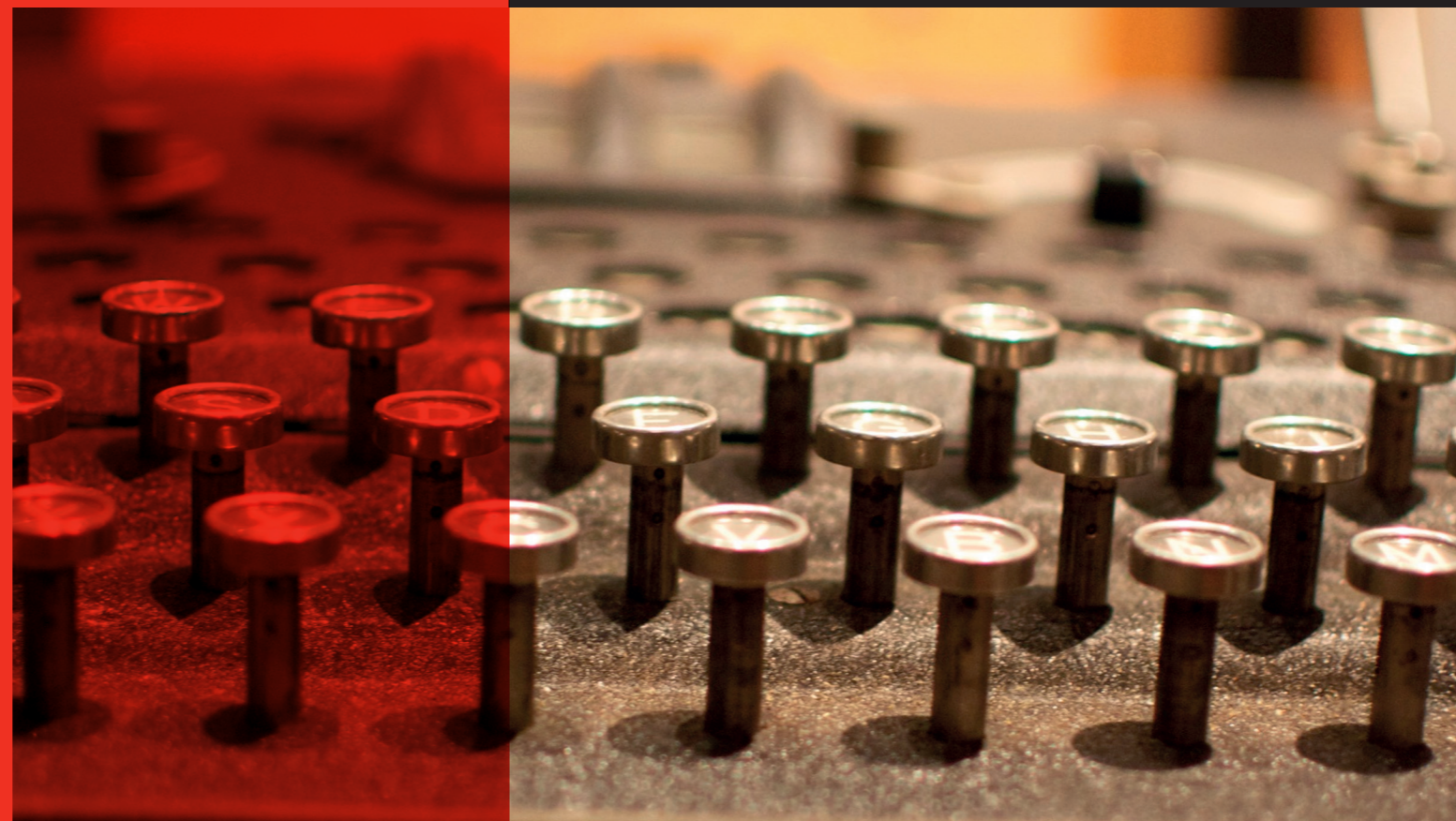


**INFORMATION SYSTEMS
AND INNOVATION GROUP**
Department of Management

ISSN 2042-5678 (Print)

iSCHANNEL

The Information Systems Student Journal



Published by the Information Systems and Innovation Group,
Department of Management at the London School of Economics.

Volume 6, Issue 1, September 2011

	Page
Faculty Editor Dr. Will Venters	
Editor-In-Chief Attila Marton	
Editorial Board Roohollah Honarvar Yunzhe Ma Deborah John Tinesh Babu Vijay Tiwari	
Reviewers Noora Alghatam Adebusoye Anifalaje Vasiliki Baka Patrizia Bertini Ben Eaton Oymen Gur Wifak Houij-Gueddana Boyi Lee Christiane Lehrer Jose-Carlos Mariategui Silvia Masiero Nuno Olivieria Huey Tan Niccolo Tempini	
Special Thanks Prof. Chrisanthi Avgerou Imran Iqbal Sarah Rayner Mike Cushman	
Cover Photography Christian Holemy	
Cover Design Elizabeth Cowie	
Lay-Out Design Shannon Spanhake	
Contents	
From the Faculty Editor Will Venters	2
Editorial - The Black Quasi-Box Attila Marton	3
Editorial - A Shift towards a Social Interaction Paradigm Editorial Board of the iSCHANNEL	5
Reframing Empowerment A new Paradigm for ICT4D Silvia Maseiro	6
Risk Management and User Prevention for Malware Threats Anand Paul	14
The Alignment of System and Organizational Design in ERP Implementation A Review of Theoretical Perspectives Ashish Mullick	19
Open Source Software Ideology, Self Interest and the Crowd Tinesh Babu	24
Code as Storytelling Insights about Free/Open Source Software Development through an Analogy with Alternate Reality Games Rafael Kenski	28

iSCHANNEL is available in PDF at
<http://is.lse.ac.uk/ischannel>
 you can also join us on facebook or follow us on twitter

Contact

Dr. Will Venters
 Information Systems and Innovation Group
 Department of Management
 London School of Economics and Political Science
 Houghton Street
 London WC2A 2AE
 Email: w.venters@lse.ac.uk

Sponsored by

The Information Systems and Innovation Group
 Department of Management
 London School of Economics and Political Science

EDITORIAL

From the Faculty Editor

The iSCHANNEL was always a journal by and for our MSc students. When two MSc students approached me in 2006 with the idea of creating the journal that was their intension. But we must now move forward and increase the reach of the journal. The inclusion of a paper based on an Alumni's dissertation research, and this year's special issue, are examples of such change. We welcome the involvement of PhD students in editing and reviewing for the journal and would welcome their writing for the journal as well.

But involving more people in writing for the journal will require a growth in the journal's size so that the core MSc students can still publish within it. As such we should perhaps think about new models for publication. Just as we have changed from ADMIS to MISI this year, so perhaps we should move from paper to Kindle for the ISChannel? Whatever we do though, we should keep the journal focused on publishing the very best of LSE student's contribution to information systems. It is the dedication of our writers, editors, reviewers, proofreaders and others who make this journal happen – they should be very proud.

Best wishes,

Dr. Will Venters
Faculty Editor

EDITORIAL - The Black Quasi-Box

The cover of this issue shows an image of a later version of the legendary Enigma machine – the encryption machine used by the German military during World War II. The embodiment of a black box, it fuelled the imagination of the wider public, historians, novelists and moviemakers alike as a symbol for the secret war waged between the intelligence agencies of the Axis and Allies. Ironically, the very first versions of the Enigma ciphers had already been broken before the war even started turning the black box into a white box. As methods and techniques of encryption became more sophisticated over time, so did the methods and techniques of hacking the code as well leading to innovations in mathematics, statistics and computer science. During the course of the war, therefore, the box switched from black to white and back to black numerous times as each side was trying to outwit the other. In the end, the Enigma machine as an ultimate black box was a myth born during World War II while the breaking of the code was one of the best kept secrets of the Allied forces.

Be as it may, the concept of a black box, used to refer to a system whose internal mechanisms can only be modelled based on the system's input and output, finds its application in a variety of scientific fields including the domain of information systems research and related reference disciplines such as computer science, organization studies and sociology, to name a few. However, with contemporary information and communication technology (ICT), the box is not black because it is hard to come by, as was the case with the Enigma machine and its codebooks, but rather because it has become too complex for anybody to fully comprehend. Indeed, contemporary ICT can hardly be conceptualized as a box anymore since it is increasingly networked and, thus, not confined to the boundaries of institutions, organizations and artefacts it used to adhere to (Kallinikos 2011).

In-formed into binary-based digits, formerly bounded, self-contained technological systems now share a common ground allowing for increased interconnectivity and interoperability (Benkler 2006; Tilson et al. 2010; Yoo et al. 2010). Bereft of a hard-wired purpose, computation affords immense potentialities for innovation (Zittrain 2008) as ICT facilitates surprises or functionalities the initial creators did not anticipate resulting in a complex and unpredictable information environment (Kallinikos 2006; Marton 2009). By the same token, the digital objects that populate this environment defy the logic of bounded entities as well. They are rather computational operations or assemblages of distributed services, data sources and user interaction mediated by bit streams of 0s and 1s (Kallinikos et al. 2010; Faulkner and Runde 2011).

Given these arguments, the metaphor of a black box presents itself as highly inappropriate. A box is a fixed entity with boundaries; contemporary ICT, however, is more like a process of computation rather than a collection of boxed computers. This is not to say that hardware is irrelevant for the functioning of ICT but rather that the materiality of ICT is not what differentiates the Enigma machine from the internet and the services it affords (Orlikowski and Scott 2008). Digital objects have novel properties which cannot be explained with reference to their material bearers (Faulkner and Runde 2011). We are dealing with quasi-objects (Ekbia 2009) and, therefore, the black box presents itself as a quasi-box. It is in this sense that the following papers discuss a wide range of phenomena who owe their intricacies to the digital objects they are related to. Be it the role of ICT in development, the threats that arise from malicious software, the challenges of implementing ERP systems or the peculiarities of open source software, the papers address the black quasi-box that is information and communication technology.

As I am bound to leave the position of Editor-In-Chief of the iSCHANNEL, it seems to be more than appropriate to have a look at what we achieved during the last two years. We re-launched the iSCHANNEL with a new visual identity, improved our web presence and, for the first time, we will publish a special issue end of the year. All of this would not have been possible without our editors and the support of the Information Systems and Innovation Group at the Department of Management, LSE. For this I cannot thank them enough. I am also glad to see that the future of the iSCHANNEL is secured as a new generation of editors will take over and continue to improve the journal. I am certain the iSCHANNEL will be in good hands.

Attila Marton
Editor-In-Chief

References

- Benkler, Y. (2006). *The wealth of networks. How social production transforms markets and freedom.* New Haven, London, Yale University Press.
- Ekbia, H. R. (2009). "Digital artifacts as quasi-objects: Qualification, mediation, and materiality." *Journal of the American Society for Information Science and Technology* 60(12): 2554-66.
- Faulkner, P. and J. Runde (2011). *The social, the material, and the ontology of non-material technological objects.* 27th EGOS Colloquium, Gothenburg, Sweden.
- Kallinikos, J. (2006). *The consequences of information: Institutional implications of technological change.* Northampton, MA, Edward Elgar.

- Kallinikos, J. (2011). *Governing through technology: Information artefacts and social practice*. Basingstoke, Palgrave Macmillan.
- Kallinikos, J., A. Aaltonen and A. Marton (2010). "A theory of digital objects." *First Monday* 15(6). <http://www.uic.edu/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/3033/2564>
- Marton, A. (2009). "Self-referential technology and the growth of information. From techniques to technology to the technology of technology." *Soziale Systeme* 15(1): 137-59.
- Orlikowski, W. J. and S. V. Scott (2008). "Sociomateriality: Challenging the separation of technology, work and organization." *The Academy of Management Annals* 2(1): 433-74.
- Tilson, D., K. Lyytinen and C. Sorensen (2010). "Digital infrastructures: The missing IS research agenda." *Information Systems Research* 21(4): 748-59.
- Yoo, Y., O. Henfridsson and K. Lyytinen (2010). "The new organizing logic of digital innovation: An agenda for information systems research." *Information Systems Research* 21(4): 724-35.
- Zittrain, J. (2008). *The future of the internet and how to stop it*. New Haven, Yale University Press.

EDITORIAL – A Shift towards a Social Interaction Paradigm

The explosion of unprecedented opportunities and uncertainties permeating recent adoptions of information and communication technologies (ICT), in development and in use, have required social interaction, collaborative solutions and users' mastery of technology artefacts. As a new paradigm, these developments are geared towards more responsiveness in handling change and innovation. The papers presented in this issue of the iCHANNEL collectively embody different aspects of social interaction with respect to the development and use of ICT. The breadth and depth of the selected literature, reviewed from a broad range of perspectives and fields of study, does not only shed light onto emerging challenges and opportunities in terms of social interaction but opens up a wider debate right at the heart of academia.

The first paper, **Reframing Empowerment: A new paradigm for ICT4D** by Silvia Maseiro, starts with a critical discussion of the literature on technology as a social regulator. Viewing technology as a cross-contextual force, she proposes a reframed or reconstructed notion of empowerment. From this alternative perspective, empowerment is considered to be a goal of development and technology alike. By reframing empowerment as well as the role of technology, the paper proposes a shift from a theoretical perspective of situatedness to a view of technology as a multipurpose development tool that mediates social interaction as well as social power.

Addressing a wider concern in **Risk Management and User Prevention for Malware Threats**, Anand Paul draws attention to the evolving growth of Malware threats. Be it individuals or organizations, the author analysis the need for a combined strategy against virus attacks. Drawing on numerous examples, the paper argues that the battle against Malware cannot be won without taking the perspectives and attitudes of individual users into consideration. The paper concludes with the suggestion to include user-motivation, user awareness and user participation practices in order to manage the risks associated with Malware.

