Association for Information Systems
AIS Electronic Library (AISeL)

MCIS 2010 Proceedings

Mediterranean Conference on Information Systems (MCIS)

9-1-2010

THE INFORMATION REVOLUTION, INFORMATION SYSTEMS AND THE 6TH KONDRATIEFF CYCLE

Carl Adams
University of Portsmouth, UK, carl.adams@port.ac.uk

Simon Mouatt
Southampton Solent University, UK, Simon.Mouatt@solent.ac.uk

Recommended Citation
Adams, Carl and Mouatt, Simon, "THE INFORMATION REVOLUTION, INFORMATION SYSTEMS AND THE 6TH KONDRATIEFF CYCLE" (2010). *MCIS 2010 Proceedings.* Paper 3.
http://aisel.aisnet.org/mcis2010/3

This material is brought to you by the Mediterranean Conference on Information Systems (MCIS) at AIS Electronic Library (AISeL). It has been accepted for inclusion in MCIS 2010 Proceedings by an authorized administrator of AIS Electronic Library (AISeL). For more information, please contact elibrary@aisnet.org.

THE INFORMATION REVOLUTION, INFORMATION SYSTEMS AND THE 6TH KONDRATIEFF CYCLE

Carl Adams, University of Portsmouth, UK, carl.adams@port.ac.uk

Simon Mouatt, Southampton Solent University, UK, Simon.Mouatt@solent.ac.uk

Abstract

This theoretical paper critically assesses existing long wave discourse which classifies the current set of innovation surges as part of a 5th Kondratieff cycle, with the 6th likely to be based on nano-technologies or bio-medical technologies. Kondratieff long wave theory provides a strong cognitive tool to examine such innovation surges. This paper argues that the existing discourse is incorrect: the 5th Kondratieff cycle should be classed as the age of computing while the 6th should be classed as the age of the information superhighway. The 5th Kondratieff wave was about computing and basic communication technologies, while the 6th is about ubiquitous access to the Internet as an information superhighway and conduit for social and technological innovation.

This paper defines attributes of the 6th Kondratieff and argues that the 6th Kondratieff cycles is the domain of the IS discipline – it is less about technology per se and more about aspects of people, organizational and the wider environmental attributes where social innovations dominate. The IS mindset and supporting tools help to examine and shape the directions within the information revolution. The paper further introduces the concept of innovation diffusion conduits.

Keywords: Information Systems, 6th Kondratieff cycle, innovation diffusion conduits

1 INTRODUCTION

Around the world we seem to have been going through a technological revolution. Global e-commerce and interaction has become the normal business and social practice for much of the technologically developed nations, as it is becoming a significant part for the generally poorer less technologically developed nations (Mouatt and Adams 2010). From Porter's (2003, p54) perspective we are going through a period of rapid change that requires a new paradigm of competitiveness based on continual technological innovation and upgrading. In a similar light, Kotter (2003, p165) argues that we have been through a new technology driven economic era for a decade or two, driven by global competition – a state that is set to continue. Business activity is conducted in an interlinked global working environment, an increasingly competitive environment as corporations are open to new opportunities from the global market space. In addition to the global opportunity for corporations there is also an increase in the number and variety of competitors from the same global market space.

This general technological revolution discourse is captured well by Toffler (1984) who argues we have been going through a prolonged set of rapid revolutionary changes. Toffler's concepts are more radical as he describes the transformation of humanity into three phases of innovation-led changes (Toffler and Toffler 1980). The First Wave occurred when peasant-centred economies supplanted hunter-gather societies. The Second Wave was the Industrial Revolution that gave us factory based systems and mass production for wealth generation. The Third Wave of civilization is the current set of revolution(s), where wealth creation is marked by 'de-massification' (less mass production), hyper-competition, successive technological revolutions and associated social dislocation. In the Third Wave, information and knowledge become the primary factor of production for wealth creation (Toffler and Toffler 2003, x.) Toffler continues stating that "vertical integration, synergy, economies of scale and hierarchical, command-and-control organization is giving way to a fresh appreciation of outsourcing, minimization of scale, profit centres, networks and other diverse forms of organisation. Every shred of industrial-era thinking is now being re-scrutinized and brilliantly reformulated. It is precisely when an old paradigm crumbles and the new one is not yet fixed in place that we get great bursts of creative thinking. This is such a moment." (Toffler and Tofler, 2003, p.ix).

