular music software Ableton Live.⁶³ Engaging users in this way is becoming increasingly widespread: in 2006, EMI ran a global competition for fans to remix the current single of the band Korn as a way of engaging consumers, promoting the band's tour and embracing 'the viral aspect of digital'.⁶⁴

4.4 Firms are building products around user content

Although the quality levels of music production often make it very hard directly to build products around user content, remixing has allowed users to create content with existing material. For example, at the time of the release of *Halfway Between The Gutter and the Stars*, Skint also released *The Rockefeller Skank* on Orange's Fireplayer system, which enables users to remix a track and download it to their mobile phone. The Fireplayer site currently has around 100 tracks available for remixing and downloading including tracks by New Order, FatBoy Slim, The Free Masons and DJ Sasha.⁶⁵

4.5 Firms are commercialising user inventions and innovations

Napster's appearance catalysed the latent demand for internet access to music and other digital content, creating a huge market. Although iTunes is a legal service delivered in a traditional way with limitations on use, it clearly appropriates the central idea embodied in the first version of Napster. Apple launched iTunes as a digital media player application that connects to the iTunes Store, allowing users to purchase digital music, video and audiobook files. The integrated nature of the iTunes system has been designed to provide users with a great deal of flexibility: they can upload music from CDs; download it from the iTunes Store; organise it into playlists; record new CDs; and copy files to audio players like the iPod. It has also been the focal point for a number of innovations in legal downloading including the emergence and distribution of podcasts (spoken audio files), music videos and other video files, and linking album art to the downloaded track. As a new entrant to the music industry, Apple's position on illegal file sharing was to compete with it: "We're going to fight illegal downloading by competing with it. We're not going to sue it. We're not going to ignore it. We're going to compete with it."⁶⁶ Since its launch in April 2003, over four billion songs have been sold over iTunes.⁶⁷

The development of peer-to-peer file (P2P) sharing has also led to the development of a plethora of services like Joost⁶⁸ (a free P2P TV and movie service), Qtrax⁶⁹ (a free P2P music download service) and SpiralFrog⁷⁰ (a free video and music download service), all of which have advertising-based business models but are free at the point of use.

65. See www1.orange.co.uk/entertainment/music/fireplayer.php

66. Steve Jobs, quoted in Kahney, L. (2003) iTunes, Now for the Rest of Us. 'Wired News.' 16th October.

67. See www.trustedreviews.com/apple/news/2008/01/15/MacBook-2008-Live-Blog-Part-One/p1

68. See www.joost.com

69. See www.qtrax.com

70. See www.spiralfrog.com

Appendix C: Social networking

1. Social networking is a leading knowledge economy sector

The growth of the internet has been a big money-spinner for some. For example, the Internet Advertising Bureau reports that online advertising spend in the first six months of 2007 was worth £1.3 billion.⁷¹

Facebook has been valued by Microsoft at \$15 billion (on the basis of paying \$240 million for a 1.6 per cent stake). In 2005, NewsCorp paid \$580 million for InterMix Media, owner of MySpace.com (current valuations put it as high as \$2.71 billion⁷²). But internet success can be as transient as it is lucrative. A year earlier, ITV paid £175 million for FriendsReunited.co.uk only to experience a significant downturn in traffic. One report put the fall as high as 35 per cent in 2006, leaving it with 2.55 million unique users. Yet, other community rivals have been attracting large audiences: YouTube (7.25 million UK unique users), MySpace (6.1 million), Bebo (4.88 million) and Piczo (3.88 million). There has been much debate about the reasons. Some question whether the subscription model used by FriendsReunited (it has 1.4 million members) is appropriate and sustainable. Without subscription, MySpace has 140 million global members. Moreover, there are an increasing number of targeted social networking sites emerging including the teen site Habbo.co.uk and the avatar-based Weeworld.com.

Social networking sites commanding these valuations function largely to bring users and advertisers together, albeit immersed in clever and enabling technology. Facebook's portfolio of user-generated innovations is perhaps the most anticipated and debated (see below).⁷³ The platform's utility, however, may be limited to the young mass consumer seeking virtual friends and consumer products like music.