In **The Alignment of System and Organizational Design in ERP Implementation: A Review of The-**

oretical Perspectives, Ashish Mullick reviews the literature on the alignment of organizational structures with the structures embedded in Enterprise Resource Planning (ERP) systems. In detail, the paper discusses the conceptual underpinnings which inform the attempts to minimize the misfit between the organizational structures as it is embedded in an ERP package and the actual structures of organizations. The author identifies two explanatory views: static and dynamic. Against this backdrop, the author suggests that a combination of these two views may be more appropriate in addressing the misalignment between organization and ERP package.

In the fourth paper, **Open Source Software: Ideology, Self Interest and the Crowd**, Tinesh Babu explores the motivational factors of individuals who contribute in the development of Open Source Software (OSS). Based on the review of various socio-technical perspectives, the author categorizes the motivations for participation into two groups; ideology and self-interest. As the paper critically reflects on the recent rise of commercial interests in OSS communities and products, the paper argues that in order to fully realize the social benefits of OSS we need to increase our understanding of what users and organizations expect from OSS.

The final paper, **Code as Storytelling: Insights about Free/Open Source Development** through an Analogy with Alternate Reality Games by Rafael Kenski, investigates the importance of joy and fun as motivators for the development of Free/Open Source Software (F/OSS). Drawing on an empirical case study, the author discusses the extrinsic and intrinsic motivations for OSS development. The evidence provided shows that factors like escapism and immersion play a significant role in F/OSS development projects.

The papers included in this volume address a variety of issues and problems through literature reviews, the design of research frameworks and empirical research. The depth and breadth of the topics reaches beyond the IS literature, to management school of thoughts, economics, sociological and political theories and concepts all in an attempt to address social interactions with respect to ICT.

Editorial Board of the iCHANNEL

Reframing Empowerment

A new Paradigm for ICT4D

Silvia Masiero

PhD Candidate in Information Systems
Information Systems and Innovation Group
Department of Management
London School of Economics and Political Science

KEYWORDS

ICT4D
Empowerment
Participation
Kerala

ABSTRACT

In this essay, we will problematize the situated view of technology that, we argue, is very much diffused in ICT for development (ICT4D), the domain in which our research is inscribed. Our problematization focuses on the idea of empowerment, that in development is regarded, we argue, entirely in terms of participation and content – without, in effect, any real attention for the role of the technology in this process. Hence, drawing on the literature on technology as a social regulator, we will propose a reframed idea of empowerment, which gives the right attention to the technological side of it, in terms of the actual balance of power between technology and its users. E-Krishi, an Internet platform implemented by the government of Kerala, a state in southern India, is proposed here as a case study to see technology-related empowerment in action.

Introduction

The concept of *empowerment* is an integral part of development theory and of the practice underpinning the field of information and communication technology for development (ICT4D). Our reflection, in this work, is triggered by the observation that empowerment, in ICT4D, is firmly predicated on the developmental vision of the problem: this monolithic vision results in neglecting, by and large, the technological dimension, epitomized by the role of ICTs in the process. In this paper, the situated view of technology, on which ICT4D is aprioristically predicated, is problematized from its very grounding bases: indeed, this vision implicitly deprives technology of any power in terms of influencing human behaviour. As such, a paradoxical situation is arrived to, in which ICT4D arises as a field where technology stays in the background, instead of being brought at the forefront of examination.

Therefore the key question, *where is the technology in ICT4D?* remains by and large unresponded, and a concept of empowerment with reference to technology is not at all devised in this academic field. Our objective here is that of structuring this lacking concept, starting from the idea, found in Kallinikos (2011; 2004), that a thorough understanding of technology should not be reduced to the interface at which humans encounter computer-based artefacts.

Our reframed idea of empowerment is therefore two-pronged, consisting of both a developmental component and a technological one, to be granted equal dignity within research and project evaluation.

To illustrate this idea, we focus on E-Krishi, a web-based device for e-commerce and e-inclusion, implemented for the farmer community in the southern Indian state of Kerala. We note that, within E-Krishi, recipient farmers are empowered on the developmental side, as several participatory arrangements are purposefully set up, for them to fulfil their own objectives through the web-based platforms provided. Yet, at the same time, E-Krishi disempowers users in the terms set out by technology, as the closed structure of the artefact makes the farmers entirely subjected to the government, which monopolizes ownership and control on the artefact's mechanics and provisions. The perspective of ICT4D, by remaining limited to a monolithic orientation to development, is *per se* unable to grasp the implications of these technological restrictions on empowerment; as such, the E-Krishi case is used here to rehabilitate technology, through our own two-pronged model for reframing empowerment.

This paper is structured as follows. Firstly, we examine the developmental vision of empowerment, as the capacity of enlarging people's choices through systematic arrangements for strong participation. Secondly, the technological vision of empowerment,

Corresponding Author
Email Address: s.maseiro@lse.ac.uk (S. Maseiro)

which is not formally contemplated in ICT4D, is brought to the fore, so that the concept of empowerment is problematized and eventually reframed in a dichotomous way. Thirdly, we look at the case study provided by E-Krishi, describing the technology underlying it and the modules in which it is articulated: as we discuss the case study, we observe that empowerment here is reached in the developmental sense, but not in the technological one. As such, our reframed notion of empowerment is presented as a new tool, for a complete picture of empowerment to be provided.

Empowerment: The Development View

The idea of empowerment is one of the key concepts in the field of development, pervading both development theory and the setting up of practical project objectives. A mainstream school of thought, in development theory, refers to empowerment as productivity-oriented, i.e. reachable solely and entirely through the mechanism of economic growth. This idea is predicated on the assumption that poor countries are just low-income ones (Prakash and De 2007: 264), and therefore, increases in national productivity are necessary and sufficient to solve the problems related to underdevelopment (Akpan 2003: 263).

The main challenge to this idea of development-as-growth comes from the work of Sen (2001), which revolves around the concept of development as freedom. It is Sen's view that the maximization of productivity, rather than constituting the primary key to development, is just one of the ways for the poor to break down the barriers that constrain their existence, and, by doing so, prevent human empowerment from coming about. Real freedoms, in the vision of Sen, are to be achieved in a set of interconnected fields: each freedom stems, in an almost tautological way, from the removal of a "substantial unfreedom". As a result, sufficient incomes stem from the removal of poverty and unemployment; equally, education comes from eliminating barriers to school attainment, and high life expectancy is the outcome of the progressive deletion of roadblocks to health. This is the vision that we adopt in this piece, relinquishing the monolithic reductionism underlying the idea of development-as-growth: empowerment is equated, as a final outcome, with a state in which people are free to fully develop their own life plan (Sen 2001: 7).

A key problem in this respect is *how* can empowerment be realized in development? To answer this question, we adopt the perspective implicit in the institutional theory of development, of which the work of Brett (2003, 1999) is paradigmatic. In this vision, the key input factor resulting in people's empowerment is to be ascribed to institutional accountability,

which is to be achieved primarily through participation: indeed, for the capabilities of the poor to be fully expressed and liberated, development practitioners need to proactively incorporate the knowledge of recipients into development projects, rather than just inform them in a top-down fashion (Chambers 1994). As a result, the developmental view of empowerment can be seen as an input-output model, where strong participatory arrangements are at the basis of the enlargement of people's capability of developing their own life plan. The dichotomous approach set up by Michener (1998), between *weak* and *strong* participatory arrangements, is relevant in this respect, as it differentiates the instruments of weak participation, limited to the informal consultation of development beneficiaries, from strong participatory toolkits that proactively endow the poor with decision-making power in development projects.

In the composite domain of ICT4D, development encounters the polymorphous arena of technology studies. Here, on the one hand, optimistic accounts highlight the potential of ICTs for economic growth and prosperity (UNDP 2001, World Bank 1999), and in particular for enabling good governance in the nations that need institutions to be strengthened. In particular, a relatively recent stream of literature highlights the relevance of "open" technologies (Smith and Elder 2010, Smith, Elder and Emdon 2011) to create social transformations that, in turn, act as drivers of development: indeed, as noted by Thomson (2008), collaborative technologies based on the web have devised a brand new way to do ICT4D, capable of involving the users more directly. On the other hand, less optimistic accounts point to the empirically registered ineffectiveness of ICTs as implanted in the developing world, and ascribe it to several reasons: the "new form of dependency" that ICTs engender for poorer nations (Wade 2002), the systematic devaluation of locally produced knowledge (Dagron 2001), the low capabilities of the Internet in terms of generating inclusion mechanisms (Mercer 2006).

Our argument here is that the problem, that arises when the developmental view of empowerment is applied to ICT4D, can be stated in the terms of a lacking focus on *mechanisms*. We sustain indeed that the developmental vision, focusing sharply on the enlargement of people's choices through participation, implicitly reduces the totality of toolkits for institutional accountability to the role of potential inputs, without establishing systematic differences according to the nature of the inputs themselves. As such, this view reduces the role of ICTs to that of a mere instrument, devised for the end of capability-based empowerment: the systematic prioritization of development objectives, and the consequent neglect of technological inputs, are, in themselves, im-

plications of a view of technology as constantly reshapable *in situ* by the agents of development. This is entailed by the argument of technological situatedness, of which the work of Orlikowski (2000) is paradigmatic: in this approach, technology is not an agent shaping human action in its own right, but rather a pliable means to service our own human purposes.

The point here is that the situated view of technology is widely adopted in ICT4D, in an unspelled and aprioristic fashion. Indeed, a careful examination of this academic domain reveals that ICT4D is not grounded on theories of technology in its own right: rather, this field relies crucially on a plethora of single, context-based case studies, out of which policy recommendations are extracted and generalized to macro-areas of action. Yet, the problem with this view is that, owing to its context- and objective-oriented nature, it systematically overlooks the technology by depriving it of any constitutive power, and relegates it to the role of tool for an existing, pre-determined purpose (Orlikowski and Iacono 2001: 123-124). As such, a paradoxical outcome comes to be reached, in which ICT4D arises as a field where the technology, epitomized by wholly pliable ICTs, stays in the background, instead of being brought at the forefront of debate and examination.

As a result, in ICT4D, empowerment is not measured with reference to technology. This concept remains, by and large, confined to the developmental vision, which measures it solely with reference to the achievement of capabilities for attaining people's life plans. Therefore the key question, *where is the technology* in this process? remains by and large unresponded: the underlying, unspelled assumption of situatedness, as it is systematically accepted in ICT4D, does not allow for examination of empowerment under the point of view of technology, and its multifaceted relations with its relevant groups of users. Thus constructed, the concept of empowerment presents, therefore, a severe incompleteness on the technological side, which calls for a thorough project of reframing and reconstruction.

Empowerment: The Technology View

As observed above, in the theoretical scheme underlying ICT4D, technology tends to be conceived *a priori* as a pliable element, amenable to be reshaped and plied for achieving the users' objectives. As such, in the ICT4D literature, a concept of empowerment with reference to technology is lacking, and the technological side of it is entirely substituted by the development-oriented purpose of enlargement of people's choices. Therefore, our objective here is that of structuring this lacking concept, starting from the idea, set out by Kallinikos (2011: 3; 2004:

236), that a thorough understanding of technology should not be reduced to the interface at which humans encounter computer-based artefacts. Hence, we examine the notion of technology as a generic, cross-contextual force, and subsequently apply this conception to the macro-area of ICT4D for reframing empowerment.

The idea of technology as cross-contextual is articulated by Kallinikos (2011: 25-31) in the argument that technology, rather than a malleable substratum of action and thought, is a powerful regulator of social practice, juxtaposed to social norms and culture in the task of influencing human behaviour. Drawing on Luhmann (1993), the strategies on which technology relies for regulation are conceptualized by Kallinikos in the terms of *functional simplification* and *closure*: functional simplification reduces the multiplicity of social settings by selecting a strict set of functions that are instrumented as strict causal couplings, whilst functional closure ensures that these couplings occur in a fixed and predictable order. Through these strategies, technology invites human action to be conducted along specific paths, and this puts into severe discussion the idea of situatedness on which academic literature, within ICT4D, implicitly relies. The relevance of this body of theory, for our work here, lies in the fact that it brings technology out of neglect and back to the centre of the academic debate, as a regulative force in its own right.

What are the implications of this body of theory, for the literature and practice in ICT4D? Counter-balanced against the conception of technology as a malleable substratum, this idea of technology as a powerful regulating force brings the key question *where is the technology* here? out of aprioristic visions, and back into discussion. The key implication of this lies in the fact that the concept of empowerment, rooted so far on a situated and context-based view of technology, needs to be reframed at its very grounding bases. As a result, if we conceptualize technology as a regulative force, then empowerment needs to be viewed with respect to technology itself, and not only under a developmental, capability-centred point of view. We need to coin, therefore, a concept of empowerment *with reference to technology* in ICT4D: this notion stems directly from the conception of a balance of power, between the regulative power of technology and the human reactions of the user. An input-output definition can be devised here, paralleling the one just devised for the development view: users are empowered with respect to technology, *if they are capable of manipulating it* at their own advantage, notwithstanding the regulative power that it yields.

If manipulability of the artefact is the outcome, what is the input required in this process? It is our view

that, whereas the developmental idea of empowerment requires toolkits for implementing strong participation, the technological view of this concept requires an *open structure* of developmental tools that is amenable to users' proactive mastery and intervention. This idea can be traced back to the point of Kallinikos (2011: 42), stating that artefacts are most retraceable when, with respect to them, processes and outcomes can be separated: which is, when there is a well-defined syntactic and semantic code lying at the basis of technological structure. Semantics is to be seen here, in a fashion similar to that of Manovich (2001: 32-33), as the meanings embedded in the artefact, which needs to be mastered for conscious manipulation to be achieved. We can conclude, as a result, that open structures are required, for developmental technologies to actually empower the users: through openness, beneficiaries are entitled to comprehend the syntax of the artefact, and to master it in the ways that are most beneficial for their intended outcomes.