Toffler's Third Wave mind set puts the technology and innovation led changes on par with those of the Industrial Revolution. If we are going through a further revolution similar to that of the Industrial Revolution, then the focus is on electronic infrastructures and technologies which dictate the rate and focus of change. Information in its wider sense, along with information-based services is the main commodity. New production practices have emerged based on virtual collaboration, supply chains, eco-nets and outsourcing, all supported by electronic infrastructures. Production activity has moved towards mass-customisation, supported by mobile, ad-hoc and virtual working teams using seamless access to information resources over the Internet. Companies can conduct business solely within the virtual operating environments – and increasingly are. Economies around the world have moved towards information based economies (Mouatt and Adams 2010). Indeed, some of the biggest and fastest growing companies are based on virtual operating activity and simply moving electronic data (such as Amazon, e-bay and Google). 'Information' in its wider sense is at the heart of the latest surges of innovation based change. This should be the realm of the information systems (IS) discipline, however, it is difficult to understand the role that IS has to play as we a re living through the revolution.

To help understand the characteristics and attributes of the information revolution, and consequently the role of IS, this paper draws upon long wave theory which provides a strong cognitive tool to examine such innovation surges. The aim of this paper is to provoke discussion covering the significance and impact of the seemingly current wave of technological changes based on ICT and the ubiquitous Internet.

1.1 **Long wave theory: Kondratieff cycles**

The foundations of long wave theory go back to Nikolai Kondratieff in the early 1920's. Kondratieff was a Russian economist who developed the concept of Long Waves and economic cycles (Kondratiev 1925). Kondratieff did not initially attract much support for his ideas, presumably because the idea and logical conclusion that a capitalist economy would emerge from a financial crisis presumably did not fit well with the communist mindset of the Soviet leadership of the time. Kondratieff initially identified three long waves: the first starting in the early stages of the Industrial Revolution, in about 1790, the second long wave starting in the mid 1800s and the last beginning in the 1890s (Lloyd-Jones and Lewis 1998, p1). There was also not much support from the West with his ideas mostly criticized for a lack of explanation of the underlying forces (Lloyd-Jones and Lewis 1998). However, Kondratieff did attract one significant following of the long wave theory concept, that of Joseph Schumpeter who provided a more robust framework and stronger support for long wave theory (Schumpeter 1954). Similarly, a long wave cycle can be deduced from Marx's view that the natural, endogenously-driven, cycle of capitalist societies will involve crashes – and again Marx provided a more robust rationale for the cyclic forces at play. Likewise, Schumpeter had a complementary view of 'creative destruction' from cycles of innovation based on entrepreneurs developing new industries resulting in the obsolescence and slumps (or destruction) of older industries.

Long wave theory really describes cycles of economic activity over long periods of time. This fits in with other discourse on economic cycles, indeed the discourse was well established (and hotly contested) in economic theory during the inter-war years (between WWI and WWII). For instance both Hayek and Keynes (and others) had looked at business cycles from a monetary perspective in terms of the influence of money supply, interest rate rises and investor confidence that resulted in boom and bust cycles (Hayek 1944) (Skidelsky 2005). Hayek had further considered horizontal influences across business sectors – touching on competition (and innovation) between sectors (Mouatt and Adams 2010).

One of the main strands of business cycle theory, provided by Schumpeter, was the notion of cycles rooted in surges or waves of technological innovation. According to this perspective, since the Industrial Revolution there have been other distinct surges of technological innovation resulting in specific economic cycles. Schumpeter (1911) defines the importance of entrepreneurship in the innovative cycle with entrepreneurs generating new technical (and financial) innovations within the context of mature industries facing increased competition and falling profits. Others have taken on the long wave cycle perspective, notably Freeman (1982, 1984), Lloyd-Jones and Lewis (1998), Perez (2002,2006, 2010) and Mouatt and Adams (2010).

