Editorial
A tune we can dance to

When portable MP3 players crashed the party in the late 1990s, they threatened the entire economic model of the old and venerable record labels. These companies had successfully navigated a series of shifts in playback technology—most recently from vinyl and magnetic tape to compact disc. Now they found themselves at the mercy of an upstart ecosystem that could replicate the digital sound files contained in those compact discs and in seconds distribute them throughout the world at almost no cost. They responded with litigation and largely ineffectual attempts to lock up the music they had commercial interests in through what was euphemistically called 'digital rights management'.

Ironically, the computer maker Apple, which had risen from the ashes in part as a result of the popularity of its own MP3 players, became a victim of innovation when music-streaming services such as Spotify and Pandora began to take business away from its own MP3 download store. Apple’s US$3 billion purchase of Beats Electronics, in May 2014, was in part an attempt to reverse the decline by bringing Beats’ successful subscription streaming service into the fold.

The music industry is not alone in wrestling with the fallout from such digital disruption. Book publishers, newspapers and other print-based media have for years struggled to create viable new business models and to stay relevant in the internet age.

But there is more to it than the displacement of a number of popular media by new, digitally-based successors. As Andrew McAfee of MIT Sloan School’s Centre for Digital Business notes, a great deal of other information is now being digitised. As a result of online social media our social interactions are increasingly digitally mediated. A vast array of sensors that measure pressure, temperature, force, stress and so on are digitising the attributes of the physical world. And our whereabouts increasingly is digitally recorded and tracked by GPS-enabled smartphones.

The Austrian economist Joseph Schumpeter famously observed that the most significant economic advances are often accompanied by what he called “creative destruction”, which realigns profit structures, shakes up entire industry sectors and topples business incumbents. And this process, which has often been driven by technological innovation, increasingly has digital disruption at its core.

Fittingly, the cover of this issue of the Business Review carries an algorithm-generated word cloud of its contents. As can be seen, the contributors cover a lot of ground—from the nationwide roll-out of high-speed broadband infrastructure to the challenges of online education; and from game-changing digital currencies and 3D printing technologies to the potentially disruptive ‘gamification’ of corporate recruitment.

The articles bear witness to the fact that digital technologies are forcing a new tune on the world. For many organisations, the question comes down to this: Is it a tune we can dance to?

Vaughan Yarwood
Editor
Articles

6 Dawn of the MOOC
Massive open online courses are forcing a rethink of university teaching.
Emma Sadera

16 3D Printing
Additive manufacturing could be the key to a new world of niche markets for New Zealand companies.
Julie Kim, David Robb

26 Ultra-Fast Business
Its backers hope that the roll-out of a nationwide high-speed digital network will fuel innovation.
Fernando Beltrán

36 Bitcoin
Online currencies look to reshape the way we buy and sell.
Noel Y Ahantpath, Zeb Wilton

44 Recruitment
Organisations should consider embracing gamification to enhance graduate selection and recruitment.
Kristine Dery, Carole Tansley, Ella Hafermalz
Massive open online courses are forcing a rethink of university teaching.
on educational technologies, MOOCs (massive open online courses) herald a new dawn of extramural and intramural teaching, which promises flexibility of offering and renders geographical location irrelevant. For others, they represent the further commodification of the academy, spelling the death of the traditional higher education model and, by extension, the end of the road for the face-to-face lecturer. So, which is it? Are MOOCs examples of innovative digital disruption, or harbingers of digital destruction? And what are the implications for pedagogy?

Online learning is not new. Distance-learning institutions such as Open Polytechnic, Massey University and the trail-blazing Open University in the UK have for some time exploited the capabilities of e-learning, and incorporated online learning techniques into their standard teaching models. Innovative teachers at more traditional-model institutions have also experimented with moving their teaching partly or wholly online, using features such as wikis, computer-marked quizzes, podcasts and audiocasts as part of their teaching methodology. For some time, these forays remained outliers and were often viewed with suspicion. However, in the past few years the traditional global tertiary education market has caught up with this innovation and, in some quarters at least, has adopted it wholeheartedly. Most universities now acknowledge the need for a level of digital interactivity in their teaching, and are slowly coming to terms with this shift—most notably in the widespread adoption of the flipped classroom (a model in which students study before class, usually by watching lecture-style videos online and undertaking set reading, then apply that learning in in-class projects and activities).

The move online has also raised questions of scale and reach, with the realisation that many of the resources being developed for small inhouse cohorts could potentially be applied to an external audience of tens (or even hundreds) of thousands. MOOCs have been gradually entering the wider tertiary market, but the past couple of years have witnessed a sudden proliferation both in the range of courses being offered and the number of students signing up for them—hence “massive”. Indeed, this explosion in providers, focus and registered student numbers prompted the New York Times to dub 2012 “the year of the MOOC”.

Though many universities are experimenting with online teaching and learning, in the past two years a number of key providers have begun to shape the overall picture. Some of these are from the privatised US tertiary market. Coursera and Udacity both have their origin in Stanford University academics, whilst edX grew out of MIT and Harvard. Coursera boasts more than 200 partner institutions and around seven million users, while not-for-profit edX has about 50 partners and two million users. Germany’siversity is a commercial MOOC provider, while FutureLearn—which grew out of the UK’s Open University and now has 40 partners (including the University of Auckland)—is launching somewhat cautiously, with initial course registrations capped at about 10,000 students. The courses offered across this suite of providers are as varied as those offered by any traditional university and range widely across disciplines, from the fundamentals of global energy business and street-fighting maths to applied cryptography, Dante’s Divine Comedy and even dental photography. (The University of Auckland plans to launch its first two FutureLearn MOOC courses—academic integrity and an introduction to data analysis—in late 2014.) These formal MOOC providers, which typically present courses created and delivered by their partner institutions, are also supported by originators of other reusable digital resources, such as the phenomenally successful TED Talks series.

University of Auckland/FutureLearn MOOCs

The first two courses produced by the University of Auckland in partnership with FutureLearn will be delivered later in 2014 and are open for registration now.

Data to Insight: An Introduction to Data Analysis
Start date: 6 October 2014 | Lead educator: Professor Chris Wild, Department of Statistics. More information can be found at: www.futurelearn.com/courses/data-to-insight

Academic Integrity: Values, Skills, Action
Start date: 10 November 2014 | Lead educator: Dr Jason Stephens, School of Learning, Development and Professional Practice. More information can be found at: www.futurelearn.com/courses/academic-integrity
T H I S  O N L I N E  M O D E L  H A S
clear benefits. The open nature of the courses, which enables students of any age, life stage, educational and work background, and geographical location to access courses from some of the world’s most prestigious universities, clearly has a profound contribution to make towards the agenda of widening participation. Indeed, the potential of the MOOC to give almost anyone access to learning resonates with Austrian philosopher Ivan Illich’s oft-quoted definition of how an educational system should “provide all who want to learn with access to available resources at any time in their lives; empower all who want to share what they know to find those who want to learn it from them; and, finally, furnish all who want to present an issue to the public with the opportunity to make their challenge known” (Deschooling Society, 1971). Theoretically, anyone can find their way to a rigorous, interesting course taught by leading academics amongst a cohort of motivated, like-minded learners. The asynchronous model—where students are not generally expected to be active at specific times of day or to adhere to particular deadlines—is particularly appropriate for students who work full-time and for returning learners with care or other responsibilities. Students with mobility issues are well-served by MOOCs, which don’t require them to travel outside their homes, and the question of diversity is answered by those who suggest that the self-guided nature of MOOC-based study would attract learners from demographic sectors for whom confidence and community disengagement in traditional tertiary environments have historically been obstacles to participation. The apparent irrelevance of a student’s geographical location suggests that learners anywhere in the world—including developing countries where accessing and trading in the knowledge economy is a key contributor to development—have an equal chance of access learning analytics data, perhaps the next big frontier in e-learning, regardless of the extent to which students are apparently welded to their smartphones. Another potential obstacle to greater global student access is the absolute requirement for a computer which meets a minimum specification, a reliable electricity supply and relatively high speed broadband internet access. The latter is not a given even in a developed nation such as New Zealand, and is even more problematic elsewhere in the globe.

**Case study: Georgia Tech’s OMS CS**

Recent attention has focused on Georgia Tech’s introduction of a fee-paying master’s degree in computer science (Online Master of Science in Computer Science) delivered entirely via a MOOC through the Udacity platform, not least as it purports to be the first such fee-charging qualification.