Our reframed concept of empowerment in ICT4D is synthesized in Table 1 above. In our conceptualization, ICT4D-induced empowerment stems from the sum of two dimensions, a development-based one oriented to participation in project-making, and a technology-based one oriented to openness in the nature of the artefacts. Our argument here is that, in contrast to a literature that systematically privileges the first conception, both dimensions of human empowerment need to be granted equal dignity in ICT4D: indeed, neglecting one of them leaves the picture incomplete, as both ICTs and development mutually interact in constituting the social practice of this composite field. This is most evident in the case examined here, picturing an ICT-based development project where the two dimensions of empowerment have been fulfilled to significantly different extents.

E-Krishi: E-Commerce and E-Inclusion in Kerala

Our case study here is that of E-Krishi, a web-based device for e-commerce and e-inclusion, designed for usage by the farmer community in the southern Indian state of Kerala. Launched in 2006 by the Kerala State Information Technology Mission (KSITM), an implementation agency depending on the Kerala Department of Information Technology, E-Krishi has been developed with the purpose of addressing the existing gap in information flow and transaction management through the toolkits provided by computers and the Internet. To achieve this purpose, the E-Krishi web space has been created out of the dynamic combination of three integrated modules: a platform for e-commerce, in which buyers and sellers are matched in specific spaces of interaction; a platform for information, providing expert advisory on cropping and agri-market highlights; and a platform for communication, allowing farmer-to-farmer interaction flows and direct communication with agricultural institutions. The project operates through IT-enabled agri-business centres, i.e. the *telecentres* that are positioned across the whole state of Kerala.

The E-Krishi project works as an interactive website, based on the mutual integration of its three platforms. The platform for e-commerce is, in itself, an "agricultural trade centre" located online: it consists of two dedicated corners, for buyers and sellers respectively, where farmers are enabled to post their own announcements. This platform is remarkably useful for the foreign trade of crops, and yet, a systemic drawback here is ascribed to the lack of transaction-support services: the site works, in the terms set out by Pare (2003), as a mere "match-making" device, which provides no additional services for ensuring that transactions are actually performed and completed by the parts.

	Input	Output
Empowerment in Development	Strong participatory arrangements: - Accountability-enhancing toolkits - Transfer of decisional power from development agents to recipients	People's capability of fully developing their own life plans
Empowerment in Technology	Open structure of artefacts: - Clear syntax underlying technology - Amenability to users' mastery	People's capability of manipulating the artefact for their own needs

Table 1: A Model for Reframing Empowerment

In effect, this platform does not supply a system for reference submission and provision: there is, *de facto*, self-assessment of the quality of goods that are sold, which sharply reduces the trustability of the agri-market vendors encountered online.

The platform for information, oriented to supply farmers with locally relevant advice for agri-business, is composed out of two complementary web spaces. On the one hand, a section on farm advisory services provides information on the appropriate cultivation of crops, weather-related forecasts, and general advice on the usage of fertilizers. On the other hand, a section revolving around agri-market information provides relevant data on commodities and prices, and constant updates in terms of both inputs and outputs in the market for farming produce. This dichotomous platform has been created to ensure that farmers benefit from best practices in their operations, while maximizing financial awareness when performing their own transactions.

Finally, the platform for communication allows farmers to raise their own points and questions, both to each other within a web forum and to the government institutions embedded in a dedicated system, namely the Karshaka Information Systems Services And Networking (KISSAN). On the one hand, a web forum organized along the lines of *panchayats* (local administrative units) and agri-market topics is in place, and it is purposefully moderated to maximize the informational gains stemming from mutual interaction between cultivators in the state. On the other hand, the institutional system of KISSAN is called into question: KISSAN is an integrated service delivery model, elaborated with the objective of providing farmers with accurate, customized information on their activity and produce.

Discussion: Empowerment Reframed

Our objective, in this section, is that of putting our reframed notion of empowerment into action, by examining if, and how, the E-Krishi device is able to generate empowerment, from both a developmental and a technological point of view. We focus on the developmental dimension first. Is there, in E-Krishi, any evidence of those strong participatory toolkits that are aimed at maximizing the recipients' capacity of fulfilling their objectives?

Our argument here is that such tools are, indeed, present and embedded in E-Krishi, and can be identified in three different respects. Firstly, the platform for information and that for communication purposefully put their users – namely, farmers subjected to systemic uncertainties, both in environmental conditions and in the market – in a situation

that sharply reduces existing asymmetries in information. Informational devices for cropping, on the one hand, and for pricing, on the other, are aimed exactly at filling information gaps, induced by isolation and factor volatility: moreover, customized information is provided by KISSAN in a farmer-centric model that provides personal consultancy for specific enquirers. As such, users of E-Krishi are systematically equipped with the background in terms of information and awareness that forms the basis of a conscious active participation in agri-business.

Secondly, the platform for e-commerce is participatory in its own nature, as it allows for enrolment and perusal by virtually every farmer in the state. This is, in our interpretation, the positive flip side of the lack of transaction support services, which lowers significantly the barriers to entry in E-Krishi's buyer-seller matching hub. Given that there is no specific requirement for references or for a minimum initial guarantee to back commercial offers, all farmers are enabled to post their announcements and to actively take part in the virtual E-Krishi marketplace. In this respect, E-Krishi provides a counter-example to the several failures that have marked e-commerce in developing nations. In a field that some literature has identified as problematic for the developing world (Molla and Heeks 2007, Moodley and Morris 2004, Odedra-Straub 2003), this toolkit has achieved, in effect, a democratization in farmers' access to the e-market. Indeed, any Keralite cultivator is now entitled to take part in it, helped by the aforementioned informational devices on adequate prices for buying and selling.

Thirdly, within the telecentres where E-Krishi is accessed, participatory action is promoted proactively and continuously by the Akshaya telecentre entrepreneurs. Indeed, these actors need to constantly monitor the social sustainability of their own e-centres (Masiero 2011), and therefore they are subjected to a strong incentive in keeping services coherent with local demand. This involves, in rural areas, the actual setting up of *bhoomi* clubs: these associations induce farmers to physically go to the e-kiosks to learn how to use the E-Krishi devices and exchange information with other local cultivators. What emerges then, in several cases, is the formation of a regular pattern of usage of the telecentres by the farmers involved in the project of E-Krishi. In this way, as noted by Madon (2007), telecentres are actually turned into shared social spaces, where participation takes the shape of awareness of a collective condition, such as that of rural dwellers in the countryside of Kerala. Collective awareness is reinforced by the mutual exchange of contents in the dedicated forum, which is an integral part of the web-based platform for communication.

Figure 1 below synthesizes these three mechanisms, which are instrumental for us in arguing that E-Krishi *does* reach empowerment, if seen from the developmental point of view on the concept. Each of these three channels, embedded in E-Krishi, proactively helps farmers in realizing their own life plans: platforms for information and communication minimize informational asymmetries, acting towards the users' liberation from the "substantial unfreedom" of lacking knowledge. The platform for e-commerce, by itself, abates barriers to entry into the e-market for agricultural goods, creating new trade opportunities and the potential of greater revenues from produce. Finally, *bhoomi* clubs and the web-based forum operate as social enablers in the farmer community, acting as an antidote to the constraints induced by geographic barriers and isolation.

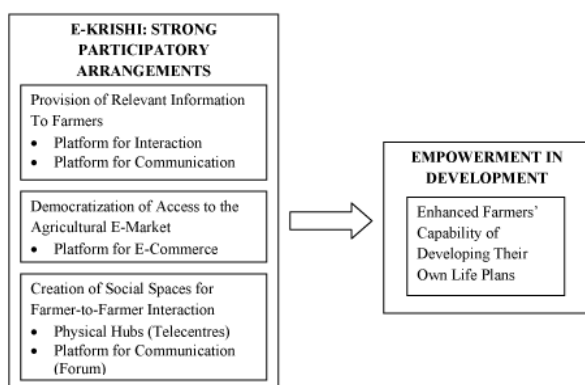


Figure 1: Factors of Empowerment in Development within E-Krishi

Notwithstanding this discourse, we now need to turn to what happens when, bringing into play our reframed notion of empowerment, we observe this very same concept from the point of view of technology. Our point here is that, by conceiving the idea of empowerment in a strictly developmental sense, E-Krishi does, in turn, sharply reduce the empowerment of farmers in technological terms. The regulative power of technology, we have argued, tends to be systematically overlooked in ICT4D, and a closer look to the mechanics of E-Krishi shows that, in effect, this project hardly makes an exception. There are, in our view, three motives for stating that the technology, in E-Krishi, minimizes the weight of users in the related balance of power.

Firstly, information supplied through E-Krishi's dedicated platforms, for accurate and business-enabling that it can be, is entirely monopolized by the Government of Kerala. On the one hand, information on best practices in cropping is based on recommendations from the Kerala Department for Agriculture. This body, committed to act in the interest of the state, has a systemic incentive towards

promoting certain cropping patterns, aimed at improving Kerala's terms of trade over other ones. The same holds for the online fertilizer recommendation system that falls under KISSAN – a government-owned information device. Through monopoly on information provision, the government is enabled to promote certain fertilizers – those produced by the "right" firms – over competing products. As of McLuhan (1964), a medium proactively shapes the informational content that it carries, and in this case, where informational devices are actually owned and operated by the government, these are amenable to be used for conveying exactly the contents that the Government wants to pass. As such, open integration of information sources is not achieved, and information provided through E-Krishi is monopolized by a single ruling actor.

Secondly, within the E-Krishi platform for e-commerce, advertising announcements are listed in order of relevance, through a ranking algorithm devised by the National Informatics Centre (NIC) of Kerala: once again, a body depending directly on the Keralite government. Here we should trace back to the discourse of Manovich (2001), stating that artefacts, to be semantically mastered by users, should have an open architectural code at their basis. Yet, in E-Krishi, the situation is the opposite. Not only cultivators have no power in determining the level of relevance of their announcements, but, despite the e-literacy achieved in the state through Akshaya, the closed architecture of the algorithm prevents *anyone* from knowing the factors that this device considers for the task of relevance attribution. The outcome of the process is that the government, interested in enacting specific patterns of agricultural trade, is enabled to manipulate the ranking as it prefers, given that ownership of the technology rests firmly in its own hands.

Thirdly, the farmer-to-farmer communication, enabled online by the dedicated forum, may look at a first glance as a grassroots instrument, where gains from virtual interaction are achieved from below by the people. And yet, two factors lead us to suspend the judgement, when assessing the nature of the interaction promoted here. First, interaction is streamlined through administrative and conceptual divisions, operationalized in the forum's structure by technology designers – belonging, once again, to the NIC. Secondly, moderation is heavy in the forum with frequent cases of direct action by moderators on the content of discussions – which has, indeed, generated widespread disappointment in local users. The interest of government, here, is not in bottom-up participation. By contrast, a top-down process of community construction is achieved, where the government, and not the user, is the actor empowered by mastering the technology for its own aims.

Figure 2 below synthesizes these three instruments, i.e. those that sharply reduce empowerment in E-Krishi from the technological point of view of the concept. These instruments provide an implicit answer to the question on if and how technology matters in ICT4D. The structuring architecture of E-Krishi is closed and monopolized. As a result, users enjoy no power in terms of comprehending its syntax and mastering it for themselves. By selecting the information most desired by the government, ranking announcements through a government-controlled algorithm and constructing communities in a top-down fashion, E-Krishi makes the user subjected to the dictates of the ruling administration, which derives its influence from controlling the technology.

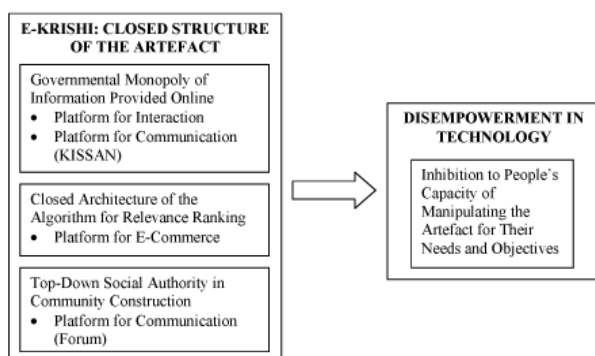


Figure 2: Factors of Disempowerment in Technology within E-Krishi

What do we conclude in terms of theory, from the case study examined here? Paraphrasing Kallinikos (2011: 142), E-Krishi gives empowerment with the hand of development, and, simultaneously, reclaims it with the hand of technology. As a result, this story illustrates the argument according to which empowerment, if viewed solely from the perspective of development, accounts for only a fraction of an inherently composite process. Indeed, participatory toolkits do exist within E-Krishi, but the grammar of the technology remains closed to its users: farmers take its consequences, but are unable to master it, given that ownership of drivers and algorithms remains firmly held in the ruling hands of government. The perspective of ICT4D, which remains by and large limited to a sole orientation to development, is *per se* unable to grasp the implications of these technological restrictions on empowerment. As such, this case is used here to reaffirm the value of our proposed framework: a two-pronged one, where empowerment is viewed both on the developmental and on the technological side.

Conclusion

Our reflection, in this paper, has been triggered by the acknowledgement of a major discrepancy between the composite nature of ICT4D – as made

out of both a developmental and a technological sphere – and the aprioristic adoption, in this field, of a developmental perspective, which prioritizes the objectives of development over the ICT-induced route to it. Our task in this work has been that of reconstructing the concept of empowerment, a mainstream one in development theory, from the technological side of the problem. By asking the unspelled key question, *where is the technology in ICT4D?* we have reframed the concept of empowerment as two-pronged along the lines of an input-output model: in the development view, strong participatory arrangements constitute the factor resulting in the outcome of people’s capability of fulfilling their own life plans. In a parallel fashion, empowerment towards technology coincides with users’ capability of manipulating the artefact, predicated upon open structures that allow the recipients to comprehend and master the syntax of technological objects.