Perez (2010) identifies five successive technological revolutions, or Kondratieff's waves, between the 1770s and 2000, the main characteristics which are represented in Table 1. While much of the business cycle work focuses on the generally short to medium-term fluctuations of the economy, lasting between 3-10 years, the Kondratieff cycles represent more long term fluctuations, lasting between 30-60 years. Long wave theories are based on the cycles being triggered by landmark inventions (or Big-bang inventions in Table 1) that fundamentally change economies.

Technological Revolution *or Kondratieff Wave*	Popular Name for the period	Big-bang initiating the revolution	Year	Core country or countries
First	The Industrial Revolution	Arkwright's Mill opens in Cromford	1771	Britain
Second	Age of Steam and Railways	Test of the Rocket Steam Engine for the Liverpool-Manchester Railway	1829	Britain (spreading to Europe and ESA)
Third	Age of Steel, Electricity and Heavy Engineering	The Carnegie Bessemer Steel Plant opens in Pittsburgh, PA, USA	1875	USA and Germany forging ahead and overtaking Britain

Fourth	Age of Oil, the Automobile and Mass Production	First Model-T comes out of the Ford plant in Detroit, MI, USA	1908	USA (with Germany at first vying for world leadership), spreading to Europe
Fifth	Age of Information and Telecommunications	The Intel Microprocessor is announced in Santa Clara, CA	1971	USA (spreading to Europe and Asia)

Table 1 First five Kondratieff's Innovation cycles, based on Perez (2002, 2010)

Wonglimpiyarat (2005), building on Perez's (2002) work and suggestions, argues that the start of the 6th Kondratieff cycle will be based on nano-technologies in a nano-revolution. Negt (2008), whilst discussing the (life-long) educational needs across Europe argues that the age of microelectronics has already started to exhaust its power of innovation and that the sixth Kondratieff period of economic prosperity will be based on other technologies (including nano). Similarly, Allianz (2010) argues that the 'current' financial crisis is the beginning of the 6th Kondratieff cycle, and on the basis of analysis of generic (mega)trends in technology investment, identifies that the new base technologies will be a collection of nano-technologies, healthcare and biotechnologies, along with a surge in environmental technologies. These Allianz argues have the potential to trigger long-term productivity improvements and increases for the global economy.

2 AN INFORMATION BASED 6TH KONDRATIEFF CYCLE?

In long wave discourse, one of the rationales for the end of a cycle is a decline in innovation activity and the emergence of a new base technology around which there is considerable innovation activity. However, Negt's, Allianz's (and others) analysis of a rising 6th Kondratieff cycle based on nano-technology misses the amount of innovation taking place over the Internet, along with the power of ubiquitous access to the Internet and social innovations. Perez and others combined together the general computing and network technologies including early stages of the Internet with the current activity over the Internet (Mouatt and Adams 2010).

Our contention is that the 5th Kondratieff wave was about computing and basic communication technologies, while the sixth is about ubiquitous access to the Internet as an *information superhighway* and *conduit* for social and technological innovation. Attributes of the 6th Kondratieff are represented in Table 2.

The history of the Internet, as we know it today, began with the Advanced Research Projects Agency Network (ARPANET) developed by ARPA (Advanced Research Projects Agency) of the United States Department of Defence during the Cold War period. ARPANET was based on decentralisation packet switching (i.e. a method that splits data traffic into packets of data which are then routed over a shared network); where as the proprietary network systems at the time were (mostly) based on centralized control. Out of the ARPANET grew the National Information Infrastructure (NII) in the US (part of the High Performance Computing and Communication Act of 1991), also known as the "information superhighway" which was famously coined by Albert Gore the Vice-President of the United States at the time. This, we contend, was the start of the digital sixth Kondratieff's innovation cycle. The NII was the base of the Internet consisting of a seamless web of public and private communications networks with interoperable hardware and software.