What is increasingly clear, however, is the importance of functionality to the users of these new sites. MySpace, for example, is predominantly young and enthusiastic about having what Meg Pickard calls 'identity-driven social network experiences' where quantity is sometimes better than quality.⁷⁴ That said, the importance of the user remains central to the development of the site. Tom Anderson, co-founder of MySpace, told *The Financial Times* "...[w]e are very conscious about what constitutes a great experience – any ideas we have come from our user base."⁷⁵

The observed dynamic is captured by the concept of Web 2.0 in which the web is primarily a platform for interaction rather than merely an information resource. The important business process was captured by Julie Meyer in *The Observer* back in 2006: "...the major platform companies are, in effect, using the venture-capital-backed start-up scene to fish for clever management, applications and business models on which the platform companies can base their product development."⁷⁶

But social networking sites are not limited to high volume, high value global sites for ad hoc meeting and the consumption of electronic products. Social networks are used extensively by business people, with the US-based LinkedIn the world leader.⁷⁷ In the UK, Ecademy provides complementary and competing services with the added value that users not only search for business contacts, but also use the functionality to market products, join clubs, blog, procure training and business services as well as attend physical social networking events mediated by the site's local members.

Other sites target demographics such as gay business people (for example, jaketm.

71. See www.iabuk.net/media/images/Onlineadspendfactsheet_H12007_1898.pdf
72. See <http://mashable.com/2007/04/02/MySpace-worth-271-billion-making-271-millionyear/>
73. See <http://money.cnn.com/2007/06/01/technology/facebookplatform.fortune/?p>
74. Pickard, M., AOL Europe at NESTA, 15th January 2007.
75. Van Duyn, A. (2006) 'Social Network Sites Battle to Befriend US Teenagers.' *FT.com*. 20th December.
76. Meyer, J. (2006) Web 2.0 Highlights How the Online World is Changing: Amateurs Come up with the Ideas, Then the Big Boys Open their Wallets. *The Observer*. 29th October.

org) or build specific communities, like Zopa (zopa.com) which fosters social lending. Zopa community members who want to borrow money are connected with people with financial resources that they are willing to lend. This effectively excludes financial intermediaries and enables favourable rates to be offered.

Topic-driven networks are those in which individuals' preferences are the key. The individuals are important only inasmuch as they provide the data on which sophisticated databases can generate unique outputs. Last.fm, for example, employs its own Audioscrobbler technology to introduce users to music that they currently do not listen to, but might like because others with similar tastes enjoy it. Last.fm was bought by CBS in May 2007 for \$280 million, making it the largest ever UK Web 2.0 sale. Previously it had attracted undisclosed private equity from Index Investors.⁷⁸

NetDoctor, the health portal, with its array of forums, self-help and expert contributors, has found itself in the portfolio of publisher NatMag (The National Magazine Company) after six years of growth and consolidation – including a substantial user-generated knowledge-base.

Equally important – if less financially rewarding – are communities that develop around geographically defined issues. The Brighton and Hove e-democracy Forum currently has 262 members who discuss and build local knowledge around issues as diverse as bus fares and local elections.⁷⁹ UKVillages is a modest but extremely innovative network linking communities with their social, intellectual and historical capital.⁸⁰ For example, it provides older users with tools to edit and upload images onto the site, making internet entries easier while exposing valuable artefacts to a wider audience.

Communities can also be leveraged for educational purposes. Huitalk.com is part of a family of language community portals. It was devised by two self-proclaimed slow-to-learn language students who felt that language learning could be made easier by linking learners and giving them opportunities to interact. They did so by combining already-existing tools such as Skype with the bespoke platform tools. Lego Mindstorms, by contrast, has an educational aspiration but is topic-driven around core products and the innovative things that can be developed around them by users.