This reconstructed, two-pronged concept of empowerment has been put into action for analyzing E-Krishi, a web-based device for e-commerce and e-inclusion targeted to the Kerala farmer community. We have noted that, from a developmental perspective, E-Krishi does act as a carrier of empowerment to beneficiaries, as a result of the participatory toolkit embedded in its three platforms: relevant information on agri-business is provided, access to e-commerce is democratized and social spaces are created – both within physical telecentres and online – for farmer-to-farmer mutual communication. Yet, it is our point that E-Krishi, while empowering users developmentally, disempowers them from the point of view of technology. Indeed, the syntax of the artefact is subtracted to users’ mastery, as its ownership and control are firmly held in the ruling hands of the government of Kerala. As a result, the government monopolizes the information provided online, manipulates the ranking of competitors in the e-market and constructs communities of participation in a top-down fashion, rather than encouraging grassroots patterns of aggregation between farmers.

Reframing empowerment, through adding the perspective of technology to that of development, is a consequence of broadening the theoretical perspective, from one that takes situatedness as an unquestioned truth to one that problematizes it, considering technology as a regulator in its own right. By doing so, we shift from an ICT4D where the “D” is hegemonic, to one where equal dignity is granted to both dimensions, and technology is viewed as yielding power *per se*, rather than being systematically reshaped as a multipurpose development tool. Moreover, and most importantly, our reframed notion of empowerment allows us to explain real-life outcomes such as that of E-Krishi, where empowerment, while achieved from the point of view of ca-

pability enhancement, is limited by the lack of any form of influence from users on the technology that informs development management.

References

- Akpan, P.I. (2003). Basic-Needs to Globalization: Are ICTs the Missing Link? *Information Technology for Development*. 10(2) pp. 261-274.
- Brett, E.A. (2003) Participation and Accountability in Development Management. *Journal of Development Studies*. 40(2) pp. 1-29.
- Brett, E.A. (1999) Understanding Institutions and Organisations. In Robinson, D., Hewitt, T. and Harriss, T. (Eds.) *Managing Development: Understanding Inter-Organizational Relationships*. London: Sage.
- Chambers, R. (1994) *Whose Reality Counts? Putting the First Last*. London: Intermediate Technology.
- Dagron, A.G. (2001). Prometheus Riding a Cadillac? Telecentres as the Promised Flame of Knowledge. *Journal of Development Communication*. 2(2) pp. 1-7.
- Kallinikos, J. (2011) *Governing through Technology: Information Artefacts and Social Practice*. London: Palgrave MacMillan.
- Kallinikos, J. (2004) Farewell to Constructivism: Technology and Context-Embedded Action. In Avgerou, C., Ciborra, C. and Land, F. (Eds.) *The Social Study of Information and Communication Technology: Innovators, Actors and Contexts*. Oxford: Oxford University Press.
- Luhmann, N. (1993) *Risk: A Sociological Theory*. New York: A. De Gruyter.
- Madon, S. (2007) Telecentres and Development: A Social Space Approach. Working Paper no. 164, Information Systems and Innovation Group, London School of Economics and Political Science.
- Manovich, L. (2001) *The Language of New Media*. Cambridge: MIT Press.
- Masiero, S. (2011) Financial vs. Social Sustainability of Telecentres: Mutual Exclusion or Mutual Reinforcement? *Electronic Journal of Information Systems in Developing Countries*. 45(3) pp. 1-23.
- McLuhan, M. (1964) *Understanding Media: The Extensions of Man*. London: ARK Paperbacks.
- Mercer, C. 2006. Telecentres and Transformations: Modernizing Tanzania through the Internet. *African Affairs*, 105/419: 243-264.
- Michener, V.J. (1998) The Participatory Approach: Contradiction and Co-optation in Burkina Faso. *World Development*. 26(12) pp. 2105-2118.
- Molla, A., and Heeks, R. 2007. Exploring E-Commerce Benefits for Business in a Developing Country. *The Information Society*. 23(2) pp. 95-108.
- Moodley, S., and Morris, M. (2004) Does E-Commerce Fulfil its Promise for Developing Country (South African) Garment Export Producers? *Oxford Development Studies*. 32(2) pp. 155-178.
- Odedra-Straub, M. (2003) E-Commerce and Development: Whose Development? *Electronic Journal of Information Systems in Developing Countries*. 11(2) pp. 1-5.
- Orlikowski, W., and Iacono, C. (2001) Research Commentary: Desperately Seeking the "IT" in IT Research - A Call to Theorizing the IT Artifact. *Information Systems Research*. 12(2) pp. 121-134.
- Orlikowski, W. (2000) Using Technology and Constituting Structures: A Practice Lens for Studying Technology in Organizations. *Organization Science*. 11(4) pp. 404-428.
- Pare, D. (2003) Does This Site Deliver? B2B E-Commerce Services for Developing Countries. *The Information Society*. 19(1) pp. 123-134.
- Prakash, A., and De, R. (2007). Importance of Development Context in ICT4D Projects: a Study of Computerization of Land Records in India. *Information Technology and People*. 20(3) pp. 262-281.
- Smith, M. L., and Elder, L. (2010). Open ICT Ecosystems Transforming the Developing World. *Information Technologies & International Development*. 6(1) pp. 65-71.
- Smith, M.L., Elder, L. and Emdon, H. (2011) Open Development: A New Theory for ICT4D. *Information Technologies & International Development*. 7(1) pp. iii – ix.
- Thompson, M. (2008). ICT and Development Studies: Towards Development 2.0. *Journal of International Development*. 20(6) pp. 821-835.
- Sen, A. (2001) *Development as Freedom*. London: Routledge.
- United Nations Development Programme (UNDP) (2001). *Human Development Report 2001: Making New Technologies Work for Human Development*. UNDP: Washington DC.
- Wade, R.H. (2002). Bridging the Digital Divide: New Route to Development or New Form of Dependency? *Global Governance*. 8(4) pp. 53-85.
- World Bank (1999). *World Development Report 1998/1999: Knowledge for Development*. World Bank: Washington DC.

Risk Management and User Prevention for Malware Threats

Anand Paul

*MSc Analysis, Design and Management of Information Systems
Information Systems and Innovation Group
Department of Management
London School of Economics and Political Science*

KEYWORDS

Malware
Risk Management
Trojan
Zeus

ABSTRACT

Internet usage has been growing at a rapid pace over the last two decades. The crux of this paper is to highlight the attitudes of participation, motivation and educational awareness within risk management practices as a combined strategy for computer users, in home and in organizations, to suppress the growth of Malware in the internet. In the last decade, there has been a big growth in Malware spread on the internet and different forms of Malware continue to evolve. One such Malware is the 'Zeus Trojan'. It is found that Malware threat awareness and its damages provoke users to take notice of malicious activities on the internet and safeguard electronic data and assets. An industry outlook of the growth, evolution and spread of the Zeus Trojan Malware suggests that IS security should start from individual level and not with technology products.

Introduction

While the emergence of the World Wide Web has enabled unprecedented access to information, it has also created unprecedented opportunities to attack information assets (Galbreth and Shor 2010). Many computer users both at home and in organizations have become vulnerable to many malicious threats. "Given the pervasiveness of the personal computer, Internet use and the blurred line between work and home, IT security breaches on personal computers can cause damages not only to individuals but also to organizations" (Liang and Xue 2010: 395). One of the major IT threats within Information Systems is Malware. The OECD report describes Malware as "a general term for a piece of software inserted into an information system to cause harm to that system or other systems, or to subvert them for use other than that intended by their owners. Malware can gain remote access to an information system, record and send data from that system to a third party without the user's permission or knowledge, conceal that the information system has been compromised, disable security measures, damage the information system or otherwise affect the data and system integrity" (OECD 2009: 10). The web has been an arena for Malware activities that causes losses and negative consequences to those affected and IS professionals are very concerned about these malicious activities. A recent Q4 report published by McAfee (2010), a world leading security Technology Company, re-

vealed Malware growth was going to be high in 2011 and also uncovered around 20 million new pieces of Malware in 2010 which equates to around 55,000 new Malware threats every day. One of these types of Malware is the 'Trojan horse'. This Malware seems to perform a useful function but also contains a hidden code that performs an unwanted malicious task without the user's knowledge. A deeper analysis of the types of Malware shows that the most prevalent Malware threats are Trojans - 59 % of all cases (Panda Security 2011).

A part of this paper explains about a growing Malware threat – the 'Zeus Trojan', a financial data stealing Malware, which has infected over 3.6 million computers in the United States (Binsalleeh, Omerod et al. 2010). This particular Malware has existed since 2007 and has evolved over time. A Symantec Security report (Falliere and Chien 2009) named 'Zeus' as the 'King of Bots' and a Trusteer (2009) report highlighted that 'Zeus' is probably the most painful financial Malware in the World Wide Web, both in terms of infection size and in terms of effectiveness. The latest reports tell that the Zeus Trojan has now attacked Blackberry and Android phones. In spite of these warnings, the 'Zeus Trojan' continues to infect computers all over the world. An alarming fact from research done by the security firm Trusteer (2009) Computers on a sample of 10,000 consumer computers in 2009 found that 55% of computers having updated Anti-virus were still Zeus infected. This infers that Anti-virus solutions have not excelled in their use and that Malware would continue to grow more complex. A complete dependence on only technol-

Corresponding Author
Email Address: a.paul3@lse.ac.uk (A. Paul)

ogy for defence from malicious threats might not be the way forward.

The remainder of the paper starts with an introduction to the Zeus Trojan Malware followed by available IS literature review. An incident relating to the Zeus Trojan and current evolution of this Malware in the industry allows author to discuss the importance of soft security. Finally the conclusions are listed.

The Zeus (Trojan Horse) Malware

One of the first incidents of the Trojan Horse can be traced back to early September 1986, when an intruder broke into a large number of computer systems in the San Francisco area, including nine universities, fifteen Silicon Valley companies, nine ARPANET (Advanced Research Project Agency Network) sites and three government laboratories and left behind recompiled login programs so that he could break into those same systems easier the next time (Reid 1987). The name 'Trojan Horse' "is inspired by the legendary wooden horse built by the Greek army, ostensibly as an offering to Athena, which in the dark of night disgorged its bellyful of murderous soldiers into the sleeping streets of Troy" (Denning 1990:288). Trojan horses require some level of user interaction to initiate the infection process such as clicking a web-link in an e-mail, opening an executable file attached to an e-mail or visiting a website where Malware is hosted (OECD 2009). Hence the author assumes that there is always an end-user involvement when Trojan Horses attack computer systems.

The Zeus is a Trojan Horse Malware that specializes in stealing banking credentials. The Zeus Trojan commonly infects computers via email phishing attacks or by 'drive-by-downloads', in which a Malware infects a user's computer without their knowledge when they visit a webpage (Cisco 2009). The Zeus Malware stays alert to know when a user logs into an account and then collects authentication credentials and passes the information to the hacker. Zeus has reportedly infected over 3.6 million computers in the United States (Binsalleeh et al. 2010). The Zeus Trojan is an easy toolkit that can create different versions of Zeus Malware. The program, when installed, connects to a command and control server where data is received from all Zeus infected computers (Stevens and Jackson 2010). The hackers then use this information to take over the user's accounts and transfer funds to a network of 'money mules' who are overseas individuals having bank accounts under fake identities. Once the money is received by the mules they transfer the cash back to the hackers and the mules are paid on a commission. Although this Malware was first identified in 2007, when it stole information from the United States De-

partment of Transportation, it has not been possible to completely eradicate this IT threat. The latest reports of the Zeus Trojan is that the Malware is affecting smart phones- Symbian and Blackberry handsets and stealing online banking details (Wakefield 2011) showing that it has evolved.

Literature Review

"Enterprises establish computer security policies to ensure the security of information resources; however if employees and end-users of organisational information systems (IS) are not willing to follow security policy, then these efforts are in vain" (Herath and Rao 2009:106). The author's preferred way to prevent Malware is to start motivating end-users by involving them in security developments so that they would not only become aware of the current security threats they face but also they participate effectively in prevention of security incidents. The Protection Motivation Theory (PMT) (Rogers 1975) invokes a protective behaviour in end-users and might help to curb Malware incidents in the companies. This framework could be chosen because it has been successfully applied in many cases to understand the range of protective actions taken by individuals (Milne et al. 2000). The variables that capture PMT are perceived security to threat, probability of occurrence or vulnerability and efficacy of the recommended preventative behaviour. A lens into the Zeus Trojan Malware effect on these variables might help research to understand the applicability of the PMT theory on Malware.

In the OECD (2009) report, awareness is shown as an important line of defence against any forms of Malware. Public and private sectors have brought in awareness programmes to educate Internet users about Malware. Few examples of awareness programs include the Australian National E-security Awareness week, EU Safer Internet Plus Programme, UK government's Get Safe Online and United States Onguard Online. These programs would help the public to improve IS security at homes. Internet users at home could look for unusual symptoms on their computers such as strange screen graphics, unusual behaviour on reboot, unexpected sound effects, reduction in system performance and similar symptoms to involve themselves in the security measures. In case of organizations, computer training and education would protect the organizations because employees become more computer literate and protect organizational assets (Boss et al. 2009).

Another method of achieving awareness is by user participation (Spears and Barki 2010). There is a link seen between user-awareness and user participation. User participation raises organizational awareness of security risks and controls within business

processes that contributes to more effective security control development and performance (Spears and Barki 2010). User participation in IS security risk analysis and control design can provide needed business knowledge, thereby contributing towards effective security measures. "By taking a multi-approach combining different activities, hazards and disaster phases, participatory work is well placed to deal with the complexity of disasters and the diversity of factors affecting people's vulnerability" (Rudolph and Ahrens 2006:215). Also one can find that in organizations when end-users are involved in the development of security policies a feeling of closeness could be seen between the users and the organization which would also motivate employees to protect the organizational assets from the outside threats.