Long wave theory provides a good cognitive base to consider technological innovation led changes, however, as Perez identifies "any dogmatic or rigid application of the model will defeat its purpose. Its main value is serving as a tool to help organize the richness of real life but not to hammer facts into tight boxes. … there is great danger of wanting to find exact dates for the end or beginning of a phase

or period, when in fact most of the processes involved are overlapping and do not allow such precision. [the dating] is basically a working approximation to help transmit the ideas" (Perez 2002, p160) The date used here as the start of the suggested 6th Kondratieff is to provide a base for considering the subtle but significant change in innovation activity around the Internet. There should be caution, as Perez suggests, in applying the start and end dates too robustly. The concept here is that the Internet changed from being a network of computer technologies to being a set of infrastructure to develop information based commodities, social interaction, social innovations and empowerment of individuals. The concept itself is strong and there seems to be ample support for newer surges of innovation over the information superhighway (as discussed below).

The late 1990s saw the move towards desktop PC's accessing the Internet through telephone wires via modems. There then followed a rapid growth of the Internet in the technologically developed countries particularly the US, Europe and Japan. There was also much hype about new business models and new businesses which heralded the dot.com bubble burst in 1999/2000. Since that time there has been steady growth in e-commerce activity with corporations moving their expertise and operating activity from the centralized network systems to the more decentralized Internet infrastructure (Mouatt and Adams 2010).

One of the currently surges of innovation is push towards mobile technologies and mobility with seamless Internet access using wireless connections to laptop computers (via Wifi and WiMax) and other mobile devices (e.g. mobile/cell phones, PDAs). At the same time there has been a rapid increase in access to the Internet by the poorer technologically developing countries. The Internet is truly global with technological 'leapfrogging' taking place where poorer countries use cheaper wireless infrastructure to provide access to Internet resources. In some countries, the predominant means of accessing the Internet is likely to be over wireless infrastructure.

A key stage in the next development of the Internet is the introduction of 'super broadband', moving from just a few Mega bytes/second (MBs) of bandwidth to 100's MBs of broadband access to Internet users. There is also discussion within the telecommunications industry of 4G (4th generation), or B3G (beyond 3G) technologies, that will offer bandwidth of 100MB (one of the first trials of which was in Shanghai, China, in January 2007). There is also discussion in the e-commerce industry of Web 2.0 Cloud computing and, the move to Web 3.0, offering even more seamless access to rich information sources (Lassila and Hendler, 2007).

Technological Revolution *or Kondratieff Wave*	Popular Name for the period	Big-bang initiating the revolution	Year	Core country or countries	Commodities
Sixth	The Information Revolution	NII's Information Superhighway, in the United States	1991	US, then developing across Europe, Japan and the far East – and then Globally	Digital and Social Innovations Information Products and Services

Table 2 Attributes of the 6th Kondratieff Wave, the Information Revolution (from Mouatt and Adams 2010)

A further contention in this paper is that the changes taking place during this 6th Kondratieff are as significant as those of the Industrial Revolution. During the Industrial Revolution a range of new infrastructure emerged (Standage 1998, Ashton 1986, Deane 1988, Marshall 1982): New production facilities called factories, emerged which enabled the mass production of goods. New types of towns also emerged to accommodate migrating farm workers as they moved towards industrial employment. New banking and capital structures also emerged to finance the development of factories and global commerce. In addition, new transportation also emerged, such as canals, rails, better road networks and steam power. Are there similar significant infrastructure emerging rivalling that of the Industrial Revolution? For a comparable Information Revolution/ 6th Kondratieff wave based on information commodities, there should be examples of new structures across society of a similar scale to the

Industrial Revolution. For identifying these we will have to examine some current trends in social and business practices across society.

3 NEW STRUCTURES: THE INFORMATION SUPERHIGHWAY AND ITS OFFSHOOTS

The main new structure that has emerged is the *information superhighway* (both fixed-line and mobile), and from this variety further structures have emerged. One significant current example is the evolving social networking infrastructure. Social networking has always been a part of human activity however, the emergence of Web 2.0 technologies, in the wider sense, has enabling new forms of communication at unprecedented levels (Mouatt and Adams 2010).