The programme was launched in January 2014 with about 375 students from an application pool of some 2,400. This represents an increase in applicants for this programme of 75 per cent on the on-campus programme. A persuasive factor behind this interest is likely to be the fee structure, with the online course around a sixth of the cost of the on-campus course. This must be of particular appeal to the student demographic: the MOOC has attracted a far older cohort than for the traditional course, with an average age of around 35, and they are predominantly domestic students who are combining study with full-time work. Students will be expected to submit examinable work electronically and are able to take between 3 and 6 years to complete the qualification. Although the course materials will be openly available on the MOOC platform, only fee-paying registered students can be awarded credit and the qualification. The intention beyond this pilot delivery is that fee-paying students who complete courses, but not the entire qualification, will receive credit or recognition. The initial cohort includes a sizeable number of AT&T employees—the company worked alongside Georgia Tech and Udacity to develop the platform. Academic rigour is being maintained, with an expectation that students will only attain full registration and be able to continue the programme once they have passed two foundational courses with at least a B-grade average, and exams are to be formally proctored.

According to Georgia Tech, the intentions behind this launch are twofold: to meet the “societal need” of training people to work in the “estimated 3 million open technology positions in the job market today”, and explicitly to “fully [incorporate] disruptive educational technologies into the value the Institute provides to its stakeholders”.

So far, then, so utopian. MOOCs seem to tick many of the more persistently difficult boxes for institutions committed to attracting and supporting a more diverse student body. However, this notion contains some assumptions. The vast major-
SO, IF THEY ARE NOT

the panacea for all educational ills, where does that leave MOOCs in the tertiary education sector? How do they fit, and what opportunities can they offer to institutions who take the plunge? One potential benefit of MOOCs is as a space for innovation. As a teaching medium currently without truly fixed rules there is an opportunity for experimentation and risk-taking that may be eroded as conventions develop and become entrenched. They constitute a locus for institutional and individual academic development; a place to validate and evaluate different models of teaching in a reasonably controlled environment. The potential is there to design and deliver courses drawing on varied models to develop integrated and inclusive areas for learning to take place.

The corollary to this vision of how MOOCs can deliver richly interactive content and foster peer collaboration and facilitation to enhance students’ learning, is the pragmatic (some would say pessimistic) view that, as with many other examples of apparently game-changing technologies, only a tiny fraction of the capabilities will be used and students will have a partial, or dumbed-down, experience. Diana Laurillard, Professor of Learning and facilitation to enhance peer collaboration and learning resources reside in the public domain and are freely available for educators and learners to use and adapt, the idea of an unmediated transmission model of teaching, and for the vast majority of their departments and content areas which students are well able to work through at their own pace and which could ultimately lead to a qualification. However, the same cannot necessarily be said for medical schools and other healthcare disciplines—MOOCs in dental imaging notwithstanding.

Quite apart from the practical and pedagogical obstacles to MOOC function, perhaps the largest challenge facing MOOC platform providers is the issue of monetisation. Based as it is on the OER (open educational resources) movement, in which teaching and learning resources reside in the public domain and are freely available for educators and learners to use and adapt, the idea of charging for content is anathema to many of those involved in the creation of the MOOC. However, there remain other possibilities for generating income which some platforms are exploring. Central to this exploration is the ‘freemium’ model in which, whilst central content remains free, payment is required for certification, subsequent extension courses, or secured assessment leading to qualifications. Other possibilities include developing sponsored content to serve specific employers who would pay employees to undertake it or for access to graduates. Alternatively, they might use MOOCs as free “funnels” to attract students who are then upsold into paid-for courses once they have developed a relationship with an institution. At this early stage in the development of MOOCs, such questions are still being debated and explored. Businesses such as Facebook and Spotify, which developed successful profit-generating models, having initially created high customer value but with no obvious revenue paths, demonstrate the potential for adding commercial viability to an existing product through carefully targeted development. The level of interest indicated by course registrations suggests that this is equally possible with MOOCs.

Another topic of some contention is the branding potential of individuals and institutions. Whilst a successful and popular MOOC can contribute a great deal to an institution’s teaching brand, a MOOC model that centres the promotion of a course on the international reputations of ‘star’ academics ultimately risks strengthening the profiles of those academics at the expense of others—including other staff working on the course—a way that may redirect some of the brand bounce the institution may otherwise have enjoyed. This question of how institutions can manipulate the branding opportunities MOOCs offer is further complicated by the issue of whether a future which potentially allows students to choose individual courses from different providers to create a programme or qualification—a scenario currently being explored by a number of providers and partner institutions—risks undermining university brands and compromising quality assurance.

The higher education market’s wider state of flux, as funding models undergo dramatic change, raises an even more fundamental question: what is university education now for? If there is tension between a notion of learning...
for knowledge’s sake and teaching skills that will enhance employability, perhaps MOOCs are able to serve both aims by shifting some of our expectations about what is practicable and desirable. That this shift is perceived as disruptive to the traditional model of higher education teaching arises in some respects from the more generalised theory of disruptive innovation proposed by Harvard Business School academics Joseph Bower and Clayton Christensen (‘Disruptive technologies: catching the wave’, Harvard Business Review, January-February 1995, pp. 41-53), which suggests that new market innovations may initially appear at odds with a business’ core product. MOOCs fall within this definition in that it is unclear whether they constitute a technology that will ‘stick’ in the environmental landscape and meet learning needs, or to what extent they will undermine universities’ core business model of selling largely face-to-face, on-campus, taught credit-bearing courses. Such a trajectory, however, is not without its critics, which include one of the world’s most influential strategy theorists, Harvard Business School’s Michael Porter. The debate between Christensen and Porter was recently featured in the New York Times, with Porter advocating that premium institutions such as Harvard resist the temptation to follow others into MOOC territory, where a price premium is anything but assured.

If Porter is wrong, and the theory of disruptive innovation is correct, then the most appropriate response to the threats and opportunities that MOOCs present is for higher education institutions to create autonomous units where exploration, experimentation and innovation can be undertaken, and positive developments rolled out, alongside the dominant business model. However, this would require a level of investment that may be beyond the reach of many institutions. Another challenge in maintaining traditional models of education, while simultaneously embracing new approaches, is the inevitable culture clash between the ‘new’ and the ‘old.’ Fortunately there is a metaphor for doing it constructively: the ‘ambidextrous’ organisation. Developed by Michael Tushman (also at Harvard) and Charles O’Reilly (at Stanford), the metaphor suggests that an organisation can, and should, support the tried and true (and profitable) lines of business, while actively pursuing new ways of doing things. The ambidexterity metaphor can help each sub-culture see the value of the other in relation to the overall goal of long-term competitive success.

So, are MOOCs the heralds of a new model of higher education or not? Ultimately, there are so many different potential sectors and needs to be met, that most likely there will not be a single one-size-fits-all model, but a multiplicity of approaches for which the appropriate funding models, frameworks and quality assurance processes will need to be developed within institutions. Face-to-face teaching will never disappear, as learners will always be individuals who need tailored support, and there is a qualitative, experiential side to on-campus learning that many will continue to want to experience. The model of face-to-face pedagogical contact will instead be developed, extended and augmented by models of online and blended learning that will require educators to embrace flexible and accessible models, but which in turn will open up institutions to a more diverse and far larger group of potential students. Universities will continue to make themselves relevant in the digital world, and students and employers will continue to benefit from that. What may begin as challenging and disruptive will swiftly become integrated into the rich tapestry of educational experience embedded in the academy. Ultimately, MOOCs may well have the potential to disrupt our habitual models of learning and teaching, but perhaps that is no bad thing.

---

**KEY TAKE-OUTS**

- In recent years Massive Open Online Courses have become hugely popular, with a proliferation of providers, course offerings and student enrolments.

- By offering access unconstrained by location, cost, time or circumstance, MOOCs make a profound contribution to the agenda of widening participation in education.

- Aside from the pedagogic issues it raises, a major challenge for providers is to generate income from the MOOC platform. Some are exploring a “freemium” model, requiring payment for certification or extension courses.

- Ultimately, MOOCs are likely to develop alongside the evolving model of face-to-face and flipped classroom teaching rather than replace it, and open up institutions to a larger, more diverse group of potential students.
Additive manufacturing could be the key to a new world of niche markets for New Zealand companies

LENTH: 10 min (2429 words)
CONSIDERED BY SOME to be the next industrial revolution, 3D printing has emerged as a highly popular manufacturing tool for users from all backgrounds.