The extent to which online social networking can be leveraged for commercial gain is an important question. Toyota and Lego demonstrate that firms use social networks to inform product development and marketing. However, others are more radical: SkinnyCorp uses its community as both the source of designs and its core customers.⁸¹

However, not all communities are so benign. Communities can also emerge around less desirable – though nonetheless legal – social activities such as gambling. Whilst there is a vibrant contemporary debate around casinos and online gambling, there is a need to investigate how online gambling communities encourage those with a gambling addiction.

2. Users and user communities play an important role in this sector

Two classes of user innovators are associated with social networks. One class has developed social networking business platforms from businesses networking activities. For example, Ecademy allowed 'corporate refugees' and 'returners' to network to build businesses, products and services. The platform was built by a member of the open-source community who now maintains and develops it to meet the needs and aspirations of Ecademy's subscribers. Within Ecademy, there is a second class of innovators; those who innovate and generate new businesses and value largely unaware of the technology that delivers the platform functionality.

NetDoctor was started by a doctor and an IT specialist whose medical and technical skills combined to empower individuals to manage health issues for themselves and their families. They understood how good communication could improve and support patient health, even in the face of the most serious of illnesses. This logic extended to carers' needs. Sufferers and carers could meet online to learn from each other's experiences. But though this important content undoubtedly brings together new knowledge it is not the revenue base for the NetDoctor businesses. The money is made from content supplied by qualified physicians, which is used in fact sheets, content syndication and localisation. Unsurprisingly, the site is built on open source software.

Threadless.com and the related businesses of SkinnyCorp are community-dependent. Threadless is a distributor and retailer of limited edition, community-designed

77. LinkedIn is a subscription-based service. It is profitable and has 16 million registered users. It is rumoured to be valued in the region of \$26 million. See <http://uk.techcrunch.com/2007/11/22/rumour-news-corp-to-buy-linkedin/>

78. Other UK sites have also attracted finance such as weeWorld.com and Softow.com.

79. See <http://forums.e-democracy.org/groups/bh/index.html>

80. See www.ukvillages.co.uk

81. See www.skinycorp.com. The firm started as Threadless in 2000.

T-shirts. The designs are drawn directly from its 300,000-strong community who rate and judge the submitted designs and buy most of the printed items (usually in runs of 1,500) generating estimated revenues of between \$25–30 million in 2007.⁸² Unusually, Threadless ‘outsources’ its design function to its community. Meanwhile the community adds 3,000 individuals per week. In all, some 450 winning designs have been printed from 60,000 submissions.

Engaging users in this way can be highly lucrative. However, it is not always socially desirable. The gambling sector has been quick to embrace online platforms, which facilitate peer-to-peer gambling and real-time bet matching. Burgeoning online casinos have been outlawed in the US but flourish in Europe and other territories. Online bookmakers also benefit from what is now a 24-hour-a-day business. One firm, GamblingCo, had a turnover of £150 million in 2007, generating profits estimated at £32 million.⁸³ The firm employs around 1,000 people.

GamblingCo engages with its users through its online forum and face-to-face events. The forum, which was set up at the same time as the business, includes several sub-forums focusing on different sports such as horse-racing or greyhound racing. There is also a ‘special bets’ forum for non-sports bets such as those based on the *Big Brother* television show and elections.

Critically, the forums allow users to share information about the betting markets. The type of information shared in these online spaces does require an extensive prior knowledge of gambling to assimilate it. As a mechanism for increasing revenue and developing products, the forums have been invaluable; though the company itself fears the communities who – as with Threadless – act as a check on the business, its service and policy. Revenue and profits, therefore, can suffer if the community is unsettled; for example, if winnings are not credited on time.

The field of education is emerging as an important area for online social networking development. In language learning, the case for platforms linking learners and native speakers for reciprocal interaction is compelling. Whilst the users themselves benefit from interacting with one another, the community – or the potential community – offers an important opportunity for business development and revenue generation. Whilst advertising may

be viable in such communities, a business model that adds value to existing educational suppliers could provide sustainable revenue and investment.