Facebook has over 400 million active users (i.e. who have returned to the site in the last 30 days). There are more than 3 billion photos are uploaded to the site each month and more than 5 billion pieces of content (such as web links, news stories, blog posts, notes, photo albums) are shared each week (from http://www.facebook.com/press/info.php?statistics, accessed 14/04/10). Further, 100 million users access Facebook via a mobile device. Indeed, in a space of 5 years an electronic community has emerged that is equivalent in size to the fourth largest national population (and twenty times bigger than the largest city).

Roger's Diffusion of Innovation (DoI) theory argues that disseminating information about a technological innovation is an important part of the diffusion process. In the example of most of the social media technologies, such as social networking sites, the technological infrastructure acts as *conduits* for both disseminating information about a digital product or service innovation as well as distributing the innovation itself (Mouatt and Adams 2010). Take for example the Farm Ville social networking game developed by Zynga. The game is based around players developing their own virtual farm by growing crops and animals. There is a farm market, where seeds, plants, tress and animals are purchased using 'farm coins' (tokens based on a micro-payment mechanism). Players can earn farm coins by selling crops or gaining experience levels. Players can also buy FarmVille coins from Zynga, using US dollars, but the majority of farm coins are generated by the users 'working' on their virtual farms. Zynga was founded in July 2007, and as of 7th March 2010, Farmville had over 83 million monthly active users, (from http://www.facebook.com/apps/application.php?id=102452128776).

Current activity over the information superhighway is dominated by very large numbers of users – often into the many millions, and very short timeframes. For instance, Visual Measures, a company that monitors and measures the distribution of electronic media over the internet, maintains a '100 Million Views Club' (see http://www.visiblemeasures.com/hundred) and, as of April 2010, there were 65 entries (Susan Boyle the star from Britain's Got Talent TV programme reached 9th with over 347 million downloads).

The number of users are getting bigger and we are seeing the emergence of the 'one billion club'. Apple, the manufacturer of computers, ipods and iphones, reached over 1 billion downloads from its store in nine months (http://www.apple.com/itunes/billion-app-countdown/ accessed 14/4/2010). In February 2010, Apple had already reached its 10 billionth down load of music from iTunes. In July 2009, the Mozilla Foundation celebrated the one billionth download of the Firefox browser after only five years (see http://www.onebillionplusyou.com/ accessed 14/4/2010). This is equivalent to one sixth of the world population. In March 2010, the comparative newcomer to the music industry, Lady Gaga, was the first person to reach 1 Billion downloads – from just three records ("Poker Face", "Bad Romance" and "Just Dance".)

A further set of structures based on the information superhighway is the Open-Global Sourcing, or 'crowdsourcing', phenomena (Surowiecki 2004, Howells 2006, Adams and Ramos 2009, Johnson 2008). The command and control model of outsourcing, that was prominent in the 5th Kondratieff wave, is being challenged by Open-global sourcing as organizations now draw upon input (ideas as well as service provision) from a vast global knowledge community. The transition to Web 3.0

technologies (Lassila and Hendler, 2007) is also bringing more seamless interaction and collaboration between people as well as access to global information resources (Giddens 2002, Holton 2008). In the same way that the innovation of outsourcing significantly changed business practice, open-global sourcing is having an equally significant impact. Howe (2008) notes, for instance, that 'crowdsourcing' activity can gather intelligence, create crowds, gather informed opinion and raise finance.

Mouatt and Adams (2010) provide two examples of 'crowdsourcing' activity involving large number of participants/collaborators along with short timeframes, Galaxy Zoo and uTest:-

1) UTest (see http://www.utest.com/), was formed in late 2007 and now claims to be the world's largest marketplace for software testing services with a global community of over 18,000 testers from more than 150 countries. UTest builds a virtual testing team for each customer, putting the call for 'testing' open to their community.