The author would like to suggest that the combined effect of user motivation (PMT), user awareness and user participation might prove to be a strong strategy to prevent the growth and evolution of Malware threats, such as the Zeus Trojan as explained through the case below.

Empirical case – A Zeus Trojan Incident

In June 2009, Jacques Erasmus and his research team at the security company Pervx discovered a list of File Transfer Protocol (FTP) credentials of accounts on domains that were high profile. The compromised accounts are linked to companies that include Bank of America, NASA, Monster, Oracle, Amazon and Cisco. These accounts were compromised by the Zeus Trojan which infected the victim's computers and then transferred the FTP credentials to a server located at a remote location. This Malware attack was discovered while the research team at Pervx was investigating a wild infection. The investigation followed the trail from the computer to the server where a dump file containing all the credentials was discovered. The report and the investigation details were passed on to the US-CERT (United States Computer Emergency Readiness Team) and companies were informed of this attack. The security company also created a list of domains so that companies can check if any of their employee's accounts have been attacked. The security company later provided instructions to clean up the infection on affected domains and suggested recommendations.

Continuing threat and evolution of the Zeus Trojan

The Zeus has continued to be a major Malware threat from 2007 and every year there are many incidents connected to the Zeus Trojan. In Feb 2011, William Hague, foreign secretary of UK, said that some computers in the British government had been

infected with the 'Zeus' computer virus after users opened an e-mail, claiming to come from the 'White House', and clicked on a link (BBC 2011). It is interesting to note that this Zeus Trojan has many different versions that have been created during the last few years and has evolved to an extent that updated Anti-virus solutions might not be able to detect the virus. A recent McAfee (2010) report has recently indicated that Zeus is also going moving towards mobile attacks. Cyber criminals know that many financial institutions use mobile SMS as a two-factor authentication method and therefore they are modifying the Zeus tool for starting similar attacks. From a prevention point of view, many anti-virus solutions are still ineffective on the Zeus Trojan. Security companies inform users that the Zeus Trojan cannot be detected by many technology products and provide step by step procedures to be followed thereby enhancing end-user participation and motivation from such Trojan attacks. One such example is given by Symantec, a security company that stresses end-users to exercise caution before opening e-mail messages and clicking URLs and not to fully rely on the Anti-virus solutions to prevent the Zeus Malware.

Discussion

Though the above Zeus Trojan incident has been stated and cited in many security journals and security websites, affected companies have not publicized this attack incident possibly due to reputation damage. However it is possible to presume to an extent on the risk management procedures or policies that have been changed because of such Malware attacks. Some of the traditional Information System Security (ISS) methods that are most commonly used include ISS checklists, ISS standards, Maturity Criteria, Risk Management and Formal methods (Siponen 2005). A critical analysis of these methods suggests that these methods are developed in isolation and that most of the traditional ISS methods are based on conceptual development offering little evidence to their usability and relevance in practice. All the affected companies in the Zeus Trojan incident would have been completely depending on technical solutions to prevent Malware attacks. After the incident, the author could now see an effort from the websites of few affected companies trying to educate end-users on the Malware threats which in turn enhances user participation to prevent Malware attacks to the systems. For example, Bank of America (2011) has a privacy and security site that educates users on the types of online fraud and protection techniques that involve user-involvement. Here, user-involvement activities include checking for the bank's trademark when logging into the website, ensuring that the address bar on the website turns green in colour, deletion of suspicious mails and even reporting suspicious mails to an e-mail address that handles such

suspicious mails. A look into the NASA (2010) website shows a new NASA Security Operations Centre (SOC) introduced in 2010 to fight Cyber-crime. The centre has brought about many awareness programs to educate end-users on types of cyber-crime and ways to prevent them. Meanwhile Cisco (2009) recommends that all web-users should erase any unsolicited request on the social networks as well as avoid clicking any applications or links in suspicious emails.

Threats such as the Zeus Trojan Malware which has the potential to cause major impacts on a global scale ought to be informed to the end-users. This would make the users aware and curious to know more about this dangerous Malware and the probability of occurrence in the Internet. Next, when the end-users understand that the Zeus Trojan has already caused financial damage in the world and updated Anti-virus solutions are unable to detect and remove this threat, there is further progress in motivation by increasing the perceived security to threat. Thirdly, many of the security companies have provided step by step procedures that require end-users to participate in the prevention of Zeus Malware attacks. These are treated as good practices when end-user encounters suspicious e-mails, unknown website links and illegal downloads and avoids them. If these steps are proved successful then end-users understand the efficacy of the recommended preventative behaviour. When all of the above points are placed together, these become the three factors that Protection Motivation theory is based on (Rogers 1975). Hence the author understands that the Protection Motivation Theory might be used to prevent such Malware incidents through user motivation and hopes future development of PMT theory to prevent Malware attacks.

Finally the author strengthens his stand that the latest security technology products cannot be completely dependent for removing Malware attacks. Hackers sometimes tend to attack those security packages that are rated high. Galbreth and Shor (2010) argues that adoption of a product by increasing the products market attracts more attackers. Hence there is also a danger if one over-relies on the latest technology products in the markets. An interesting point to think is whether security software companies add features in their products with adequate regard for the potential increase in vulnerability in a security product. This means that a technology product that can detect and remove Zeus version 2 might not be able to do the same for Zeus version 3. With competition among security companies for growth and market, a critical approach might be needed before adoption of technological products.

Conclusion

From the study it is seen that although technology products are used by individuals in organizations or in homes, information security cannot be achieved by completely relying on the technology products. A growing Malware threat in the Internet space – the Zeus Trojan is discussed through an incident and its evolution. Discussions around the study conclude that: a) a more user-involvement approach is needed to improve information security through a combined approach on participation, motivation and educational awareness. This approach is unique because many research papers discussed using either motivation or participation alone for better IS security but a combined effect could further strengthen the IS security. b) IS Security should start at the individual level where users would have to take more precautionary measures to prevent attack from evolving threats such as the Zeus and similar Malware. Safe security procedures or suggestions by Security industries are indicators about the necessity and strength of user participation and awareness to combat Malware. c) Many technology products lack strong detection and prevention techniques for many types of Malware and one is expected to shift from over-dependence on security technology products towards individual preventative actions. It is also seen that such security approaches might be cost-effective and sustainable for the future.

References

- Albrechtsen, E. (2007) A qualitative study of user's view on information security. *Computers and Security*. 26(4) pp.276-289.
- Bank of America (2011) Fraud Prevention and Identity Theft page for customer awareness. https://www.bankofamerica.com/privacy/Control.do?body=privacysecur_prevent_fraud (accessed 17 July 2011).
- BBC (2011) William Hague: UK is under cyber-attack. <http://www.bbc.co.uk/news/uk-12371056> (accessed 17 July 2011).
- Binsalleeh, H., Ormerod, T., Boukhtouta, A., Sinha, P., Youssef, A., Debbabi M. and Wang, L. (2010) On the Analysis of the Zeus Botnet Crimeware Toolkit. *Eighth Annual Conference on Privacy, Security and Trust*. Ottawa, Canada.
- Boodaie, M. (2011) Man-in-the-Browser attacks target the enterprise. *Computerworld*. <http://news.idg.no/cw/art.cfm?id=7E66FDE5-1A64-6A71-CE16C4982827E112> (accessed 17 July 2011).
- Boss, R.S, Kirch, J.L., Angermeier, I., Shingler, A.R. and Boss, W.R. (2009) If someone is watching, I'll do what I'm asked: mandatoriness, control, and information security. *European Journal of Information Systems*. 18(2) pp.151-164.
- Bu, Z., Bueno, P., Kashyap, R. and Wosotowsky, A. (2010) The New Era of Botnets. Santa Clara, McAfee Labs. <http://www.mcafee.com/us/resources/white-papers/wp-new-era-of-botnets.pdf> (accessed on 17 July 2011).
- CISCO (2009) Annual security report. http://newsroom.cisco.com/dlls/2009/prod_120809.html (accessed 17 July 2011).

- Denning, J.P (1990) Computer Viruses. In Denning, J.P (Ed.) *Computers under Attack: intruders, worms, and viruses* (pp.285-292). New York: ACM Press.
- Dhillon, G., Silvia, L. and Backhouse, J. (2004) Computer Crime at CEFORMA: A case study. *International Journal of Information Management*. 24(6) pp.551-561.
- Falliere, N. and Chien, E. (2009) Zeus: King of Bots. Cupertino, Symantec. http://www.symantec.com/content/en/us/enterprise/media/security_response/whitepapers/zeus_king_of_bots.pdf (accessed 17 July 2011).
- Galbreth, R.M. and Shor, M. (2010) The Impact Of Malicious Agents On The Enterprise Software Industry. *MIS Quarterly*. 34(3) pp.595-612.
- Hannan, M. and Tucker B. (2004) Risk Management and Organisational culture: The implications of Computer Network Attacks and Malware Incidents on Organizational Risk Management. *2nd Australian Information Security Management Conference*. Perth, Australia.
- Herath, T. and Rao, R.H. (2009) Protection motivation and deterrence: A framework for security policy compliance in organisations. *European Journal of Information Systems*. 18(2) pp.106-125.
- Lee, Y. and Larsen, R.K. (2009) Threat or coping appraisal: determinants of SMB executives' decision to adopt anti-Malware software. *European Journal of Information Systems*. 18(2) pp.177-187.
- Liang, H. and Xue, Y. (2010) Understanding Security Behaviors in Personal Computer Usage: A Threat Avoidance Perspective. *Journal of the Association for Information Systems*. 11(7) pp.394-413.
- Liang, H. and Xue, Y. (2009) Avoidance of Information Technology Threats: A Theoretical Perspective. *MIS Quarterly*. 33(1) pp.71-90.
- Loch, K. and Carr, H. (1992) Threats to Information Systems: Today's Reality, Yesterday's Understanding. *MIS Quarterly*. 16(2) pp.173-186.
- McAfee (2010) McAfee Threats Report: Third Quarter 2010 shows Zeus attacking mobile. <http://www.mcafee.com/us/resources/reports/tp-quarterly-threat-q3-2010.pdf> (accessed 17 July 2011).
- Milne, S., Sheeran, P. and Orbell, S. (2000) Prediction and intervention in health-related behaviour, a meta-analytic review of protection motivation theory. *Journal of Applied Social Psychology*. 10(1) pp.106-143.
- NASA (2010) Security Operations centre for protection from Cyber Crime. http://www.nasa.gov/offices/ocio/ittalk/07-2010_soc_prt.htm (accessed 17 July 2011).
- OECD (2009) Computer Viruses and Other Malicious software – A threat to the Internet Economy. http://www.keepeek.com/Digital-Asset-Management/oecd/science-and-technology/computer-viruses-and-other-malicious-software_9789264056510-en (accessed 17 July 2011).
- Ollmann, G. (2008) The evolution of commercial Malware development kits and colour-by-numbers custom Malware. *Computer Fraud and Security*. 2008(9) pp.4-7.
- Panda Security (2011) Trojans - Biggest Malware threat. <http://press.pandasecurity.com/news/in-january-50-percent-of-computers-worldwide-were-infected-with-some-type-of-computer-threat/> (accessed 17 July 2011).
- PNG, L.P.I. and Qiu-Hong, W. (2009) Information Security: Facilitating User Precautions Vis-à-vis Enforcement against Attackers. *Journal of Management Information Systems*. 26(2) pp.91-121.
- PriceWaterhouseCoopers (2010) Information Security Breaches Survey 2010 - Technical Report. Report commissioned by Infosecurity Europe, London. http://www.infosec.co.uk/files/isbs_2010_technical_report_single_pages.pdf (accessed 17 July 2011).
- Reid B. (1987) Viewpoint: Reflections on some recent wide spread computer breakins. *Communications of the ACM*. 30(2) pp.103-105.
- Rogers, R. W. (1975) A protection motivation theory of fear appeals and attitude change. *The Journal of Psychology*. 91(1) pp.93-114.
- Rudolph, M.P. and Ahrens, J. (2006) The Importance of Governance in Risk Reduction and Disaster Management. *Journal of Contingencies and Crises Management*. 14(4) pp.207-220.
- Siponen, T.M. (2005) An analysis of the traditional IS security approaches: implications for research and practice. *European Journal of Information Systems*. 14(3) pp.303-315.
- Spears, L.J. and Barki, H. (2010) User Participation in Information Systems Security Risk Management. *MIS Quarterly*. 34(3) pp. 503-522.
- Stevens, K. and Jackson, D. (2010) ZeuS Banking Trojan Report. Atlanta, DELL Secureworks. <http://www.secureworks.com/research/threats/zeus/?threat=zeus> (accessed 17 July 2011).
- Trusteer (2009) Measuring the in-the-wild effectiveness of Anti-virus against Zeus. New York, Trusteer Report. http://www.trusteer.com/files/Zeus_and_Antivirus.pdf (accessed 17 July 2011).
- Vroom, C. and Solms, v.R. (2004) Towards information security behavioural compliance. *Computers and Security*. 23(3) pp.191-198.
- Wakefield J. (2011) How safe is your smartphone? London, BBC. <http://www.bbc.co.uk/news/technology-12710763> (accessed 17 July 2011).
- Whitman, E.M. (2003) Enemy at the Gate: Threats to Information Security. *Communications of the ACM*. 46(8) pp.91-95.