Younger learners are attracted to networks such as Swapits. Whilst not strictly a social network, the site enables 6–18 year olds to exchange unwanted goods for Swapits, a virtual currency. To date 500,000 young people have set up accounts, generating 50,000 monthly transactions. This has expanded to enable young people to create their own products and services as well as developing marketing strategies and campaigns (www.swapitshop.com). They can also buy goods from responsible brand owners who partner the site including the BBC, Hamleys, Mattel and Procter & Gamble. Members also get involved in targeted campaigns including healthy eating.

Lego inadvertently became a pioneer in user social networks for business development. Their experience has radically shifted the focus of the business and the nature of intellectual property values. Controlling the behaviour of users as they adapt products to their own needs or pleasure is increasingly futile (see video games and music cases in Appendices A and B). Mindstorms exposed Lego to a small community of users with a desire to innovate in their combination of bricks and computing. This community of professionals and hobbyists shared, amongst other things, designs and programming techniques. Lego ultimately embraced this development model, though it was challenging managing data from a user community that previously had all been centralised.

At a basic level, they used a wiki to maximise the creative potential and collaborative efforts of participants. Lego facilitated this further by making available code through the website and by holding competitions and events. Lead users worked with enthusiasts to access the computer-aided design (CAD) system to design their own Lego products and then post the images in the gallery. Lego ultimately embraced the user community to develop its brand on the basis that it cannot compete on manufacturing bricks and that innovative applications of the toy were needed to retain the value of the brand. In essence, the approach is captured in the words of Paal Smith-Meyer, Head of Lego’s New Business Group: “...if you want to make a brick, make it with us.”⁸⁴

Some social networks link the virtual and real worlds. Ecademy has considerable real-

82. See <http://mashable.com/2007/10/03/threadless-store/>

83. ‘GamblingCo’ is a pseudonym.

84. NESTA workshop, 12th February 2008.

world activity associated with it (see below). UKVillages seeks to erode the boundaries between villages and towns, fostering valuable business development and promotion through its company directory and political engagement through council news. Most content, however, is derived from users. The success of the platform is not accidental. Rupert Dick, UKVillages' founder, constantly upgrades the site's functionality often from within the open source software community. His Community Heritage Store is a repository for cultural artefacts, particularly photographs. But, as many users are older technology novices, all the tools are designed to be simple to use.

Also embedded in the community are issues forums. Notable examples include Brighton and Hove, Newham and Bristol. The motivation is to: "...build e-democracy with the citizens' needs up front. That provides real value to local authorities, the local media, and the local community as a whole."⁸⁵ As the content expands, and the utility of the knowledge base is appreciated, the platform developer community responds. Steven Clift describes the self-help potential of e-democracy:⁸⁶ "Try searching 'graffiti' on [a] search engine... now imagine the power of knowledge and experience from 25 community forums at your fingertips." The development vision, therefore, is clear. "With funding", he says, "someday I'd like to create 'tag' cloud windows to, say, 50 local issues communities face – from transportation to graffiti – and show how knowledge can spread across communities, and explore cross-community Q and A options."

3. User-led innovation takes a variety of forms

The corporate world has a mixed approach to social networking. Ecademy's Penny Power – herself a 'corporate refugee' – thinks that firms harm themselves by restricting employees' access to social networks. She argues that it shows ignorance about how social networks function, and potentially impedes the development of firms' knowledge base. Not all companies are so restrictive. Procter & Gamble has a successful internal social network that delivers up to a third of its product ideas. It also reaches out to consumers; for example, through its *Beinggirl* social network.⁸⁷ IBM's 'global jams' bring together the firm's combined intellectual might to tackle global social problems. IBM's Big Blue programme facilitates multi-national product

development. The complementary Small Blue is a search engine that scans employees' blogs, email, instant messages, and reports on skills and expertise inherent to the organisation and the enquirer's proximity to the sources of knowledge and expertise (not unlike LinkedIn). It has resulted in new ideas for development, and has led to the launch of a market application called IBM Atlas.