THE POTENTIAL impact of this new technology on New Zealand manufacturing should be seen in the context of the country’s remoteness and small size. These characteristics, in particular, compromise the ability of manufacturers to reach the scale needed to compete in the global market. A recent Ministry of Business, Innovation and Employment (MBIE) report on high-technology manufacturing concludes that New Zealand has strengths in research and product development, short manufacturing runs, and the manufacture of high-value products, but that high-volume manufacturing is moving to lower-cost countries, closer to international markets. About a third of potential New Zealand exporters cite distance to markets as a major barrier to entry—particularly when they are looking to mass produce goods. However, there is great potential for New Zealand companies to make products aimed at niche markets that are mostly untouched by large, international companies.

3D printing allows small businesses and start-ups to take innovative ideas to market without the high set-up costs associated with traditional manufacturing. It provides entrepreneurs and ‘makers’ with the tools to create prototypes and consumer-ready goods close to the customer and at a relatively low cost—a standard 3D printer, for example, can now be purchased online for around $2000. Businesses and individuals without such a printer can readily access the technology via firms that offer 3D printing as-a-service, and which not only provide printable files but also offer the option of printing them on partner-network printers. One such firm, 3DLT, also offers its products through online retailer Amazon.

An internet search of 3D printing yields thousands of articles and blogs relating to additive manufacturing technologies across the globe. From orthodontic braces and bio-printed transplantable human organs to aircraft parts and self-replicating 3D printers, the world has witnessed groundbreaking achievements with the increasing popularity of this technology. 3D printing has given manufacturers a new tool for making things, including objects that were previously impossible to produce, and it has the potential to transform the way in which people from every industry and background operate. As with any technology, however, additive manufacturing has a number of limitations that should be considered before a decision is made to adopt it. These will be discussed later.

In 2013, the McKinsey Global Institute predicted that by 2025 the economic impact of 3D printing could reach US$230-550 billion per year. We believe that New Zealand manufacturers can capture some of this gain through the innovation and enhanced manufacturing processes made possible by 3D printing. The new technology can improve the prospects for import substitution, and mitigate the tyranny of distance that at present limits many companies to exporting products such as commodities, for which responsiveness isn’t crucial.

WHAT IS 3D PRINTING?

ESSENTIALLY, 3D printing—or additive manufacturing—entails splitting a three-dimensional model into very thin horizontal layers using CAD (computer-aided design) software, with each cross-sectional layer “printed” successively until the entire object is built (see sidebar: Additive Manufacturing Technologies).

Additive Manufacturing Technologies

STEREOLITHOGRAPHY (SLA)

uses ultraviolet lasers to cure or solidify polymer resin. Guided by the instructions from a selected CAD file, a beam of ultraviolet light is directed over the liquid polymer, solidifying areas it contacts and creating the first layer of the threedimensional object. This layer, which sits on a tray within the vat of resin, is then incrementally lowered, allowing subsequent layers of liquid polymer to be solidified on top of it.

SELECTIVE LASER SINTERING

uses a high-powered laser to melt powderform material, once again in a layer-by-layer process. The laser traces out the first cross-sectional layer to melt and fuse the granules together. A new layer of powder is then laid over this and the process is repeated to build the entire model.

FUSION DEPOSITION MODELING (FDM)

is conceptually very similar to the process used by inkjet printers, but with the extrusion nozzle depositing melted material, rather than ink. Plastic filament passes through a heated nozzle, which can stop or release the flow, while a motion control system follows the path created by the design file for each cross-sectional layer.

Adapted from descriptions by Chuck Hull, the inventor of 3D printing, and Ken Vartanian, the marketing director of 3D-printer manufacturer Optomec.
THE CURRENT SITUATION

DOMINIC BARTON, global managing director of management consultancy McKinsey & Company, told the Wall Street Journal in June 2014 that the bold claims made for additive manufacturing may prove justified, noting that it was included in the top 12 technologies deemed by the McKinsey Global Institute to have a potentially disruptive economic impact over the next decade. He went on to say: “Additive techniques are being used to create intricate, low-volume parts, including medical implants and difficult-to-cast parts for aerospace products. We see great potential for 3-D to speed up and improve mold making. But for high-volume manufacturing, additive methods are still too slow”.

A more forthright proponent of additive manufacturing is Robert Plant, Director of the Intelligent Computer Systems Research Institute at the University of Miami. He believes that additive manufacturing has the ability to “enable agile manufacturing to occur, in essence the manufacture of any item, anywhere and in any volume”. He notes that additive manufacturing would enable localised manufacturing and would cut labour and transportation costs.

However, despite additive manufacturing being particularly suited to situations involving low production volumes and high levels of complexity, traditional manufacturing methods remain highly relevant for large-scale production runs. Depending on the business strategy, each manufacturing method can be advantageous, and in some circumstances performance could be improved by combining the two. Additive manufacturing technology should be considered an alternative tool for manufacturing small volume batches, where customisation, flexibility and localisation are desirable.

EXPLOITING THE BENEFITS OF ADDITIVE MANUFACTURING

Six environments are especially ripe for additive manufacturing:

• **Low-volume production**
  One significant drawback of 3D printers is their relatively low speed. This gives traditional manufacturing methods the advantage where large quantities are involved. However, as they require little configuration, 3D printers can begin manufacturing any design, simply by receiving the design file and appropriate materials. Low set-up times and minimal configuration requirements drastically reduce the time it takes to build prototypes or manufacture small batches. Another reason for favouring the technology for low-volume production is the cost and availability of suitable raw materials. Currently such printers are limited to using plastics and some metals and these are often far more expensive than materials for traditional manufacturing. As the use of 3D printers becomes more widespread, the range of materials is likely to expand and the cost to reduce.

• **Customisation**
  3D printers allow for extensive customisation due to their ability to switch to new printing jobs with very little human intervention. They permit cost-efficient on-demand production, meaning that customers can provide specifications for an item before it is printed without adding to the overall cost. 3D printing is thus highly suited to prototyping, which has been one of its main applications to date. In contrast, traditional manufacturers have advantages in standardisation and mass-production, where costs can be distributed across large quantities.

• **Localised production**
  3D printers operate using digital design files that are easily and instantaneously shared. As a result, production can take place locally, all over the world. Companies that previously had to manufacture products at a distance—even in foreign countries—are now able to bring production home. The ability to share design files globally dramatically cuts lead times as well as transport and other inventory-related costs. The economics of localised production may be further improved by the minimal labour requirements of additive manufacturing, which removes the cost advantage of making goods in low-wage countries.

• **Highly complex designs**
  Following CAD ‘instructions’, 3D printers are able to build intricate and geometrically complex designs, layer by layer, yielding greater strength-to-weight ratios. The additive nature of 3D printing means an object of high geometric complexity—for example, one with many hollows and curves—can be printed with the same level of ease as a simple solid block. This could be highly attractive to customers looking for replacement parts which are often difficult or impossible to source. Where the part required is difficult to reproduce using traditional means of manufacturing, the benefit of owning a 3D printer is even greater. Design files sold online allow anyone to print what they need, when they need it, and at a significantly lower cost.

• **Fast-paced, unpredictable business environment**
  Additive manufacturing can provide the flexibility and adaptability to help companies remain competitive in a rapidly changing market environment, and at a relatively low cost compared with alternative manufacturing methods. For example, the modification of existing products and the development of new ones, including prototyping and small batch runs of highly customisable products, can be simplified. Companies with a low-volume, high-customisation strategy are better able to make rapid modifications and keep up with the constant change in customer expecta-
producing prototypes over the next five years the application of 3D printing in New Zealand is likely to shift from making consumer-ready, sellable experimental hobbyist items, to making consumer-ready, sellable products direct to market.** Small start-ups, entrepreneurs For entrepreneurs or start-up businesses, the impact of additive manufacturing is related to market entry barriers. Chris Anderson, a former editor-in-chief of Wired magazine and a recognized supporter of the 3D printing industry, considers the greatest barrier entrepreneurs face in entering the consumer goods market is the cost of manufacturing. Additive manufacturing significantly reduces this barrier by largely eliminating the initial cost to set-up and reconfigure machinery and to source materials for prototypes.

**ADDITIVE MANUFACTURING IN NEW ZEALAND**

Prototype manufacturing costs are a significant barrier to entry for businesses looking to expand their product lines, and for entrepreneurs trying to bring their ideas to life. Relatively remote in geography and small in size, New Zealand holds little power in international markets for common manufactured goods. In order to compete globally, New Zealand must target niche markets, representing specialty products originating from, or unique to, this country. Catherine Beard, the Executive Director of Manufacturing New Zealand, supports this view. She believes that New Zealand manufacturers cannot compete with the cheap labour and materials costs in New Zealand lead local manufacturers to focus on high-quality, low-volume niche production. This is evident in the statistics. According to MBIE, small businesses dominate the country’s industries, with only one per cent of enterprises having more than 50 employees. MBIE also finds that small businesses in New Zealand are increasingly engaging in innovation activities. Additive manufacturing could further this engagement and provide new opportunities for innovation.