The Alignment of System and Organizational Design in ERP Implementation

A Review of Theoretical Perspectives

Ashish Mullick

*MSc Analysis, Design and Management of Information Systems
Information Systems and Innovation Group
Department of Management
London School of Economics and Political Science*

KEYWORDS

ERP
Misalignment
Static View
Dynamic View

ABSTRACT

An ERP system streamlines the business processes of different departments of an organization. The ERP system has an organizational structure embedded in it which is designed by the developers of the ERP package. These developers tend to incorporate standardized organizational processes but in reality, these embedded structures are often misaligned with the organizational structure where these ERP packages are implemented. The primary aim of this paper is to analyze a misalignment between the structure of an organization embedded in an ERP package and the structure of an organization where it is implemented. The paper argues that both package customization and organizational changes are required to deal with this misalignment. The paper identifies two views: static and dynamic to classify and review various information system (IS) theories in this context. The static view helps the managers and researchers to form an ideal path for the ERP implementation process and helps in dealing with the misalignment between the organization structure and the structure embedded in the ERP package during initial stages of ERP implementation. The static view in the context of ERP implementation is discussed using three IS theories: Resource Based View, Structural Contingency Theory and Technology Acceptance Model. A major drawback of this perspective is that it does not provide an insight into the dynamics of implementation processes. Since ERP implementation is an enterprise level project, it involves interaction between the different elements which produce some unexpected events. The dynamic view of the ERP implementation deals with the situation arising due to the unexpected complementary effect when various forces act together. In this view, three IS theories: Actor Network Theory, Emergent View and Socio Technical Theory are discussed. This paper highlights some of the key issues using these IS theories to help future research in this area.

Introduction

It is suggested by the proponents of an Enterprise Resource Planning (ERP) system that it enables integrating major business processes of an organization to achieve high quality of work, improve profitability and performance. The main feature of the ERP system is that it streamlines the business processes of different departments of an organization. "The other motivations behind adoption of ERP system include: cost reduction, improved efficiency, reduced product lifecycle time, improved customer satisfaction and enabling e-commerce" (Nicolaou 2004: 79). The ERP systems make data more available to the employees and thus improve their decision making ability (Hitt et al. 2002). But often, organizations

are apprehensive to replace their existing isolated systems with the ERP systems (Brown and Vessey 2003). They find that the huge investment of time and capital in the ERP systems is a high risk activity. "90% of SAP R/3 ERP projects run late and with the study of 7400 IT projects, only 24% completed in time and in budget" (Aloini et al. 2007: 548). Soh et al. (2000) analyze the case studies of seven hospitals in Singapore and suggest that the major failures in ERP implementation occur due to 'misfits' or the gaps between the functionality offered by the ERP package and that required by the organization implementing the ERP solution.

This paper explores the issue of the misalignment between the structure of the package and the organization which is a major cause for the ERP failures. The first section of the paper discusses why both organisational changes and package customization are

Corresponding Author
Email Address: a.mullick@lse.ac.uk (A. Mullick)

required to fit the ERP system into the organization. The paper then explores the two views: static and dynamic using various IS theories in context of the ERP implementation to find different perspectives to achieve this adaptation.

ERP Implementation and Organizational Fit

An ERP package has an organizational structure embedded in it which is designed by the developers of the ERP package. These developers tend to incorporate standardized organizational process but in reality, these embedded structures are often misaligned with the organizational structure where these ERP packages are implemented (Soh and Sia 2004). It raises a key issue whether the organization should change to adapt to the embedded structure in the ERP package or the ERP package should be customized so that it can become compatible with the organization structure. The “organizations have to adapt to the systems than other way around” (Benders et al. 2006:197). The organizational structure embedded in the ERP package is considered to be the best practices and the organizations should adopt this structure. The three mechanisms for this institutional isomorphism are coercive forces, mimetic forces and normative pressure. The concept of “technical isomorphism is introduced which encourages actors (developers, consultants and users) to centralistic philosophy and standard incorporated in the ERP” (Benders et al. 2006: 201).

But changing only the organizational structure to adapt to standardized business process embedded in an ERP package is not a solution. There are many companies whose business practices are their differentiating factor from their competitors. Nike did not change its business process during the implementation stage as their different strategy and business process was its identity (Soh and Sia 2004). Also, the mechanisms of coercive, mimetic and normative pressures are region specific. The structure of the institutions in different regions are influenced by the government agencies, professional practises, religion etc. and in these cases the ERP package has to be modified according to the organizational structure of the company. Therefore, it can be inferred that both organizational change and package customization are necessary for the successful implementation of an ERP system. But a key concern in this regard is the extent to which the ERP package should be customized.

This question can be answered by taking two elements into consideration: imposed structures and voluntary acquired structures (Soh and Sia 2004). The imposed structures are influenced by the external factors like government agencies, professional

institutions, norms etc. and the voluntary structures are influenced by the organization experiences and practices. Both voluntary and imposed structures are present in the organization embedded in the ERP and the organization where it is implemented. These structures are often misaligned and there is a need to make adaptation among the two. The changes in the ERP package will increase the cost of implementation and making changes in voluntary structures in the organization can affect their identity. The author suggests that it is important for the organizations to identify the imposed structure within their organizational context which cannot be compromised and compare it with the imposed structures in the ERP package. If there is significant misalignment between the two, then there is a risk associated with the project. The author also suggests that the voluntary misalignments can be managed by a proper implementation strategy and change management steps like user training, project communication etc.

Therefore, from the above discussion it can be concluded that it is necessary to modify both organization and the system design so that they adapt to each other. Following in the paper, the two views - static and dynamic - are discussed using IS theories to explore the various elements affecting the fit of an ERP package into an organization.

Static View

This view provides a static picture of the complex forces and elements affecting the ERP implementation process. This view can help the managers to plan an initial strategy as, after evaluating these forces, they can build an ideal roadmap for the implementation process. Now, three important IS theories, Resource Based View, Structural Contingency Theory and Technology Acceptance Model, are discussed in the ERP implementation context which incorporates the static view.

Structural Contingency Theory

The structural contingency theory helps to study the relationship between the structure of a technology and the organization. Morton and Hu (2008) use the theoretical framework of structural contingency theory to examine the fit between structure of an organization and the structure embedded inside an ERP package. The authors perceive task interdependence and task uncertainty as the important contingencies in ERP implementation environment. The authors discuss the effect of these contingencies on the formal parameters of contingency theory which are structural difference, formalization and decentralization. The task interdependence contingency is inversely proportional to the structural difference, formalization and decentralization. The task uncer-

tainty is inversely proportional to formalization. But for a greater probability of success of ERP implementation, the authors propose high task interdependence and low task uncertainty. This causes a state of dilemma (Figure 1) whether to have more formalization or not. But the authors argue that the task uncertainty is a stronger contingency than task interdependence and, thus, high formalization with low centralization and low structural difference will result in low resistance by the users towards the change.

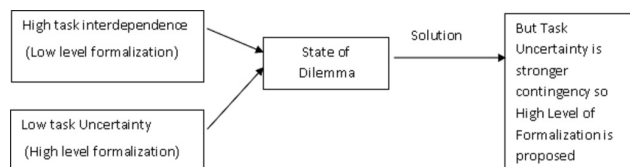


Figure 1: State of Dilemma with High Task Interdependence and Low Task Uncertainty

This theory can help the managers and researchers to assess the organizational structure and the amount of change required in the ERP package to fit into the organization. This study can also help the top management in selecting an ERP vendor as they can compare their own organizational structure with the structure of the organization embedded in the ERP packages of different vendors and identify a best match.

Resource Based View

The Resource Based View (RBV) gives a static picture of the resources which are possessed by an organization and how they can be utilized to build firm's capabilities. Karimi et al. (2007) explore RBV and argue that the complementary effects of the resources of an organization play a key role in determining the ERP implementation success. The authors give reference to a study by Makadok that an organization gains competitive advantage by "selecting and deploying resources to build capabilities and resource picking and capability building are complementary activities" (Karimi et al. 2007: 223). In context of ERP implementation, the authors empirically tested and identified three critical IS resources that play a key role in the ERP implementation. These are knowledge resources, relationship resources and IT infrastructure resources. The authors argue that these IS resources have greater combined effects as compared to in isolation and the ERP capabilities are directly related to the business process outcome of an organization. This theory provides a basis for managers and researchers to evaluate the key resources of the organization. Managers can play a significant role in identifying the synergies between resources and selecting a best set of resources to build ERP capabilities.

Technology Acceptance Model

A key motive of an organization for the implementation of an ERP package is to improve the productivity of employees. Therefore, there is a need to understand the impact of ERP implementation on the users. Gyampah and Salam (2004) propose a model which is an extension to the Technology Acceptance Model (TAM) and empirically examine it in an ERP implementation environment. The existing TAM framework takes Perceived Usefulness (PU) and Perceive Ease of Use (PEU) as external factors to examine the behavioural intention of the users about the change. Gyampah and Salam (2004) model, in context of ERP, takes three more external factors into account. These are training of employees, project communication and shared belief in the benefit of the system. The authors suggest that the shared belief in the benefit of the system can help the managers to analyze the advantages of the ERP to them and to the organization as a whole. The two other external factors, training and project communication help in developing this shared belief and also have a positive impact on PU and PEU. This theory allows managers to build an initial strategy to implement the organizational change during the ERP implementation. It has taken two important factors of project communication and training into the account. According to Akkerman and Helden (2002), the interdepartmental communication and cooperation also play a key role during a project crisis.

Static View and ERP Implementation

The static view plays an important role in forming an ideal path for the ERP implementation process and helps in dealing with the misalignment between the organization structure and the structure embedded in the ERP package during the initial stages of ERP implementation. The static view can help in the selection of ERP package and the ERP vendor such that the misalignment between the organization structure and the structure embedded in ERP package is minimal. The static view can also help in evaluating the existing resources of the organization as well as the design of training modules for the employees so that necessary organizational changes can be analysed in order to adapt the organization structure to the structure of organization embedded in the ERP package. The static view though fails to incorporate an important factor of frequent changes due to the dynamic interactions of different elements during an ERP implementation where managers have to make decisions in situations which were not anticipated in the initial strategy. These situations arise due to the interaction of various forces that participate during the ERP implementation process. Thus, to handle these situations the paper explores the dynamic view.

Dynamic View

The dynamic view of an ERP implementation deals with situations that arise due to unexpected complementary effects when various forces act together. Being dynamic in nature, this view helps managers to deal with the practical problems they encounter during the implementation of a technology. Further, the paper discusses three important IS theories: Actor network Theory, Emergent View Theory and Socio Technical Theory in an ERP implementation context which incorporates the dynamic view.

Actor Network Theory

Actor Network Theory (ANT) focuses on the alliances formed by different networks of actors. Elbanna (2006) uses an ANT framework and Improvisation to analyze the dynamic aspects of ERP implementation. Elbanna (2006) argues that the Improvisation approach can be applied to a rigid ERP technology and it is not only meant for low risk and low cost projects. The author uses a case study of the implementation of SAP in Drinco to explain this point. During the implementation of SAP in Drinco, there were many crucial stages like excluding EUB members and changing SAP 'plain vanilla' implementation strategy to adapt with Drinco's existing system. The Improvisation approach used by the top management played a key role in re-aligning the different actors in different networks of an organization to accomplish the implementation goal. Thus, it can be inferred that ANT provides an excellent framework for the managers and researchers to explore the dynamic aspects of ERP implementation. The case study of Drinco discussed in Elbanna (2006) gives an example of a typical situation of changing requirements occurring in almost every ERP implementation. The case teaches that, often, situation demands negotiation with the previous planned strategies and the actions performed at one stage affect the future implementation strategy.

Ensemble View

The ensemble view focuses on the effect of interaction of technology with a wide variety of communities of people. Xue et al. (2005) analyse the ERP implementation through a lens of ensemble view and examine that certain contextual issues arise due to the dynamic interaction of people and the ERP technology. In the contextual issues, cultural and environment are two major factors which play a crucial role in determining success or failure of ERP implementation. The study analyzes five case studies of ERP failure in China on grounds of cultural, environmental and technical issues. The research focuses on socio-cultural perspective and argues that "ERP has embedded norms, values and cultures

of developers who built the system with the local norms, values and culture of the location where the ERP will be implemented" (Xue et al. 2005: 285). The study provides an opportunity for different global ERP vendors to explore the cultural issue that causes many ERP implementation failures especially in China. This is because the majority of the ERP vendors have a western organizational culture embedded in their ERP package which fails to adapt with the Chinese or Asian organizational culture. This theory provides a useful tool for both managers and researchers to study the organizational fit with the structure embedded in the ERP system in terms of contextual issues of culture and environment.

Socio Technical Theory

The socio technical theory takes both social and technical factors into consideration. Lyytinen et al. (2009) examine the dynamic nature of socio technical theory using Levitt's socio technical systems comprising people, technology, task and structure as its core elements. The authors then incorporate this socio technical system in their proposed PSIC model and argue that "ERP implementation as a series of socio-technical change" (Lyytinen et al., 2009: 292). In context of ERP, the authors suggest that when a stable socio technical system is encountered by some significant events, a state of disequilibrium is created. Due to this, some gaps are created between the elements of the socio technical system and, thus, some measures have to be taken to fill those gaps and transform the system back into the stable state. The study provides an insight into the consequences of a stable system when it is encountered by any anticipated or unanticipated events that can disturb its state of equilibrium.

Dynamic View and ERP Implementation

In summary, a dynamic view is closer to reality than a static view. An important advantage of this view is that it helps the managers to deal with unexpected situations that are very frequent during implementation of large projects like ERP. During the implementation process, both package customization and organizational changes take place so that the misalignment between the two can be minimized. The dynamic view can help in analyzing the social environment like culture, actors participating during ERP implementation or the socio-technical changes that play an important role during the implementation phase of ERP. The dynamic view helps to tackle the issues which arise due to the interaction of various social elements.

Conclusion

This paper analyzes different IS research in the field of ERP implementation in organizations. The paper identified that both package customization and organizational changes are required to fit an ERP system into the organization. The two views - static and dynamic - are recognized to analyze the misalignment between the package and the organization using various information systems theories. The static view is useful for the managers for planning an initial implementation strategy which can serve as an ideal roadmap but fails to incorporate unexpected changes that occur due to the interaction of various elements during the ERP implementation. The dynamic view helps to deal with this situation and proves to be more useful especially during the implementation phase of ERP systems. However, this study has some limitations as it only focuses on aligning packages and organizations but does not incorporate environmental factors like politics, power etc. and how to handle risks associated with the ERP implementation.