With business networks such as Ecademy, innovative activity is broad ranging but intangible. The site itself has changed radically since its inception. For pure logistical reasons arising from growth, a robust architecture was needed. This was drawn from the open source community and continuously developed through novel combinations of tools such as 'twitters' and Skype. The extent of innovative activity by user members is harder to measure, as the site owners do not monitor activity explicitly. Consequently, the evidence for innovative activity is anecdotal. However, businesses have been created on the platform, including profile writing services and breakfast clubs. There are 500 free-standing physical networking events each year on a platform also used as a shop-window and marketing tool.

Corporate entities can readily integrate social networks into their operation costs, but many social networks rely on dedicated individuals to maintain sites. Ecademy, for example, used to struggle to attract investment because its business model does not conform to traditional forms. Its founder, Penny Power, argues that the market is seduced by performance indicators that are unable to capture the quality of interaction and relationships: "We could have got investment if we had become total tarts and changed that attitude that we had towards the business. One investor said that 'you...care too much about your members and you put too much into them'. We said, 'okay, we are not going to change that'."

E-democracy forums equally struggle to attract grants and other funding. Bristol is being used to pilot a series of e-democracy initiatives. The project is spearheaded by Bristol City Council with support from the Ministry of Justice. Bristol's issues forum, Viewfinder,⁸⁸ is multi-platform with video, audio and the written word. It particularly welcomes contributions from young people. There are also e-citizen panels, e-petitions, e-consultations and e-bulletins.⁸⁹ However, the Brighton and Hove Forum remains a shoestring operation with limited resources to develop it to its full potential.

85. Steven Clift, Founder and Board Chair of e-democracy.org (correspondence with author, 14th August 2007).

86. Ibid.

87. See www.beinggirl.com/en_US/aboutbeinggirl.jsp

88. See www.viewfinder.public-ictv/viewfinder.php

89. See www.askbristol.com/other_consultations.php

Appendix D: Music software

1. The music software industry is a lead knowledge economy sector

The music software industry is an important knowledge economy activity that is also a lead sector for the new and emerging relationships between firms and users. Music software is a relatively young industry in the UK. There are few major firms, but many more small-scale concerns that produce either educational products or shareware.⁹⁰ The sector also includes large international firms like Apple, Sony, Numark and Yamaha who also base part of their music software operations in the UK. The music software industry in the UK provides around 2,000 jobs and is worth £250 million,⁹¹ with expectations of significant future growth.⁹²

Music software is part of the modern tool-making industry. The UK industry produces a range of software toolkits aimed at the professional, domestic and educational markets. These systems, produced purely as software, or as hardware/software combinations, are designed to automate or simplify important aspects of the creative process. They also include tools to help create music scores, record or mix live performances, or mix music to create a final master version of a track.

2. Users and user communities play an important role in this sector

The music software industry produces tools to improve the creative process for the musicians that use them. Users are often highly demanding and intimately engaged with product functionality and performance, seeking

out liked-minded peers for discussion. The many online communities have either emerged spontaneously or have company backing.

Music software is a good example of a modern information industry where established firms exist in a complex ecosystem of individual users and user communities transcending national boundaries. Firms are clearly commercial actors within this ecosystem, but they operate in a market also served by low-cost shareware and software developed and distributed by users and user communities for free. Although some user-developed software complements commercial products, some of the more complex systems compete with them.

Firms are very important within this ecosystem, and may be dominant, but their relationship to users or consumers is quite different from other sectors. One major difference is that many users possess the technical skills required to develop their own music software, as evidenced by the large amount of shareware and freeware available. Users here may be consumers, but they may also become collaborators in developing software complementing commercial products. Crucially, they may also develop low-cost or no-cost competitor systems or software that is incompatible with commercial offerings which may undermine their market position.