Wellington-based 3D-printing company Ponoko is an online manufacturer that facilitates the purchasing, selling, sharing and making of 3D print designs. Founded in 2007, Ponoko now has digital manufacturing hubs in California, Berlin, Milan, London, and Wellington. Industry specialists consider Ponoko to be a major driver for the 3D printing industry worldwide. Co-founder Derek Elley believes that over the next five years the application of 3D printing in New Zealand is likely to shift from producing prototypes and experimental hobbyist items, to making consumer-ready, sellable products direct to market. The world is already beginning to see the expansion of 3D printing beyond prototyping (see sidebar: Some Applications). Elley further expects that New Zealand consumers will increasingly rely on distributed on-demand manufacturing companies. The challenge for additive manufacturers and service providers such as Ponoko will be to meet growing and changing market needs. Even at this early stage in their development, 3D printers and the associated materials for manufacture are readily available at low cost. Makerbot’s Replica 2, for example, currently retails for little more than $2000. Considering how easily they can be obtained and operated, 3D printers may find their way into the average household, much as computers have done. At present, however, lower-end printers have a long way to go in terms of accuracy and product integrity (rough edges and weak structures are common issues), and therefore are better suited to hobbyists and tech-lovers.

Some Applications

- In 2003, US-based aircraft engine supplier GE Aviation successfully printed a single-component jet engine fuel nozzle that was 25 per cent lighter, and up to five times stronger than its previous design, which consisted of 25 assembled components.
- San Diego-based bio-printing company Organovo is currently working on the creation of functional human tissues using additive manufacturing technology. Organovo expects to reveal the world’s first 3D-printed liver sometime in 2014.
- In early 2012, Belgian manufacturer Layerwise used titanium powder to print a transplantable jawbone for an 83-year-old patient. The metal jaw was made to exactly fit the patient’s bone structure and was finished with a bio-ceramic coating. 3D-printing of such bone replacements could mean shorter waiting times, lower costs, improved accuracy, and greater success rates for patients.
**Government Initiatives**

The government has demonstrated a commitment to additive manufacturing. In 2013 it awarded $12.7 million to the NZProduct Accelerator, a partnership of six universities, Callaghan Innovation, and Scion that aims to develop, among other things, capabilities in advanced manufacturing. In 2014, one of the themes of the National Science Challenge—‘Science for Technological Innovation’—was the development of next-generation additive manufacturing technologies. New Zealand has natural advantages when it comes to extending the materials used for 3D printing beyond metal and plastic to biological materials. In particular, we can extract, modify, and print biopolymers from resources including lignin, cellulose and collagen.

---

**THE FUTURE OF ADDITIVE MANUFACTURING**

AS 3D-PRINTING technology advances and spreads, it will likely accelerate trends in manufacturing and supply chain strategy toward the localisation of production. This, in turn may reduce the distance-to-market barrier for New Zealand firms. Additive manufacturing remains a relatively new technology and there is still much to learn. For this reason, the country should continue to invest in research and development for 3D printing applications in manufacturing. (see sidebar: Government Initiatives).

However, while additive manufacturing may be highly appropriate for New Zealand, there is no reason that large, low-cost manufacturing nations such as China will ignore it. In fact, the Chinese government has already invested heavily in 3D printing technology—including the creation of clusters and innovation centres in cities such as Nanjing, Qingdao, Sichuan, Wuhan, and Zhuhai. Breakthrough applications of 3D printing have already occurred around the world and New Zealand companies such as Ponoko are contributing to this transformation of manufacturing. New technologies encourage new ways of thinking, and from new ways of thinking we find new ways of doing things. New Zealand has much to gain from participating in this revolutionary shift in manufacturing. 3D printing technology mitigates some of the barriers and limitations we face and as such, we should explore and exploit the new opportunities it affords.

---

**KEY TAKE-OUTS**

- New Zealand’s small size and distance to markets are major barriers for manufacturers.
- 3D printing, or ‘additive manufacturing’, offers small businesses and start-ups the tools to create prototypes and consumer-ready goods close to the customer and at a relatively low cost.
- New Zealand should continue to invest in research and development for 3D printing applications and exploit the opportunities it presents.

---

Julie Kim completed her BCom(Hons) at the University of Auckland Business School, majoring in Economics and Operations and Supply Chain Management. She now works as a Supply Chain Graduate at Goodman Fielder.

julie.kim@goodmanfielder.co.nz

David Robb is Professor of Operations and Supply Chain Management at the University of Auckland Business School’s Graduate School of Management. He is currently investigating operations and supply chain issues in China and New Zealand, especially as they relate to retail, managing uncertainty, and lead times.

d.robb@auckland.ac.nz
Its supporters hope that the roll-out of a nationwide high-speed digital network will fuel innovation.
A World Bank study found that a 10 per cent increase in broadband penetration generated an increase in GDP of about 1.5 per cent. The government’s decision to connect 75 per cent of New Zealand households with optical fibre through a partnership model largely rests on the expectation that establishing a modern, high-speed network will fuel innovation.

NEW ZEALAND’S UFB network is being funded through two investment models agreed with four partners. Three of those partnerships follow the Public-Private-Partnership (PPP) model which finds a middle ground between public and private investment. A PPP is defined as a contract between a government and one or more private partners that seeks an alignment of objectives while shifting a substantial amount of risk onto the private partners.

Under this model, funds from a government-owned company, Crown Fibre Holdings (CFH), are used to lay the ‘dark’ fibre along urban and suburban streets. When a customer subscribes to the network, the partner builds the ‘drop’ into the customer’s premises and a subscription-based retail commercial relation starts between the customer and a Retail Service Provider (RSP) of their choice, with the retailer paying for capacity to the Local Fibre Company (LFC) at fixed wholesale prices. The LFC is then ensured a capacity to the Local Fibre Company (LFC) at fixed wholesale prices. The LFC is then ensured a

The agreement signed with the fourth and largest private party, Chorus, is not a PPP contract. In developing a strategy for its broadband initiative, the Government ruled that no bidders could be vertically integrated. This forced Telecom to split into two completely separate companies which, in late 2011, were listed on the New Zealand and Australian stock exchanges. These are Chorus, owner the old copper network and future owner of UFB fibre assets, and Telecom Retail, which retained the switched network, the wireless network and the national backhaul (transport) network.

In the contract signed between CFH and Chorus, the Crown invests directly in Chorus, and Chorus bears the risk associated with uncertain demand uptake. The investment takes the form of a zero-interest loan, in return for which Chorus must comply with specific coverage and uptake goals.

Likewise rural New Zealand will be connected through the mixed wired and wireless infrastructure built by the Rural Broadband Initiative (RBI). While UFB promises to deliver high-speed fibre-optics connection to premises, the RBI will connect rural New Zealand to the information backbone through DSL and fixed-wireless connections using the latest Long Term Evolution (LTE) standard.

Providing business stability and reducing uncertainty for fibre investors is crucial if the country is to reap the benefits of the new infrastructure. One decision with medium-term impact is the wholesale service price levels negotiated between CFH and its partners. Wholesale service prices are known until 2020, with price levels set for the first year of operation and changes predeterm in the negotiated tariffs. As a result, each RSP knows how much it will have to pay an LFC for a home or business fibre connection for the rest of the decade.

However, infrastructure and connectivity are not the only goals devised by the UFB/RB initiatives. Though monopoly rights have been conferred on respective LFCs, technological and regulatory principles dictate that the network must be open to any RSP willing to provide end-user services in each service area. In other words, consumers and business will be able to choose a provider from the many RSPs expected to operate on the UFB network, while LFCs can only provide so-called wholesale services to RSPs, and are forbidden from dealing directly with consumers.

The newly-elected National government announced that it would spend close to $1.6 billion in two connectivity programmes: the Ultra-Fast Broadband (UFB) initiative and the Rural Broadband Initiative (RBI), to offer New Zealanders high-speed access to the telecommunications network.

New Zealand was promised that by 2019 three quarters of households and businesses would be connected to the UFB by means of optical fibre connections.

A government-owned company, Crown Fibre Holdings (CFH), was created to manage the funds and search for private investment.