2) Galaxy Zoo project (see http://galaxyzoo.org/), also launched in 2007 (July), shows how open-global sourcing can tackle very large problems, such as robustly classify over one million galaxies from images collected through the Sloan Digital Sky Survey (SDSS) telescope. The initial expectation was that it would take a few years for visitors to the site, along with cosmologists, to work through the million images. However, within 24 hours of launch, the site was receiving 70,000 classifications an hour. More than 50 million classifications were received by the project during its first year from almost 150,000 people from the global general public. To date there has been over 60 million classifications with input from 200,000 people.

4 THE IMPORTANCE OF SOCIAL INNOVATIONS

A further contention of this paper is that the 6th Kondratieff wave is dominated by social innovations (Gabor 1970). One of the best examples of social innovation that continues to have a significant impact on business working practices is the Program Evaluation and Review Technique (PERT), used for the Polaris submarine (Gabor 1970 p.6). PERT enables the management and coordination of large and complex projects by providing the ability to plan the collaboration of many different contributors with very many components, within a guideline budget and timeframe. Indeed most of the information systems produced for governments and corporations will have followed a PERT type management approach as a result. The information revolution now means that these types of activity can take place on-line greatly enhancing efficacy.

The impact of social innovations can be subtle but far reaching (Adams and Ramos 2010). They do not translate to a specific 'technological' innovation as such although they may be closely related, providing new thinking or changes to working or social practices. The power of the Internet is not the hardware and software systems *per se* but, rather, how businesses, governments and people use it. Wikipedia, as an example of social innovation, is probably the largest ever repository of human knowledge and has been created in a short space of time with contributions from hundreds of thousands of people all over the world. It is accessed daily by millions of people from all over the world. As a knowledge sharing repository it is unsurpassed. Mouatt and Adams (2010) argue that Wikipedia and similar Web 2.0 phenomena are our own modern global monuments, monuments to knowledge creation and sharing on a global scale, our own modern day 'wonders' of the world. Indeed, they are equivalent in terms of human time and effort to the development of the pyramids or similar very large-scale monuments in history.

5 CONCLUSION: AN INNOVATION REVOLUTION FIT FOR IS

This paper has drawn upon long wave theory to try and understand the attributes of the significant and rapid technologically led changes taking place in society. The paper has suggested that we are going

through a 6th Kondratieff cycle that is based on the information superhighway and that there are significant new structures emerging. The new structures are characterised by large user-numbers and a global presence. Further that the infrastructures act as a conduit for disseminating information about an innovation as well as diffusing the actual digital innovations. The speed of innovation diffusion is consequently faster than in previous times. The paper also contends that many of the innovations can be classed as social innovation, and consequently fall into the domain of IS. Indeed, we can go further and say that IS is ideally suited to play an active role in interpreting, facilitating and shaping the evolution of such innovations.

One could argue this may be a wakeup call for the IS discipline. IS is a relatively young discipline (Anderson and Vendelo 2004) with the traditional IS mindset is based within the older 'computing' era. Consequently the IS discipline has been engaged in trying to carve out its own field separate and distinct from the computing, management and other source domains. The focus of attention for much of the early years of the IS discipline was on development methodologies and the use of development techniques (Hardy et al 1995; Wynekoop and Russo 1995; Fitzgerald 1996,1997; Avison and Fitzgerald 2003a, 2003b; Adams and Avison 2003). The focus of IS changes as technology capabilities and business imperatives change: The move towards web based technologies saw the an increase in focus on web based development (e.g. Vidgen 2002, Vidgen et al 2003), the innovations in mobile technologies saw an increase in focus on mobile aspects of development (e.g. Urbaczewski et al 2003). As Baskerville and Myers (2009) identify there are 'Fashion Waves' in the focus of Information Systems research and practice in response to changes in technology and the business environment. They also note that the IS discipline is mostly reactive and there is a need for 'more proactive engagement' and that IS needs to be more fashion-setting. Similarly, Adams (2009, p75) argues there is a tendency for the IS discipline to be 'myopic' in focusing just on the *current* context (requirements, issues etc) and not looking at the future impacts: Longer term requirements and the wider impact of a new system, or the impact of systems over time on different stakeholders are not well covered.