There have been many past researches done in this field. However, there are several areas which are still to be exploited. The first area is that the ERP may be implemented in an organization which has different subsidiaries having different organizational structures made to fit an ERP package. Another area is that the majority of empirical studies focuses on manufacturing firms. By contrast, ERP systems are implemented in diverse industries including government, retail, hospitals etc. to an increasing degree. The issues with implementing ERP systems in these sectors can be different from those in manufacturing firms. Therefore, further research in these areas is recommended so that future ERP implementations can benefit.

References

- Aloini, D., Dulmin, R. and Mininno, V. (2007) Risk management in ERP project introduction: Review of the literature. *Information & Management*. 44(6) pp.547-567.
- Akkermans, H. and Helden, K.V. (2002) Vicious and virtuous cycles in ERP implementation: a case study of interrelations between critical success factors. *European Journal of Information Systems*. 11(1) pp.35-46.
- Benders, J., Batenburg, R. and Blonk, H. V. D. (2006) Sticking to standards; technical and other isomorphic pressures in deploying ERP-systems. *Information & Management*. 43(2) pp.194-203.
- Brown, C.V. and Vesssey, I. (2003) Managing the next wave of enterprise systems: leveraging lessons from ERP. *MIS Quarterly Executive*. 2(1) pp.65-77.
- Elbanna, A.R. (2006) The validity of the improvisation argument in the implementation of rigid technology: the case of ERP systems. *Journal of Information Technology*. 21(3) pp.165-175.
- Gyampha, K.A. and Salam, A.F. (2004) An extension of the technology acceptance model in an ERP implementation environment. *Information & Management*. 41(6) pp.735-745.
- Hitt, L.M. (2002) Investment in Enterprise Resource Planning: Business Impact and Productivity Measures. *Journal of Management of Information Systems*. 19(1) pp.71-98.
- Karimi, J., Somers, T. M. and Cherjee, A.B. (2007) The role of Information Systems Resources in ERP Capability Building and Business Process Outcomes. *Journal of Management Information Systems*. 24 (2) pp.221-260.
- Lyytinen, K., Newman, M. and Al- Muharifi, A.R.A. (2009) Institutionalizing enterprise resource planning in Saudi steel industry: a punctuated socio-technical analysis. *Journal of Information Technology*. 24(4) pp.286-304.
- Mahring, M., Holmstrom, J., Keil, M. and Montealegre, R. (2004) Trojan actor-network and swift transaltion. *Information Technology and People*. 17(2) pp.210-238.
- Morton, N.A. and Hu, Q. (2008) Implications of the fit between organization structure and ERP: A structural contingency theory perspective. *International Journal of Information Management*. 28(2) pp.391-402.
- Mumford, E. (2006) The story of socio-technical design: reflections on its successes, failures, and potential. *Information Systems Journal*. 16(4) pp.317-342.
- Nicolaou, A.I. (2004) Firm Performance Effects in Relation to the Implementation and Use of Enterprise Resource Planning Systems. *Journal of Information Systems*. 18(2) pp.79-105.
- Soh, C., Kien, S.S. and Tay-Yap, J (2000) Cultural Fits and Misfits: Is ERP a Universal Solution? *Communications of ACM*. 41(4) pp.47-51.
- Soh, C. and Sia, S.K. (2004) An institutional perspective on sources of ERP package-organization misalignments. *Journal of Strategic Information Systems*. 13(4) pp.375-397.
- Xue, Y., Liang H., Boulton W.R. and Snyder, C.A. (2005) ERP implementation failures in China: Case studies with implications for ERP vendors. *International Journal of Production Economics*. 97(3) pp.279-295.

Open Source Software Ideology, Self Interest and the Crowd

Tinesh Babu

*MSc Analysis, Design and Management of Information Systems
Information Systems and Innovation Group
Department of Management
London School of Economics and Political Science*

KEYWORDS

Open Source Software
Free Computer Software
Technology Innovation
Ideology
Economics of Technology
Professional Open Source
Software

ABSTRACT

Researchers have tried to analyse and represent the organisation and development within the Open Source Software (OSS) realm using various socio-technical models. In this literature review, I have tried to compare and contrast these various models. Also, this literature review looks into various reasons that have been proposed by researchers for the motivation of individual programmers to contribute towards OSS. This paper attempts to compare how both ideology and self-interest act as a motivating factor for contribution. With private companies participating and investing heavily in Open Source projects, I try to identify their motivation and benefits from participating in OSS projects by looking into past studies in this area.

Introduction

The Open Source Software (OSS) arena has been undergoing interesting changes for some years now. Found on the basis of the Free Software Movement and knowledge sharing, developers or volunteers contribute willingly and wholeheartedly for no apparent monetary gain. Recently, the arena has seen the influx of corporate giants based on pure capitalist ideas, focused mainly on profits, contributing considerably to OSS. The main reason why Open Source Software has been able to grow to its current levels and challenge Closed Source Software in open market is attributed to its high quality, which is comparable or at times better than closed source software. OSS communities have been able to attract highly skilled programmers to contribute voluntarily in large numbers towards the development of software. Reasons attributed to this include ideology, a quest for reputation, career growth etc. (Steward and Gosain 2006; Markus et al. 2000). Though not explicitly evident, economic benefits too have been mentioned as another reason.

At the same time, more and more contributions to the OSS realm are coming from paid software professionals as part of their work within their organisations. In fact, a majority of the contributions towards embedded Linux kernel nowadays comes from paid programmers as part of their work. The libertarian values which formed the basis for OSS

could be eroded by the entry of private firms into the OSS realm, but on the other hand, the irreversible nature of the open source code adds to the knowledge base of the contributors, both independent and paid.

The organisational structure of OSS communities and their development models have been of great interest for researchers for some time now. The complex social phenomena and interaction within the OSS communities have necessitated a socio-technical approach in analysing the OSS development and organisation. While the metaphoric cathedral and bazaar models had been proposed by Raymond (1999) to analyse the OSS development model, Actor Network Theory (ANT) has been proposed to better capture the complex social characteristics within the OSS community. The complex social structure and communication within the OSS communities provides a compelling case for analysing OSS based on the Social Shaping of Technology (SST), ANT and the Social Construction of Technology (SCOT).

Motivation: Ideology and Self Interest

Open Source Software production contrasts greatly in contrast to closed source software production, especially in terms of participation and contribution of developers. While the closed source software producers pay a salary to their developers, the OSS participants contribute without any financial gain, and yet produce software of high quality. This unique aspect of OSS has prompted many to ask the question as to why developers contribute, with many

Corresponding Author
Email Address: tinoos@gmail.com (T. Babu)

researchers reaching conclusions such as the altruism, reputation and ideology of the OSS development community (Markus et al. 2000; Steward and Gosain 2006). Ideology and tenets of OSS ideology are shown to have a positive impact on the trust and communication within the OSS project (Steward and Gosain 2006). Trust and strong communication are extremely important to OSS, in order to bring about better coordination among programmers within the community, but also to keep defections to a minimum as well as to attract new programmers to the project.

Yet, OSS ideology and altruism does not give a complete picture regarding the motivation of individual programmers. Studies have shown that most developers in OSS projects are not driven by ideology or altruism but rather by self-interests (Hertel 2007). Apart from aspects like gaining reputation amongst peers, wanting to learn new skills or creating better software for one's own use, economic benefits have been mentioned as a possible motivator for an OSS contributor. But, seeing economic benefits as a motivating factor for individual programmers is ambiguous as these volunteers contribute to the project without any immediate visible financial gain. It has been suggested that economically, compared to short term benefits or immediate gain, programmers have good long term incentives.

By being part of a successful open source project, the programmers are able to show outsiders their exact contribution, the complexity of the problem and the approach taken towards its solution. The ability of the programmer to perform and follow through also becomes evident to outsiders, as the programmer works on his own on a sub project of the OSS project (Lerner and Tirole 2005). These acquired qualities and skills make the OSS programmer more valuable to future employers. The results of an econometric study on contributors to the Apache project, which draws upon a wide range of project records, has been consistent with the view that individual programmers/volunteers to OSS projects do benefit directly (Lerner and Tirole 2005; Hann et al. 2004). Finally, long term benefits for programmers are stronger under three conditions: "1) the more visible the performance to the relevant audience (peers, labour market and venture capital community); 2) the higher the impact of effort on performance; and 3) the informative the performance about talent" (Lerner and Tirole 2005: 103). Hence, it is quite evident that the economic benefit, even though delayed, plays a major factor in attracting individual programmers towards OSS projects. Whether the motivating factor is ideology or self-interest, the fact that the programmer is also a user means that there should not be any impact on the quality of the software produced.

The Crowd: Social Organisation within OSS

The high quality of OSS is attributed to its ability to attract large numbers of volunteers to participate and improve the product. To put it in Raymond's words, "[p]erhaps in the end the open-source culture will triumph not because cooperation is morally right or software "hoarding" is morally wrong but simply because the closed-source world cannot win an evolutionary arms race with open-source communities that can put orders of magnitude more skilled time into a problem" (Raymond 1999: 54).

This aspect could be compared to a socio-technical approach towards the OSS communities, in particular, the Social Shaping of Technology (SST) for the development of open source software. From an engineering point of view, Raymond (1999) suggests that OSS developers tend to follow a Bazaar model in contrast to the Cathedral model followed by closed source software developers and early OSS developers. The focus here is to release early and often and to delegate as much as you can (Raymond 1999). But it also lays a great deal of emphasis on the project and its leaders in order to attract a large number of contributors and beta testers. It is the ability of OSS to bring together a large team of dedicated developers that actually contribute to the high code quality of the software. In what Raymond (1999:30) calls the Linus' law, "[g]iven a large enough beta-tester and co-developer base, almost every problem will be characterized quickly and the fix obvious to someone. Or, less formally, 'Given enough eyeballs, all bugs are shallow'."

In return, it is this high quality and reliability that fundamentally contribute towards the popularity and growth of Open Source Software. It has to be noted here that since the developers are also users of the program, the motivation for contributing towards development and error correction remains stronger in comparison to a paid software professional working on closed source software. This could be evaluated as a socio-technical model of organisation that fits perfectly with the Social Construction of Technology (SCOT), wherein the view or requirement of the user needs to be taken into consideration by the developer, which is satisfied within OSS with the developer himself being a user.

It is the ability of OSS to attract large numbers of volunteers, either as developers or testers, that has enabled it to produce high quality software, comparable or even better than closed source software. It's been puzzling for researchers, how OSS developed without any use of conventional software development methodologies and, being more like an amorphous, bazaar like and structure less organ-

isation (Dahlander, 2007), can produce products of such high quality, even if it can attract a large team size. It has been suggested that it is the trust (both cognitive and affective) in the team leader, output task or project completion as well as communication quality, which have their basis on OSS norms, beliefs and values, that has contributed to large team sizes and committed efforts for individual projects within OSS (Steward and Gosain 2006). This in itself is even more puzzling considering the fact that a project leader or team leader within the OSS realm does not have any actual control over participating developers. OSS communities establish mechanisms for reporting contributions from members to be evaluated, monitored and integrated into the community. They have tools like discussion boards, forums etc. that help volunteers to participate in discussions and to develop formalized structures in which certain individuals within the community have more formal authority than the rest (Dahlander 2007). The social organisation within the OSS project/community determines the structure of formal authority and leadership progression, which can range from a completely democratic process to that of a benevolent dictator.

It has been suggested that OSS communities work in a meritocratic fashion, a system of government based on rule by merit rather than by wealth, class, political power or the social position of the individual (Dahlander 2007; Kogut and Metiu 2001). The Apache web Server project is an example of a meritocratic democratic organisational setup, wherein to be a leader one has to be a major contributor to the project. The group of leaders, called a project management committee, decides by vote (Apache 2010). For instance, code changes to the web server can be requested by any developer via a mailing list, which is then evaluated and put to a vote.

Not all OSS communities/projects work in a meritocratic fashion. Despite contributing about 2% of code to the Linux kernel, Linus Torvalds remains its ultimate authority (Dahlander 2007). He, along with his trusted lieutenants, controls any changes or modifications that need to be done to the Linux kernel code and, hence, is considered a benevolent dictator. While an individual contribution plays a major role with respect to becoming a leader, it is also the ability to form connections or ties within the community - especially with the current leadership - that plays an important role in rising through the ranks of the community (Dahlander 2007).

Open Source Software development and its organisation could be looked through another socio-technical model, namely Actor Network Theory (ANT), a view that in itself contrasts with the traditionally perceived bazaar model. The version control soft-

ware used in the OSS development could act as an agent in the actor network of OSS development (Cornford et al. 2005), while strong mentorship and encouragement can act as a factor towards attracting new developers (Steward and Gosain 2006), in called allies in ANT. ANT considers the social and technical as inseparable and analyses both people and technology involved with the same conceptual apparatus (Howcroft et al. 2004). The OSS community and the network between the developers within the community, the tools they use, the controversies and dissents about OSS, which sometimes even lead to the forking of the project, all of which together form a complex social phenomenon, can be analysed using ANT. The powerful and elaborate vocabulary offered by ANT for analysing the development of a project, through its concepts of enrolment, mobilization, dissidence and inscription, helps to draw greater attention to the process of translation and the political implications with respect to OSS development and organisation (Ramiller 2007; Cornford et al. 2005).

Open Source and the Business World

Commercial software developers, including ones who were previously strong proponents of Closed Source Software, too have entered the OSS arena. Primarily with a view of increased revenue and profits, their strategies and approaches vary greatly in comparison to developer communities and individual programmers. Some of these companies have seen an opportunity for revenues through training, consultancy or support of OSS packages (Watson et al. 2005; Fitzgerald 2006), while others follow the loss-leader strategy, where the actual package or product is in itself distributed for free with the goal to enlarge the market for allied closed source products and services (Fitzgerald 2006). Companies in OSS also have an additional advantage when it comes to recruiting. They are able to tap into an already existing pool of developers from the OSS communities lowering training costs and quality risks (Watson et al. 2005).