The bidding process ended in early 2011, with four companies winning shares of the available funds to be invested in partnership with CFH. The partnerships are known as Local Fibre Companies (LFCs).

Also in 2011 Telecom and Vodafone won bids to become CFH’s partners in the RBI. Under the initiative, 1,340,000 fibre connections are to be completed by 2019.

The four LFCs offer fibre connections to households and businesses in the following areas:
• North Power Fibre in the Whangarei region, with 1.5 per cent of the UFB;
• UltraFast Fibre in Hamilton, Tauranga, New Plymouth, Wanganui, Hawera and Tokoroa regions, with about 14 per cent;
• Enable Networks in Christchurch, Rolleston and Rangiora, with 15 per cent.
• All other urban areas, comprising about 70 per cent of the country, will be served by Chorus.

Under RBI, Vodafone and Telecom are to build close to 250,000 connections to rural premises by 2016.
As of June, 2014, a third of New Zealanders in UFB areas (517,000 people) had access to UFB, with about 40,000 premises connected. Whangarei was the first city in New Zealand to complete its fibre-to-the-home (FTTH) deployment, making North Power Fibre the first partner to reach the target.

As the fibre uptake gathers pace—from a marginal uptake rate a few months into the project to a current uptake of 7.7 per cent of premises—it is important to realise that similar figures have been reported elsewhere, including in Singapore and the UK, over the same time span. Future activity in New Zealand is expected to stabilise at about 200,000 new connections per year.

Under the RBI about 195,000 homes and businesses in rural areas have access to fast wireless broadband, and 72,000 out of 100,000 lines to rural households have been upgraded. The Ministry of Communications reports that 40 of the most remote rural schools now have peak speeds of at least 10 megabits per second and that 90 per cent of the targeted schools—more than 2,220 schools nationwide—can now connect to UFB, as can 32 of 37 rural hospitals.

The main hurdles facing fibre uptake are consumer awareness and a willingness to switch from current DSL connections, along with a willingness to pay for the equipment needed to connect to a retailer. One other issue which is becoming significant for the deployment rate is the need to coordinate construction of the drop into multi-dwelling properties and along shared driveways. As work progresses in city neighbourhoods, LFCs need to deal with multiple owners’ perceptions about the benefits of fibre connections, whereas RSPs need to step up efforts to make people aware of the services they will have access to once they sign up with the UFB network.

Some issues arising from industry concerns, regulatory decisions and market forces have the potential to affect the deployment of the UFB network.Foremost has been the Commerce Commission review on the price of the copper lines leased from Chorus by internet service providers.

Chorus owns and operates more than 90 per cent of New Zealand’s copper lines. Setting the right price for this infrastructure is of the utmost importance as the current internet market uses DSL-based technology, which in turn depends on the copper lines that connect the customers’ premises to the telephone company. In its review, the Commerce Commission ruled that the rental charge must drop by 23 per cent. Chorus responded that such a drop would hinder its ability to raise the necessary funds—$1 billion is forecast—to invest in UFB and would cause major delays in achieving its targets.

As of March, 2014 a legal appeal on one of the components of the Commission’s price cut was being reviewed by the High Court. Chorus also applied to the Commission for a review of its decision on another price component, claiming that a cost-based price should be used instead of the Commission’s international benchmark approach.

The dispute over the price of copper was exacerbated by the Government’s subsequent announcement that it would pass legislation to overrule the Commission’s decision. The Government has since backed down from a marginal decision, but another episode reminds us of the frequent uncertainty surrounding the build-up of the UFB network. In 2011, when seeking to provide certainty to LFCs, the Government advocated a 10-year “regulatory holiday” to be instated in the Telecommunications Amendment Bill. Opposition from political parties and from the telecommunications industry prompted the Government to take a more considered approach to attracting investment for the project.

As the UFB network expands and providers start to bring their service offers to the markets—as of Q2-2014, 74 RSPs were actively offering services—transitioning to the new network operation while the old telephone network remains operational will continue to cause tension between policy makers, regulators and affected operators. The failed Australian approach to FTTH deployment sought to replace each telephone line as soon as fibre was connected, with the installation and switching being done regardless of whether the household owner agreed. Furthermore, the cost and management of the A$40 billion-plus project was borne entirely by the Australian government. As New Zealand follows a different pathway, in which a single private partner builds 70 per cent of the country’s promised connections while also owning the telephone lines, issues such as the price of copper line rental and the termination of the wired telephone network will need to be closely watched, by CFH as well as the regulator.

...transitioning to the new network operation while the old telephone network remains operational will continue to cause tension between policy makers, regulators and affected operators.
INDUSTRY EXPERTS routinely refer to the central and regional governments’ lack of a vision for the role of the new infrastructure. The UFB and RBI were conceived as promoters of economic growth. There was also the expectation that high-speed broadband and an open-access platform would positively impact the way people learned, conducted business, procured health services and dealt with the government. It is therefore relevant to ask what can be expected of the UFB in the future.

In 2009 a group of World Bank economists coined the term “broadband ecosystem” to refer to the collective set of users, services, high-speed networks and applications involved in providing access to a broadband network, offering services to consumers, purchasing services from providers and intervening in policy decisions surrounding the network. By opting for a high-speed, open-access broadband platform New Zealand is effectively instigating major changes in the structure of the market, which in turn are expected to deliver profound changes in the range of services and the way they are delivered to consumers.

In the United States, Google is laying out FTTH connections in several locations (see side bar, page 34) and the duopolistic operators—cable and telephone companies—in affected regions have started to react to Google’s threat. The Singaporean market has been restructured around two entities—a dark-fibre provider, and a network operator—which together manage the National Broadband Network in an open-access manner. These market disruptors illustrate the potential for the UFB to radically change the telecommunications industry landscape. The first wave of new industry participants came about with the creation of the internet access market, and as New Zealand transitions to a fibre-based access network, other entities are being given the technical means and the necessary medium-term regulatory stability to operate on the UFB’s content markets. It is an unprecedented situation in the country’s telecommunications market history.

The next five years will be a key period that will confirm (or reject) the disrupting role of the UFB network.

International cases illustrate what is currently at stake on the supply-side of a broadband market. The recently announced purchase of satellite television company DirecTV by AT&T in the United States adds to obvious moves by established operators to extend their commercial presence beyond network operation into the contents markets. Locally, although LFCs are forbidden to get involved in the provision of end-user services, Telecom as an RSP is committed to becoming a content provider. The company has embarked on a comprehensive rebranding exercise to signal this new direction, most overtly in August 2014 with a corporate name change to Spark. The implications of such integration of retail operation and content delivery is the likely consolidation of the company’s market share in the commercial services provided on the UFB network and as such is a clear threat to competitors in the retail market.

But these commercial interests in the mature television market contrast sharply with the efforts by promoters of fibre in places such as Chattanooga, Tennessee in the United States (see side bar, page 34). New Zealand’s broadband leaders must closely watch such developments and commit to turning the UFB platform into a place...
Google offers a fibre-to-the-home broadband internet service to a small number of cities in the United States. The initiative began in Kansas City, Missouri and has now expanded to Austin, Texas and Provo, Utah.

Google’s model of fibre deployment begins with an invitation to communities to become ‘Google Fibre towns’. The company negotiates terms and conditions with these municipalities and city councils and expects support in return. Since cabling the last kilometre is complex and expensive, Google has introduced so-called fibre huts, from which cables are laid along utility poles to homes in selected neighbourhoods. A “reasonable use” clause, in the agreement, prohibits hooking up any type of server to the connection.

Undoubtedly Google’s strategy worries the incumbent cable and telephone companies which hold a strong duopoly across the United States. It is not clear whether Google will operate as an ISP but with the company aiming to connect some 8 million addresses by 2022 at a cost of $7 to $10 billion, it will become an important supplier of fast broadband.

Google’s presence in the broadband market is already forcing the cable and telephone incumbents to tweak their business models. Austin subscribers have been offered free wi-fi by Time Warner Cable, while AT&T has announced plans to build a fibre-to-the-home network in the same city.

**TENNESSEE**

Tennessee’s fourth-largest city, Chattanooga, developed a 1 Gigabit fibre-optics network using federal funds and private capital. Chattanooga’s community-owned electric utility invested in a FTTH network built to run a smart grid and offer internet-based services to its residents. The high-speed network, which is 50 times faster than the national average, is a collaboration involving the city government, the electric utility, and private investors.