In the current context as discussed in this paper, the environment has changed significantly. We are in the throes of a 6th Kondratieff innovation cycle, based on the information superhighway and information based commodities and social innovations, resulting in significant changes to business and social practice. The IS discipline needs to make sure that it is at the forefront of those changes. The IS discipline is multidisciplinary and continually evolving (Anderson and Vendelo 2004), but core of IS captures not only the technology and management aspects but also provides understanding of the human, social and cultural perspectives. It is in a good position since many of the IS tools for analysis and research are well suited for the information and social innovation based surges of innovation.

Further, as Bannon (2004) identifies "In Europe, we have a strong philosophical, sociological and anthropological research tradition that should be able to make a significant contribution to the articulation of more realistic scenarios for life in the future than those derived purely from technological fetishism. We are beginning to see the mergence of an approach to technology that is informed by an understanding of our social and cultural world." (p145) …" This can be seen in our developing understanding of how work gets done, of the importance of human networks, of how knowledge is not viewed simply as a thing to be delivered, of what motivates people. We need to build on this understanding, rather than ignore it." The IS discipline is well placed to engage in this activity and influence when innovation should take place.

There are of course other interpretations of the 6th Kondratieff cycle we have suggested here. Indeed, there may well be a strong case for considering the current set of technological based innovations as a continuation of the 5th Kondratieff cycle – after all it includes aspects of the Internet. However, according to existing long wave theory and discourse the 5th Kondratieff, "The Age of Information and Telecommunications" that started sometime around 1971 is currently at the turning-point of changing over to a new 'basic' set of technologies. During this turning point there is expected to be a decline of innovation around the older basic set of technologies (i.e. computing and internet technologies). The current discourse places the next Kondratieff cycle in the realms of nano-technologies and biomedical technologies. There may well be surges of innovations around these technologies. However, as we have tried to show in this paper, that to say "there is a decline in

innovation around Internet technologies" is premature. Indeed, we have tried to show that the reverse is true: Many things are in place for significant surge in innovation and that there are examples of these innovation surges already taking place. There is a strong case for 6th Kondratieff cycle based on the information superhighway – but irrespective if it is a separate Kondratieff cycle or a continuation of the 5th, there is clearly significant surges of innovation based around the information superhighway and social innovation.

The aim of this paper was to provoke discussion covering the impact and significance of technological changes within ICT, particularly within the context of long wave theory. Existing discourse on the 6th Kondrateiff cycle is focussed elsewhere, while the activity covered in this paper, it is argued, indicates the information superhighway could be a significant candidate for the 6th K. This is an area calling for further research and investigation. If indeed the current surge of innovation around ICT and the information superhighway can be classed as the base for a new innovation long wave, then the IS discipline is well placed and needed to make sense of these changes as well as to actively engage in 'fashion-setting' and influencing the direction of innovation.

References

Adams C. (2009) Temporal, Stakeholder and Event Analysis (TSEA): A tool for exploring technological evolution and impact within organisations. Journal of Decision Systems, vol. 18, 1, pp75-97.

Adams C and Avison D (2003) Dangers inherent in the use of techniques: identifying framing influences. Information Technology and People, Vol.16, No. 2, pp203-234.

Adams, C & Ramos I. (2009). Crowdsourcing: a Social Networking Approach to Outsourcing, *Cutter IT Journal*, 22(10)

Adams, C. and Mouatt S. (2010). "Evolution of Mobile Business and Services: Government Support of M-Payment Services." *International Journal of E-Services and Mobile Applications* **2**(2).

Anderson K.V. and Vendelo M.T. (eds) (2004) The past present and future of Information Systems. Elsevier Butterworth-Heinemann, London.

Ashford, R. S., Rodney (1999). *Binary Economics: The New Paradigm*. Lanham, Maryland, University Press of America.

Avison D.E. and Fitzgerald G., Information Systems Development: Methodologies, Techniques and Tools, 3nd. ed., London, McGraw-Hill, 2003a.