The two firms in this case study, Sibelius and FXpansion, are both leading UK-based firms operating in different parts of the music software industry. Sibelius is a world leader in music notation software and was awarded the prestigious Queen's Award for Innovation in 2005. FXpansion is one of the UK's leading independent developers of music software whose products have consistently won awards.

90. Shareware is trial software such as that given away by magazines or in free downloads.

91. Estimate provided by A. Hewlett, FXpansion.

92. For example, Sonic Control (2007) Marketing Overview of the Music Technology Sector. 'Sonic Control.' 6th March.

The two firms also operate within quite different parts of the music world, with Sibelius being primarily focused on classical music, and FXpansion focused on a range of music genres including rock and pop as well as techno, dance and hip-hop.

Founded by Ben and Jonathan Finn in 1993 to sell music notation software for the Acorn computer, Sibelius Group has customers in over 100 countries today and is the world market leader in software for writing, teaching and publishing music. In 2006 Sibelius was acquired by Avid Technology Inc., an international firm specialising in digital media.

Founded in 1999 by Angus Hewlett, FXpansion produces over 12 specialist music software products including BFD2 (best-selling professional drum software), GURU (loop-based virtual drum machine aimed at dance and hip hop producers), and a series of adapters that enable content to be moved between different music software packages.

Both Sibelius and FXpansion emerged from user-led activity to become significant firms in their own right. The Finn brothers began to develop the Sibelius program themselves in 1987, six years before they founded the firm. Angus Hewlett of FXpansion was also writing software for some time before he founded the firm, and his chief technology officer SKoT McDonald had also spent years developing his own music software before he helped to get FXpansion up and running.

Both firms have remained close to their respective user populations and although they vary in size,⁹³ users play a hugely important role in product support and development.

Sibelius has a series of highly active user communities around its portfolio of products. Some emerged spontaneously; others have been developed by the firm. Sibelius takes user activity very seriously and a great deal of effort is expended maintaining a presence within these professional and educational music communities. One important group is the user community that creates and shares software (sometimes referred to as 'plug-ins') that provides additional functionality to the Sibelius programme.

The Sibelius notation software originally started out as an Acorn programme and the product lends itself to ongoing user engagement. FXpansion also has a series of highly active user communities, and is linked

into a much wider group of user communities across a wide range of music genres. FXpansion hosts and maintains its own user communities as part of its web presence, but also provides informal support for other user-driven communities active within its target market. The firm emerged following the release by Steinberg of the Virtual Studio Technology (VST) software development kit in 1997 which enabled users to write plug-ins for Cubase (a music editing and sequencing system) but also led to a huge growth in third-party plug-ins for that product. The VST plug-in developer community (from which FXpansion grew) grew very quickly and is still developing, with many firms emerging from this activity.

3. User-led innovation takes a variety of forms

3.1 Provision of feedback and support by users

In common with many firms in the music software industry, user feedback and involvement are very important aspects of the product development process for both Sibelius and FXpansion.

Building strong relationships with users is an important part of the Sibelius business model, and Chat Pages are a central feature of this approach. The Chat Pages are a series of online discussion forums for user feedback and support hosted by Sibelius on its homepage. Initially set up as a technical support forum for users to discuss the software with each other, they were later modified to allow the company to build a knowledge base with searchable questions and answers (Q&A). In its early incarnation, only Sibelius users were allowed to see and use the forum – to see it, one had to log in with a Sibelius serial number. Today, while only Sibelius users are allowed to interact, the site can now be openly read by anyone online.

The Q&A have also been developed into a separate Frequently Asked Questions (FAQ) page which complements the Chat Pages. All historical articles are archived and searchable. Although the individuals who populate the Chat Page only make up a small percentage of Sibelius users, many are long-term Sibelius customers who possess great technical knowledge and represent a significant resource.

FXpansion's users range from hard-core technophiles to more pragmatic musicians

93. Sibelius has 180,000 registered users; FXpansion has a user base of around 35,000.

looking for a good piece of software. The relationship with users is complex and multi-faceted: they are actively engaged at several levels, including developing the technology and providing the best insight into its workings and functionality. Hard-core technophiles are often involved in several stages in the product development process. They provide lots of ideas about how a product should work; they help with beta-testing; and they are often given new products first and free to get early feedback.