Chattanooga’s success has led to the creation of start-ups fostered by GigTank, a business accelerator that seeks to exploit the potential of the network to bring new, fibre-based services to the market. Said to be the world’s only start-up accelerator connected to a living, city-wide fibre-optic network, GigTank supports start-up teams through a network of mentors, industry specialists and business development resources. The teams have access to Chattanooga’s 1 Gbps internet service while conceiving businesses designed to operate and evolve on advanced broadband platforms.

Google’s model of fibre deployment begins with an invitation to communities to become ‘Google Fibre towns’. The company negotiates terms and conditions with these municipalities and city councils and expects support in return. Since cabling the last kilometre is complex and expensive, Google has introduced so-called fibre huts, from which cables are laid along utility poles to homes in selected neighbourhoods. A “reasonable use” clause, in the agreement, prohibits hooking up any type of server to the connection.

Undoubtedly Google’s strategy worries the incumbent cable and telephone companies which hold a strong duopoly across the United States. It is not clear whether Google will operate as an ISP but with the company aiming to connect some 8 million addresses by 2022 at a cost of $7 to $10 billion, it will become an important supplier of fast broadband.

Google’s presence in the broadband market is already forcing the cable and telephone incumbents to tweak their business models. Austin subscribers have been offered free wi-fi by Time Warner Cable, while AT&T has announced plans to build a fibre-to-the-home network in the same city.

**THE KEY TAKE-OUTS**

- The decision to run optical fibre to 75 per cent of New Zealand households rests largely on the expectation that establishing a modern, high-speed network will fuel innovation.

- Providing business stability and reducing regulatory and market uncertainties for fibre investors is crucial if the country is to reap the benefits of the new infrastructure.

- Exploiting the potential of a fibre-based broadband network requires a good understanding of how users, service providers, regulators and networks combine to form an effective broadband ecosystem.
Online currencies look to reshape the way we buy and sell

LENGTH: 10 min (2343 words)
A SHORT TIME AGO, the idea of a decentralised virtual currency based on cryptography technology and operating over a worldwide peer-to-peer network would have been considered science fiction. However, it is now a daily reality for users of bitcoin and other virtual currencies.

Bitcoin was introduced to the world in a 2008 paper released by an unknown individual, or group, using the name Satoshi Nakamoto. The paper detailed a decentralised virtual currency that anyone could use, with a transparent ledger and transactions, not based on trust but secured mathematically by cryptography. Satoshi, whose identity remains a mystery, is widely believed to hold one million units of this currency (known as bitcoin).

In creating bitcoin, Satoshi’s intention was to devise an efficient, trustless, electronic payment system. Given the willingness of payment processors to perform chargebacks, merchant fees (driven by consumer fraud) make small transactions impractical and require merchants to exercise caution when dealing with customers. Bitcoin entirely bypasses the traditional system: transactions are sent person-to-person like digital cash, and their irreversibility eliminates the possibility of fraud from chargebacks. This allows merchants to confidently accept payments from customers and keeps fees low.

Bitcoin can be transferred anywhere almost instantly, generally have lower fees than bank transfers and other money transfer services, and provide high levels of anonymity for senders and receivers. Bitcoins are exchanged for traditional currencies on many exchange markets, through various brokers, and even via ATMs. New bitcoins are created at a diminishing rate to limit the total number to 21 million. This has led many to view bitcoin as a deflationary currency with a value that is likely to rise over time, and therefore to treat it as a speculative investment.

Unlike earlier centralised attempts at virtual currency such as E-gold and Liberty Reserve, which were shut down following US government prosecution relating to the illegal operation of money transmittal services, the bitcoin network is decentralised, so is resilient in the face of such takedown attempts by governments and regulatory agencies. The network is made up of thousands of individual volunteers and organisations running software that propagates transactions to all peers in the network, with each keeping their own complete record of historical bitcoin transactions—known as the ‘blockchain’. As a result, the bitcoin network has no central point of failure.

Bitcoin addresses, which function as accounts, are not linked to real world identities. Instead, they appear as a seemingly random string of characters (e.g.: 126c6D51U4Rq3P42xZkKzrLSLm-MBrzrjX) which represent a user’s cryptographic public key. A user can transfer bitcoins from their address by using the corresponding private key to prove ownership. These public/private keys are generated by bitcoin wallet software and new addresses can be readily created.

Newly-generated bitcoins are awarded to people known as ‘miners’ who contribute computing power to the bitcoin network. Miners process transactions by performing mathematical calculations to confirm batches of bitcoins in ‘blocks’ appended to the blockchain. The difficulty of such calculations adjusts to maintain an average block creation rate of 10 minutes and the reward for creating the blocks halves every 210,000 blocks (about 4 years) to limit total production to 21 million bitcoins. Recently bitcoin mining has become more centralised with the manufacture of dedicated bitcoin-mining devices.

APPLICATIONS

THE MOST visible use for bitcoins has been in commerce—predominantly, e-commerce. Merchants accepting bitcoins typically use a third-party payment processing service such as BitPay or Coinbase that can automatically convert received bitcoin payments to traditional currency over an exchange, eliminating the exposure of retailers to the currency’s volatility and protecting against exchange losses.

For merchants, there are many advantages in accepting bitcoin payments through bitcoin payment processors and as standard bitcoin transactions. The irreversibility of such payments, which eliminates chargebacks and fraud, enables global online merchants to expand their customer base by safely accepting payments from high-risk countries such as Russia, Indonesia, and Malaysia. Merchants and consumers in these regions, who have been neglected by traditional payment processors, similarly benefit by gaining access to the global economy through an alternative international payment network. Accepting bitcoin transactions also generally incurs lower merchant fees than credit cards and other payment processors such as PayPal, and start-up costs for small retailers are low—a device capable of accessing the internet is usually all that is required. The downside is that the relatively low use of the currency creates a barrier for large retailers who face significant implementation and staff training costs. Many are not able to justify such an investment, given bitcoin’s uncertain future.

From a consumer perspective, payment by bitcoin is not a particularly attractive option. Holding such a volatile currency with the intention of spending it is a gamble and not practical for most people. With initial exchange and transfer fees factored in, payments in bitcoin may end up costing more than traditional payment methods. Furthermore, bitcoin transactions do not offer protection against potentially fraudulent merchants and contactless payment technology may be more convenient for in-person payments.

Bitcoin has also been tarnished by its role in black- and grey-market transactions, and the anonymity it offers users has been well utilised by criminals. Silk Road was a marketplace website accessible through the Tor anonymising network.
that connected buyers and sellers of illegal goods, primarily drugs—much like a black-market version of Amazon. Carnegie Mellon University researcher Nicolas Christin monitored customer feedback on Silk Road for an eight-month period in 2012 and found that daily sales from all vendors averaged about 20 per cent of the daily trades on the largest USD/BTC exchange market at the time. Silk Road was shut down in October 2013 by the US Federal Bureau of Investigation, which seized almost 175,000 bitcoins with a current value of about US$100 million from the site and its alleged owner, Ross Ulbricht. Despite the closure of Silk Road, numerous other drug markets have continued to grow and recent reports indicate that together they have surpassed the original Silk Road in the number of unique listings and total sales.

Other illegitimate uses of bitcoin include for online gambling in areas where gambling is illegal or highly regulated, as payment extorted by ransomware computer viruses, and for money laundering and tax evasion.

Perhaps the most popular use of bitcoin, however, is for speculative investment. With its artificially manipulated scarcity and declining rate of supply, many investors are betting on the future of bitcoin, believing that its value will continue to rise. Within New Zealand very few local merchants currently accept bitcoin payments, and it is probable that most local bitcoin exchange is for speculative investment and trading.

Our research has found bitcoin exchange growth in New Zealand, and its adoption by users, to be consistent with that reported elsewhere. Downloads of bitcoin wallet software and exchange volumes on NZD/BTC markets suggest that bitcoin is thriving in New Zealand as it is in the rest of the westernised world.

Although comparatively still small—the largest volume of NZD/bitcoin exchange was just $2.8 million in Q4 2013—bitcoin/NZD exchange markets have displayed exponential growth, most notably in Q2 and Q4 2013, which coincided with sharp rises in the market value of bitcoin and increased media coverage of the currency. With bitcoin still far from a critical mass level of adoption, explosive growth is still possible in the future. It is worth noting, however, that due to a lack of liquidity on NZD markets, institutional investors and others trading large amounts of bitcoin will likely do so on USD/bitcoin markets.