Avison D.E. and Fitzgerald G., "Where now for development methodologies?" Communications of the ACM, vol. 46 no. 1, 2003b, p. 78 – 82.

Bannon L.J. (2004) Human-centred computing; A new perspective? In Anderson K.V. and Vendelo M.T. (2004) The past present and future of Information Systems. Elsevier Butterworth-Heinemann, London, pp 137-162.

Baskerville R. L. and Myers M.D. (2009) Fashion Waves in Information Systems Research and Practice. *MIS Quarterly*, 33(4) pp.647-662.

Bello, W. B., Nicola & Malhotra, Kamal & Mezzera, Marco (2000). Notes on the Ascendancy and Regulation of Speculative Capital. *Global Finance: New Thinking on Regulating Speculative Capital Markets*. W. B. Bello, Nicola & Malhotra, Kamal. Malaysia, Zed.

Boyle, D., Ed. (2002). *The Money Changers*. Ebbw Vale, Earthscan.

Hilferding, R. (1910). *Finance Capital*, Routledge.

Kliman, A. (2007). *Reclaiming Marx's Capital: A Refutation of the Myth of Inconsistency*. United States, Lexington.

Kondratiev, N. (1925). *The Major Economic Cycles*. Moscow, Richardson & Snyder.

Lietaer, B. (2001). *The Future of Money - Creating New Wealth, Work and a Wise World*. Guildford, Random House.

Lietaer, B. (2003). "A World in Balance?" *Reflections: The Journal of the Society for Organisational Learning*(Summer: Special Issue on "The Feminine Approach to Leadership").

Marx, K. (1971). *Theories of Surplus Value*: Part Three. Moscow, Progress.

Mouatt, S. (2008). "*Evaluating Stephen Zarlenga's Treatment of Historical Monetary Thought*." International Journal of Social Economics **35**(11).

Mouatt, S. (2009). *The Dissolution of the Financial State*. Miliband: 40 Years On, Leeds Metropolitan University.
Mouatt, S. A., Carl (2010). "Marx, Subjugated Banking and an Emerging Corporate Monetary System." *Science and Society*. (forthcoming)
Potts, N. (2005). *The Political Economy of Money, Profitability and Value*. London School of Economics. London, University of London.
Schumpeter, J. A. (1954). *History of Economic Analysis*. Guildford, Routledge.
Skidelsky, R. (2005). *John Maynard Keynes 1883 -1946 Economist, Philosopher, Statesman*. USA, Penguin.
Thirlwall, A. P. (1985). *Keynesian Economic Development 7th Keynes Seminar*. Hong Kong, Macmillan.
Zarlenga, S. (2002). *The Lost Science of Money - The Mythology of Money: The Story of Power*. United States, The American Monetary Institute.
Toffler A. (1980) *The Third Wave*.William Morrow Publishing.
Toffler A. (1984) *Future Shock*. Bantam Books, London.
Toffler, A. and Toffler (2003) Forword to Gibson R. (ed.) (2003) *Rethinking the Future*. London, Nicholas Brealey Publishing.
Urbaczewski A., Valacich J.S. and Jessup L.M. (2003) Mobile commerce opportunities and challenges. *CACM,* vol. 46 (12), p. 30-32.
Vidgen R. (2002) "WISDM: Constructing a Web Information System Development Methodology", *Information Systems Journal*, vol. 12, p. 247-261.
Vidgen R., Avison D., Wood b. and Wood-Harper T. (2003), *Developing Web Information Systems*, Butterworth-Heinemann.
William, J. (ed.) (1998) *Money: a History*. London, British Museum Press.
Wonglimpiyarat, J. (2005) The Nano-Revolution of Schumpeter's Kondratieff Cycle. *Technovation*, 25 (11), pp1349-1354.
Wynekoop J.L. and Russo N.L., "Systems development methodologies", *Journal of Information Technology*, Summer, 1995, p. 65-73.
Wynekoop J.L. and Russo N.L., "Studying systems development methodologies: an examination of research methods", *Information Systems Journal*, vol. 7 no. 1, 1997, p. 47-65.