Users of both Sibelius and FXpansion's products have gone beyond the conventional on-line forum to create short videos broadcast on YouTube. Such user-generated videos may take the form of a tutorial about a specific feature of the software or simply be a demonstration of the user's own virtuosity. Examples include 'Tuba players at their best',⁹⁴ 'Another quick piece in Sibelius',⁹⁵ 'Intro to VPT 1'⁹⁶ and 'BFD + e-kit'.⁹⁷

3.2 Production of content by users for existing products

User-generated content for music software systems like Sibelius and FXpansion requires significant musical ability at an entry level. At its most sophisticated level, it will require users to possess high-level skills in programming, design or musical arrangement. Sibelius has attracted many complementary products that have been developed by users including software plug-ins, sounds, scores and music fonts.⁹⁸ Of these, the software plug-in is perhaps the most complex, requiring both deep musical understanding and high-level programming ability.

The software plug-ins provide additional functionality to Sibelius. Although the installed base of Sibelius is very large, the user community developing plug-ins is relatively small. However, it is very active, and is an integral part of Sibelius' R&D process. Over 150 user-developed plug-ins are currently freely available on the Sibelius website, and a further 110 user-developed plug-ins have been acquired⁹⁹ by Sibelius and included within their latest software release. The plug-ins provide significant added value, both to the individual user and the firm, having generated nearly 600,000 individual downloads. The top five plug-ins alone account for some nearly 190,000 downloads, with the top user-developed plug-in (German Chord Names¹⁰⁰) having been downloaded over 86,000 times in its own right.

Within the plug-in developer community, one individual – the 'super-developer' Bob Zawalich – is responsible for generating a large proportion of the plug-ins. Zawalich is a retired Microsoft programmer who was involved in developing the macro function in Word. He is also an active guitarist and composer. His combined talents for music and programming have enabled him to produce a large number of complex plug-ins. His plug-ins have been downloaded by other users over 200,000 times.

Within FXpansion the hard-core technophiles play a very important role in developing content for use by the wider user community. For example, users create and share new drum kit sounds, their own sound libraries, tutorials, demo songs, and make their own promotional videos on YouTube. They also create new sound sets and other extra bits of content for the products – something very useful for users without the time or inclination to create their own sound libraries. Some users also develop and sell add-on sound sets and packs of rhythms for FXpansion products like BFD 2.

3.3 Modding by users of existing products

Both Sibelius and FXpansion are closed, proprietary systems not designed for modding. Although there was an active modding community around earlier versions of FXpansion's products, there is none around the current generation of software.

This decline in modding may reflect the relatively small size of the user base, the limited opportunities for users to improve on the current generation of sophisticated products, and (probably most importantly) the complexity of the software. However, some of FXpansion's earlier products were often modified. For example, the graphical interface on early VST plug-ins was often modified, or re-skinned, by users and it was a big thing about five years ago to have plug-ins that could be altered so easily. At that time the initial graphic was produced in-house and the modding community could improve it by adding chrome sliders. As the production values of the interface have improved, there is now less opportunity (or need) for such activity.

94. See www.youtube.com/watch?v=emk5H0NHs80

95. See www.youtube.com/watch?v=kZjMLNNyy4Q

96. See www.youtube.com/watch?v=Yw981gw17k

97. See www.youtube.com/watch?v=NZGg3voVjs4

98. A list of third-party resources can be found at www.musicprep.com/sibelius/

99. These are acquired from the user for around \$500 per plug-in.

100. This plug-in converts chord symbols text in your score between the German (B = B flat, H = B) and standard (B♭ = B flat, B = B) conventions for chord symbols. This is useful when transposing German chord symbols (for example, to convert them to standard chord symbols, transpose, then convert them back to German chord symbols).