A Guide to Virtual Currencies

AMAZON COINS
Online retailer Amazon is one of a small number of technology companies that have created virtual currencies—largely limited to use on their own websites. Amazon coins was released in May 2013 as an easy way for customers to purchase apps, games, and in-app items on the company’s app store and website. Amazon coins—which can be purchased in bulk at a small discount but cannot be converted back into dollars—are seen by some principally as a strategy for reducing merchant fees on credit card purchases.

FREICOIN
Based on the bitcoin protocol, the peer-to-peer system allows for the creation of up to 100 million freicoins, some 20 per cent of which have been mined so far. Unlike bitcoin, freicoin imposes a demurrage fee in an attempt to improve the currency’s long-term stability. At present, the currency’s use is largely restricted to niche online merchants.

LITECOIN
Also based on the bitcoin protocol, litecoin transactions can be confirmed with less delay. So far about a fifth of the total of 84 million litecoins have been mined. The combined value of those in circulation is estimated at $60 million. As with freicoin, the currency is almost entirely limited to online merchants.

RIPPLE
Developed by a Silicon Valley company, OpenCoin, ripple is both a currency and a payments system capable of recording transactions in real-world assets such as dollars and gold. OpenCoin (now called Ripple Labs) intends distributing some 50 billion units of the virtual currency over the next few years to boost usage. The system is designed to eliminate the reliance on centralised exchanges and to speed up transactions. The New Zealand gateway for ripple is Coinex.
BITCOIN USERS and investors face a large amount of risk, including software and technical risk, currency volatility, theft, and fraud. Bitcoin reference software, funded by the non-profit Bitcoin Foundation, is considered stable but is still in development and errors continue to cause disruption to the network. In 2013, for example, a compatibility issue between different versions of the software caused a blockchain split (in which some transactions were only recognised on certain versions of the software) and panic selling devalued the currency by more than 20 per cent in a matter of hours. In February, 2014, a ‘transaction malleability’ bug was thrust into the spotlight when one of the largest bitcoin exchanges—Mt Gox—claimed the flaw had allowed hackers to steal bitcoins from its system.

Users themselves can also make mistakes. A failure to back up wallet files has been the cause of a number of losses, with one UK user claiming that his hard drive, which is now in a landfill, still holds 7500 bitcoins. Without the digital wallet file, the bitcoins are irrecoverable.

The market value of bitcoins has shown extreme volatility. At the start of 2013, for example, bitcoins were each worth $20, but after a period of rapid growth they peaked at $1,300 toward the end of the year. The first half of 2014 has seen the value fluctuate between $400 and $1,200. Because of its low market cap (currently US$8 billion), large orders or manipulation by significant holders of it’s low market cap (currently US$8 billion), large orders or manipulation by significant holders can readily move the market and it is not unusual for price movements to exceed 10 per cent in a single day. Such volatility is expected to decrease if the currency continues to gain acceptance, but with almost 20 per cent of bitcoins currently held by only 100 addresses, it is likely that early adopters will maintain their influence for some time.

The irreversibility of transactions and the anonymity of users has made fraud and theft involving the currency worryingly common and many online wallet services and bitcoin exchanges have lost funds entrusted to them by users. The largest failure to date has been the demise of the Japan-based Mt. Gox exchange, which in February 2014 announced losses of more than US$400 million in bitcoin. A similar local case involved the Bitcointica exchange, registered as a financial services provider in New Zealand, which lost around US$0.5 million in two separate incidents in 2012. A common theme in these events has been the attribution of losses to hackers who were somehow able to infiltrate the systems and steal bitcoins. Whether this indicates weak controls or dishonest service operators, it highlights the need for users of bitcoin to avoid leaving them in the control of third party services.

REGULATION

THE TREATMENT of bitcoin by regulators has varied wildly across the world. The most common response has been to leave the currency unregulated and to issue taxation guidance and warnings to investors while investigations are undertaken.

Strong negative reactions to bitcoin have come from Iceland, where bitcoin exchange is illegal, and from China, which has barred financial institutions and payment processors from using bitcoin. The US Financial Crimes Enforcement Network (FinCEN) has released guidance, that has been actively enforced, requiring virtual currency exchanges to comply with legislation countering money laundering and the financing of terrorism.

In New Zealand, bitcoin has been largely ignored by regulators. The Reserve Bank has stated that it will not regulate bitcoin as it does not involve the issuance of physical circulating currency. New Zealand’s financial super-regulator, the Financial Markets Authority (FMA), which among other things oversees financial markets and financial service providers, and monitors compliance with anti-money laundering legislation, has remained silent on bitcoin.

CONCLUSION

BITCOIN IS A virtual currency with a rapidly increasing user base and exchange volume both in New Zealand and worldwide. Its ability to be used anonymously for irreversible, low-fee global transfers raises the spectre of its use for money-laundering, tax evasion, the funding of terrorism, and black-market transactions. It is a groundbreaking technology in a sector that historically has been seen as lacking innovation, and it brings with it as many regulatory challenges as it does opportunities to facilitate trade. As with many other communicative technologies, including the telephone, email, and the internet itself, the full benefits of bitcoin and other virtual currencies will not be realised until it reaches a critical mass of adoption. With bitcoin service failure already occurring in New Zealand with the collapse of the Bitcoincica exchange, it is concerning that the FMA has not taken a proactive stance on virtual currencies.

Whether or not bitcoin reaches mainstream acceptance, decentralised currency technology has been established. Bitcoin has proven the concept and, at the very least, will provide a stepping stone for the electronic payment systems of the future. Traditional payment processors have stagnated and are failing to meet the needs of business in a globalising world that is being transformed by digital mediation. Virtual currencies have highlighted the inefficiencies of such processors, which will need to adapt to remain relevant.

KEY TAKE-OUTS

- Bitcoin and other decentralised virtual currencies have evolved to meet the needs of an increasingly digital world.
- Though bitcoin has been used for illegal purposes, and for currency speculation, it is becoming increasingly popular for legitimate online commerce.
- Regulators have been slow to respond to the challenges of virtual currencies.
Organisations should consider embracing gamification to enhance graduate selection and recruitment.

Kristine Dery
Carole Tansley
Ella Hafermalz

What is your biggest weakness?
Give an example of a time when you had
Where do you expect to be in five years’ time?
How do you manage your time and priorities?
Give an example of a time when you showed
Give an example of your lateral thinking...
What motivates you?
Why do you think you will be successful in this job?

▶ Organisations should consider embracing gamification to enhance graduate selection and recruitment

LENGTH: 10 min (2240 words)
THE EXponential GROWTH in social media has resulted in the disruption of many traditional organisational processes. One such activity is recruitment and selection, where social media have been used to disrupt practices at industry, organisational and individual levels.

 COMPANIES are beginning to bypass traditional agency channels with new in-house recruitment practices, new executive search entities are challenging existing models, and individuals are using novel pathways to reach out to prospective employers. This is one of the areas of interest for a team of researchers and industry partners in the University of Sydney’s Digital Disruption Research Group (DDRG), which is looking at fundamental changes that are occurring in business as a result of digital technologies.

 In this study, we worked alongside a large, global professional services firm to understand the impact of social media on corporate recruitment, and to identify ways in which the recruitment processes can be effectively managed for better quality outcomes. The ability to attract and retain top talent is a source of sustainable competitive advantage for such firms. Large accounts are won and retained through the ability of professional service firms to offer a wide range of accounting, consulting and advisory services that leverage the talent of staff to add value to clients. Not only is the process of finding and recruiting this talent expensive, it is also inefficient and wasteful when the wrong people are recruited. Findings from this study suggest that graduate recruitment activities can be improved by applying a form of game mechanics called ‘gamification’.

 Social media is now so integrated into our daily lives that we can barely remember a time without it. Many junior employees have never known a workplace without the capabilities to interact with a wide range of web-enabled technologies and mobile devices. Facebook, Twitter, LinkedIn, Instagram, Snapchat and other social tools are part of the vernacular in both our personal and corporate lives. In fact, at times it is hard to find the line that divides our workplace from our home as we constantly switch digitally between the two. Hand-held devices such as smartphones and tablets make our online engagement ever easier as we connect any time, anywhere. The growth of social media has seen channels such as LinkedIn (238 million members globally and adding 50 million new members a year), and Facebook (more than 1 billion users globally) explore new ways of finding and engaging with people.

 Processes associated with attracting and selecting the best available talent are built around networking, relationship building, and engaging with people who have the necessary attributes to add value to the organisation. Social media is designed to enhance capabilities around all of these activities, and therefore is well positioned to alter traditional talent management practices. It is clear that organisations able to use these platforms effectively have much to gain.

 In the context of talent management, and more particularly graduate recruitment, we were interested in whether or not digital technologies were fundamentally changing the way applicants engaged with the recruitment process. If the process was being disrupted we would expect to see induced shifts in power relations and changes in the way information traveled.

...at times it is hard to find the line that divides our workplace from our home as we constantly switch digitally between the two.

Recruiting Graduate Talent

 LARGe organisations—professional services firms in particular—deploy considerable resources to compete for the best university graduates, many of whom juggle multiple job offers. Online processes have been characteristic of graduate recruitment for some time, with organisations using websites, online application processes and talent management systems to attract and manage applications. Millennial graduates—those born between 1982 and 2003—tend to be highly technologically connected, and therefore the use of online channels is more characteristic of graduate recruitment than experienced-hire recruitment. However, little research specifically addresses how graduates engage with social media, which increasingly is seen by companies as a cost-effective vehicle for recruiting top graduates.

 Professional service firms typically have large graduate recruitment programmes, with the firm selected for this study (here called Consultex to preserve anonymity) hiring some 500 graduates each year. These are chosen from more than 11,000 applicants in complex and rigorous selection processes that use social media and other web-based technologies. Consultex has a talent management strategy aimed at developing a diversified workforce to support business development focused on innovation. Graduate recruitment is an integral part of that strategy and therefore is designed for both renewal and growth. The firm has a history of working closely with universities and their graduate programmes are highly contested among the student applicants.

 The present research project was designed to understand how social media was impacting on the recruitment process; in particular whether the existing processes had been augmented and modified by social media, or whether a more fundamental shift had changed the rules of the graduate recruitment game.

 We examined the Consultex recruitment process over a period of nine months and analysed social media activity on Twitter, Facebook, Yammer, Whirlpool and Linkedin. We also interviewed the executives involved in graduate recruitment, together with a sample of students who had been through the company’s recruitment process. The
process itself worked like a funnel, with a series of sifting points where graduates were either retained and advanced to the next sifting point, or were politely ejected. Social media was not a part of the process itself, but was a presence around it. At first, it didn’t appear to disrupt the process, but rather to support and enhance the experience as graduates were filtered through a series of phases. However, further analysis of the data suggested that more fundamental shifts occurred that reframed and redefined the graduate recruitment process, opening up new opportunities to generate value.

Thinking of the recruitment process in three distinct phases—recruitment, selection, and on-boarding—gives a clearer view of how social media was used by Consultex.

**Phase 1: Recruitment**

Traditional face-to-face campus activities still formed the foundation of the graduate information and recruitment activities, but increasingly Twitter and Facebook were used to augment these activities and draw applicants to the website and the on-line application process. This is typically the ‘fishing’ phase where students may apply to many firms to see who ‘bites’. Social media was used to answer simple questions and to provide information to assist with the application process. In this context, social media was considered background to existing recruitment processes.

**Phase 2: Selection**

For those graduates who were invited to the more advanced phases of the selection process (including the assessment centre, case study analysis and partner interviews), social media activity began to fundamentally disrupt the process. At these stages there was a significant increase in social media activity as graduates were connected with current employees in the areas of the business aligned with their stated interests. They were consequently invited to engage with topics of interest to Consultex, and generally encouraged to participate in conversations designed to provide applicants with an authentic view of the organisation. The use of social media to engage applicants at this stage was designed to (1) enable graduates to self-select out of the recruitment process if they recognised that they did not fit with the firm, (2) provide the graduates with the opportunity to be more Consultex-informed in order that the interview process might be further enhanced, and (3) begin the process of establishing networks with existing employees. In this phase, social media was used as a way of enabling candidates to identify with the organisation and to begin a more integrated dialogue designed to enable them to get to know the people of Consultex. In other words, social media effected a broader window into both the company and the applicant beyond skills and potential abilities, and into less tangible identification processes.

**Phase 3: On-boarding**

Given that these roles were accepted 12-18 months (and for some of Consultex’s competitors up to two years) before the candidate completed his or her degree, there was a substantial period after the offer was accepted during which the candidate was vulnerable to other offers or different opportunities. Social media was therefore used to seamlessly extend the recruitment process into the on-boarding process. Yammer, the main internal social media communication tool at Consultex, was also used to connect graduates to on-going corporate conversations.

Social media was therefore used to seamlessly extend the recruitment process into the on-boarding process. Yammer, the main internal social media communication tool at Consultex, was also used to connect graduates to on-going corporate conversations. Facebook, LinkedIn and Twitter were further used to extend the recruitment process.

In recent years, Whirlpool has evolved from a forum dedicated to the discussion of broadband providers to an active set of online communities. At the time of writing, the site had 627,774 registered members, with 2,019,235 threads and twenty times as many posts. The ‘Life’ section of the site includes threads on jobs, education, finance, lifestyle and travel. An established graduate programme section includes hundreds of threads, each relating to a specific company and its current graduate recruitment or vacation programme. Members on these threads adopt pseudonyms and are usually not represented by profile photos. This anonymity effects the nature of web forum data.

Although members’ posts are technically public, they are often candid, and relate experiences as they happen, often asking others in the forum for advice on upcoming assessments. For example, one forum member asked: “Hi Guys, I have an AC [assessment centre] on Monday. What should I be expecting for the case study and how should I approach working within a team. Eg. Do I find the right balance of leadership (eg 50% talking 50% listening)?”

A significant number of such graduate recruitment posts on the Whirlpool site were dedicated to the Consultex process, either in the form of questions and advice, or the sharing of experiences. In order to make sense of the implicit (hidden) rules of the selection process, students were using this social media open forum to share information in much the same way as online gamers use social network-
platforms, while designed to provide applicants with forms. The added complexities of the social media networking and co-creative capabilities of these platforms, while designed to provide applicants with forms, rather than to elicit the unique competence of the applicant, are likely to be more successful.

In the open Whirlpool forum, freed from the Consultex spotlight in social media discussions that were mediated formally by the graduate recruitment team, potential applicants more openly discuss how they might “win” the game and “fit” with the Consultex model.

Gamification involves the application of game-like mechanics to encourage certain desired behaviours in an audience. As students in the study interacted with social media, they appeared to continually adjust their behaviour and responses as they ‘gamified’ the recruitment process in order to improve their chances of progressing to the next level. Applicants both competed and cooperated in order to translate the process into a ‘game’ in which those with the best knowledge of both the explicit and implicit rules were likely to be more successful.

As information flows shifted beyond the Consultex-controlled process into more open crowd-sourced platforms, the power base that was previously centralised within the firm shifted toward the applicants as they shared information to ‘be’ the candidate who met the Consultex brief.

Given Consultex’s aim of creating a diversified workforce to support a growth strategy based on innovation, its graduate recruitment would seem to be problematic. Social media was used to digitally enhance the existing process, rather than to elicit the unique networking and co-creative capabilities of these platforms. The added complexities of the social media platforms, while designed to provide applicants with an authentic view of the organisation and create touch points, tended to also open up more ‘moves’ for applicants within the process.

To succeed it became more apparent to applicants that the implicit rules needed to be understood. Given the high desirability to ‘win’ the final prize (i.e. to be employed), informal social networking platforms were enabling crowd-sourced strategies that led to a ‘gamification’ of the process by the applicants themselves. Those who learned fastest how to play the rules and appear most like the current Consultex employees were more likely to be able to keep playing.

While we cannot claim that the selection process accounted for all of the fall out of graduates in their first two years, there appears to be potential to better engage with the capabilities of digital technologies to disrupt this process. The explicit adoption of the mechanics of a recruitment ‘game’ potentially opens up significant opportunities to mitigate against the selection of Consultex clones, and instead to engage a more diverse and innovative cohort of graduates capable of meeting the organisation’s longer term objectives.

Those who learned fastest how to play to the rules and appear most like the current Consultex employees were more likely to be able to keep playing.

KEY TAKE-OUTS

- Social media must not be seen as automated versions of traditional organisational practices. Alternative forums should be recognised, and their impact and value understood, as part of the recruitment process.

- Graduate employees should be valued as resources in the process. Rather than broadcasting conventional messages through social media, they can suggest new ways to engage with applicants.

- Given that graduates are competitive and treat recruitment as a game, organisations should consider embracing gamification to enhance their graduate selection process.
Get a return on ambition

Get Business Ready
Three professional masters programmes for recent graduates

Get Performance Ready
Executive Education for individuals, teams and organisations

Get Leadership Ready
Part-time pathways to MBA qualification

gsm.auckland.ac.nz