4. Firms have embraced user-led innovation in many different ways

4.1 Firms are engaging with user communities

Vibrant active and engaged user communities are very important to both Sibelius and FXpansion. We have seen how both firms devote significant resources to their support and development. However, Sibelius finds it easier to attract users because of its market dominance than FXpansion which, despite being a leader in its field, is in a far more crowded marketplace. Both Sibelius and FXpansion make great efforts to engage with their user bases through their forums.

For example, FXpansion supports Smartelectronix,¹⁰¹ a user community that develops and distributes free music software plug-ins. These people are scattered across the globe, but are bound together by a shared interest in making music software that resists the current trends and norms in the music software world. They prefer to make more experimental software. They also share high quality standards. And they like to make their software free or at least affordable through voluntary donations.

Firms like Sibelius and FXpansion recognise that users will belong to several communities. User opinion, feedback and comment are very important to both firms, not least in support of their marketing and information dissemination activities. Such firms sit at the centre of their communities, absorbing feedback and spotting issues and trends in the market.

4.2 Firms are recruiting innovative users to develop new products

Both firms make extensive use of innovative users across many stages in their product development process. Users may be formally recruited and rewarded for their efforts, but they may also be part of a wider group of enthusiastic and engaged users. Collectively, these users demonstrate and confirm the presence of a need that will be translated into a system function in a subsequent software release. Although a tiny percentage of the functionality of the programme is actually user-built, practically all the recent features added to it will have been derived from user suggestions.

4.3 Firms are opening product architecture to users

Both Sibelius and FXpansion supply products designed to allow users to develop and share their own content and applications. Neither firm's products are fully 'open' in the accepted sense, but the APIs of part of their product architecture have been published, enabling users to innovate around the core product. The design of Sibelius' product architecture, enabling users to develop software plug-ins that add functions to their core product, was fundamental.

This partial opening of the product architecture was a formal recognition that users had needs that could not be anticipated by Sibelius, and that some users could create plug-ins to satisfy these needs. By partially opening the product architecture in this way Sibelius becomes a platform around which users are able to innovate.

4.4 Firms are providing users with toolkits

Sibelius has provided a series of toolkits giving users the means to create their own applications and other content. To enable users to create plug-ins, Sibelius created its own programming language called Manuscript. Sibelius provides a range of resources around this language including a tutorial, a plug-in developer mailing list and a Tech Support forum. User-developed plug-ins are effectively open source and the code may be viewed by any user who wishes to develop his or her own plug-in. Sibelius provides a series of Sound Sets for use with synthesisers and also makes available a Sound Set editor for users.

Sibelius plug-in developers also make and share their own user-developed tools on an ongoing basis. The community has developed into a toolmaking community where tools are developed and shared, with the result that their plug-ins have become more ambitious and sophisticated.

FXpansion has had less success providing user toolkits. In 2001, FXpansion tried to engage with the modding community with its DR-008 product, a drum machine with playback, synthesis and sequencing facilities. The DR-008 included a software development kit to enable drum-synth generators to be written by users, but the community struggled and few users really engaged with the challenge to write their own modules. Toolkits, although clearly necessary, are not sufficient unless a firm has a critical mass of users who have the means to make use of such tools.

101. See www.smartelectronix.com

4.5 Firms are building products around user content

Sibelius and FXpansion make extensive use of plug-ins, sound sets, drum loops, demos and tutorials. They are both relatively young firms with origins in the interests and activity of their founders. Both firms operate in a commercial context that enables users to be far closer to the productive process than is usual in more traditional industries like car manufacturing. Although both firms make products, their architecture has been specifically designed to enable users to provide content that supports and extends the core product. Users are helped and encouraged actively to innovate around the core product and to support other users to participate in this process.

Both Sibelius and FXpansion take this one stage further by enabling users to share the music they have created using their products. SibeliusMusic.com is a separate website that enables users to self-publish scores using a specialist plug-in, Scorch, which was developed by Sibelius specifically for this purpose. The site currently has over 95,000 scores available as pay-per download, as well as some free scores.

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