Additionally, companies have adopted OSS products, due to their high reliability and lower costs (often zero cost), as a basis upon which they have created their own platforms to deliver value added services within their business domains, which also ensures that the Open Source remains invisible to their customers (Fitzgerald 2006). Apart from adopting the above strategy, companies like Google, Amazon, Sourceforge.com etc. also customize open source products to suit their internal needs. By the same token, they do not face any problems regarding noncompliance of OSS licences, since there is no redistribution of this customized Open Source Software (Fitzgerald 2006). Open Source firms also ben-

efit from lower Research and Development (R&D) costs due to free riding (Llanes and Elejalde 2009) driving down the total expenditure for OS firms bringing a positive impact on profits.

Conclusion

Open Source Software has been able to attract large numbers of developers to its projects reaching levels that cannot be matched by any closed source developer (Raymond 1999). This is due to a variety of reasons ranging from an adherence to an ideology, quests for reputation, career growth (Steward and Gosain 2006; Markus et al. 2000) to a work ethic to achieve the common goal of producing high quality software. Analysing OSS through different socio-technical models has helped to understand how the OSS communities organise themselves in order to form common goals, clear leadership roles and control mechanisms even in the absence of formal organisational structures. While an analysis of OSS development using ANT is certainly helpful, it needs to be further probed and researched.

On the one hand, one can argue that the ideology inspired, altruism-based development of OSS has given way to self-interest-based development and participation, which has not only sustained OSS, but also helped prosper both in terms of attracting more participants/users and applications. On the other hand, it can also be argued that since all new additions remain open, it helps the social commitment as originally envisaged in F/OSS, even if it is not the primary intention of the developer. The same holds true for open sourcing of code by private firms and increased contributions by paid programmers to OSS projects as part of their work. Any contribution to OSS, whether by private firms or individual contributors, will always add to the knowledge base of OSS.

What effects the entry of private firms has on OSS structure and development will need to be further researched. The effect of increased contributions by paid programmers to OSS also needs to be further researched, especially in the context of the effects it can have on bug/error reporting within OSS. Linus' law of a sufficiently large number of eye balls being able to find all errors is founded on the assumption that the developers and testers are first users of the same software. In most of the cases, the paid programmers themselves are not users of the OSS project they are contributing to, hence their motivation

to improve the software or their understanding of the software is in itself in question and needs to be further investigated.

References

- Apache (2010). The Apache HTTP Server Project. http://httpd.apache.org/ABOUT_APACHE.html (accessed 13 December 2010).
- Cornford, T., Ciborra, C. and Shaikh, M. (2005). Do penguins eat scallops? *European Journal of Information Systems*. 14(5) pp.518-521.
- Dahlander, L. (1993). In the club: Human and social capital of leaders in Free and Open Source Software. *Academy of Management*. 9(8) pp.1-6.
- Fitzgerald, B. (2006). The transformation of Open Source Software. *MIS Quarterly*. 30(3) pp.587-598.
- Hann, I.-H., Roberts, J., Slaughter, S. and Fielding, R. (2004). An Empirical Analysis of Economic Returns to Open Source Participation. Working Paper, Carnegie Mellon University.
- Hertel, G. (2007). Motivating job design as a factor in open source governance. *Journal of Management & Governance*. 11(2) pp.129-137.
- Howcroft, D., Mitev, N. and Wilson, M. (2004). What we may learn from the social shaping of technology approach. In Willcocks, L. and Mingers, J. (Eds.) *Social Theory and Philosophy for Information Systems* (pp.329-371). Chichester: John Wiley.
- Kogut, B. and Metiu, A. (2001). Open-Source software development and distributed innovation. *Oxford Review of Economic Policy*. 17(2) pp.248-264.
- Lerner, J. and Tirole, J. (2005). The Economics of Technology Sharing: Open Source and Beyond. *Journal of Economic Perspectives*. 19(2) pp.99-120.
- Llanes, G. and Elejalde, R. D. (2009). Industry Equilibrium with Open Source and Proprietary Firms. Harvard Business School Entrepreneurial Management Working Paper Series, Working Paper No. 09-149.
- Markus, M. L., Manville, B. and Agres, C. E. (2000). What Makes a Virtual Organization Work? *Sloan Management Review*. 42(1) pp.13-26.
- Ramiller, N. C. (2007). Constructing safety: System designs, systems effects, and the play of heterogeneous interests in a behavioural health care setting. *International Journal of Medical Informatics*. 76 pp.196-204.
- Raymond, E. (1999). The cathedral and the bazaar. *Knowledge, Technology & Policy*. 12 pp.23-49.
- Steward, K. J. and Gosain, S. (2006). The Impact of Ideology on Effectiveness in Open Source Software Development Teams. *MIS Quarterly*. 30(2) pp.291-314.
- Watson, R. T., Wynn, D. and Boudreau, M.-C. (2005). JBOSS: The Evolution of Professional Open Source Software. *MIS Quarterly Executive*. 4(3) pp.329-341.

Code as Storytelling

Insights about Free/Open Source Software Development through an Analogy with Alternate Reality Games

Rafael Kenski

*MSc Analysis, Design and Management of Information Systems
Information Systems and Innovation Group
Department of Management
London School of Economics and Political Science*

KEYWORDS

Open Source Software
Alternate Reality Games
Software Development
Brazil

ABSTRACT

It has been proposed that the concepts of joy and fun have a central status to understand motivation in Free/Open Source Software (F/OSS) development projects. This study tries to be a detailed analysis of what this proposition implies and how a massive collaborative project fuelled mainly by enjoyment-based intrinsic motivations can work. The method was creating a careful analogy between F/OSS development and Alternate Reality Games (ARGs) and checking its assumptions in a case study of a Brazilian ARG called Zona Incerta. The paper concludes by confirming that the analogy is appropriate and by stating that F/OSS development projects may be motivated by factors usually strictly associated with gaming, such as immersion and escapism.

Introduction

In 2007, a project manager in the informatics department at a city council in Brazil used to play an Alternate Reality Games (ARG) in his free time. These games propose puzzles or mysteries so complex that no single person can solve them. Over the time, Jack specialized in managing projects in the community. He used the same tools and skills as in his day job, but to solve puzzles or to interpret storylines, with no promise of a reward or a career for the best players. And he did that every night, for hours on end.

Work for free may look strange, but it is also very common in another community: Free/Open Source software (F/OSS) development projects. These programmers dedicate a huge amount of time developing software that will be distributed for free, in activities almost identical to what they do in their paid jobs. This phenomenon has puzzled many scientists during the last decade. These projects require a huge amount of work from contributors, but each one of them has little incentive to participate, since they can get the same benefits as a free rider. A great amount of research over the last decade has helped us understand some of these issues. Regarding the motivations for developers, it was shown that many motivators interact to account for collaboration in F/OSS projects. However, a group of researchers have pointed out the pre-eminence of joy of the activity itself as the main driver of participation in these projects (Lakhani and Wolf 2005; Hemetsberger 2004; Luthiger and Jungwirth 2007).

This paper will try to study some of the implications of considering F/OSS development projects as an activity based on fun. It will try to understand better what is behind this concept, how it relates to institutional settings and to other motivations and its relationship with other activities built around enjoyment-based intrinsic motivations. The method will be to create an analogy between F/OSS development and ARGs. Communities built around gaming such as ARGs are assumed to be about fun, and the output of their interactions is usually neglected. This will help us isolate some motivations in F/OSS development and look at online collaborative activities through a new angle. The next section is a literature review of F/OSS development motivations and on ARGs. The third part formulates the hypothesis, the fourth part presents the results of the case study and the final part discusses the results.

Literature Review

Motivation in F/OSS Projects

Many different psychological theories have been used to study collaboration in F/OSS projects. Most studies have followed the framework provided by Self-Determination Theory (STD) (for a review, see von Krogh et al. 2008), that distinguishes motivators between intrinsic and extrinsic (Deci and Ryan 1985). Even though authors have been trying recently to expand studies to other theoretical frameworks (von Krogh 2008; Benbya and Belbaly 2010; Krishnamurtha 2006), there is still a predominance of the extrinsic/intrinsic framework in F/OSS studies. According to von Krogh (2009), it happens for three reasons. First, SDT is a widely used framework

Corresponding Author
Email Address: rafael.kenski@gmail.com (R. Kenski)

in psychology and economics, backed up by a large literature and empirical studies. Second, once it became a dominant framework, it enabled comparison of results in many studies. And third, by combining paid and unpaid contributions, the characteristics of F/OSS development make it an interesting phenomenon to study complementary intrinsic motives in collective action.

Bellow, I will discuss in more depth the current status of research of intrinsic and extrinsic motivators in F/OSS development.

Extrinsic Motivators

Extrinsic motivators are those where the reward for the activity is outside of the action itself. The main example is money, a motivator that gains importance in F/OSS development as more and more companies start to collaborate in these projects. Studies have shown that a great part of collaborators in F/OSS projects are at least occasionally paid to contribute, and that payment should be considered in these cases as a strong motivator (Lakhani and Wolf's 2005; Hertel et al. 2003; Roberts et al. 2006).

Economic studies of collaboration in F/OSS development projects have proposed other external rewards for collaboration. Lerner and Tirole (2002) believe that collaboration may provide "delayed" incentives such as experience and career signalling. However, Hann et al (2002) found that Apache developer's salaries do not correlate to the amount of contributions, but to the higher rank within the community.

Some other extrinsic motivations can become "internalized" by programmers, becoming part of their ethos and behaviour and leading to self-regulation (Roberts et al. 2006; von Krogh et al. 2009). A first motivator of this type is reputation, which is important not only as a matter of ego-gratification, but also helps defining leaders and guiding the definition of responsibilities within the community (Weber 2005). Other motivator is the "own-use" value: developers programming to adapt products to their needs or to solve personal problems (Raymond 1999). A third example is reciprocity, also referred to as the "gift culture": each individual has a incentive to collaborate under the premise that he will also receive something in return when needed (Lakhani and von Hippel 2003). And fourth, learning. The fact that the source code is open allows programmers to learn the techniques and the creativity used to build it (Ye and Kishida 2003).

Intrinsic Motivators

Motivators are intrinsic when the rewards for the activity are embedded in the very act of performing

it. Psychological studies within the SDT framework say it is fuelled by activities that increase a person's feeling of autonomy and competence (Roberts et al. 2006). Lakhani and Wolf (2005) divide these motivations in two groups: enjoyment-based motivations and obligation/community-based motivations. The former are activities that are done just for the fun of it. It is frequently analysed in terms of Csikszentmihalyi's (1991) concept of "flow", the experience that occurs when a person's skill matches the challenge of a task and receive feedback for his accomplishments. It is a state of optimal experience, characterized by the loss of the sense of time, increased concentration, aligning of emotion, awareness and action, sense of control over the situation and extreme enjoyment. Obligation/community-based intrinsic motivators are related to the way contributors may be socialised to act in a manner consistent with the norms of the group (Lindenberg 2001). In F/OSS development, these norms include the belief that software should be open, rules and ethics of the hacker culture or even Raymond's (1999) lessons about the F/OSS development method (von Krogh et al. 2008).

In a web-based survey administered to 684 developers in 287 F/OSS projects, Lakhani and Wolf (2005) found that enjoyment-based intrinsic motivation was the strongest and most pervasive driver of participation. More than 61% of the respondents stated that their contribution to F/OSS was at least as creative as anything they have ever done, and the sense of creativity was the most important determinant in the number of hours spent coding for free. The findings also highlighted the importance of flow: more than 72% of developers reported losing the track of time frequently or always when programming. The authors believe programmers in F/OSS development projects may be seeking the enjoyment of matching their skills with the difficulty of the challenge, something that may not be possible in their jobs. The findings led the authors to summarize work in F/OSS projects as "a creative exercise" leading to useful output, or a "form of joint production-consumption that provides a positive psychological outlet for the participants as well as useful output" (Lakhani and Wolf 2005).

They are not alone in putting so much emphasis on intrinsic motivations. In a survey with 1486 contributors of F/OSS development projects, Hemetsberger (2004) also found that the pleasure of the activity itself takes a decisive role in the intensity of collaboration. In a third large scale survey, with 1330 open source developers, Luthiger and Jungwirth (2007) found that the joy of programming accounted for between 27% and 32% of developer's engagement. Fun and flow were motivations for all groups of programmers, unpaid or paid (although in the latter it accounted less for engagement in terms of

number of hours working in F/OSS projects). They also revealed that programmers experienced more fun developing F/OSS than working in commercial conditions. They conclude that working for free is absolutely rational if you consider developers want to maximize their fun.

Alternate Reality Games

We are still far from having a consensus on the definition of ARGs. Most attempts tend to be based on examples, and some definitions only relate them to other concepts such as transmedia storytelling (Jenkins 2006) or pervasive games (Montola 2005). I will follow the definition proposed by Stewart (2008). He focuses on five hallmarks that define ARGs, which will be analysed below.

The first hallmark says that designers break a story into many pieces, and spread them through player's "information space". It includes websites, IM, email, social networks, forums, physical places and news sources (Kim et al. 2009). These elements are all interrelated, being linked by references or puzzles. It is up to the players to find them, interpret them and put them together in a meaningful story. Usually these tasks are so complex that no single person can solve them, which forces the collaboration between players.

The second hallmark states that ARGs are not bound by any medium. This characteristic challenges usual assumptions about gaming. Traditionally, play has been defined as an activity with limits: it is a voluntary contractual activity, limited in time and space (McGonigal 2006; Montola 2005). Pervasive games such as ARGs challenge the magic circle by expanding it either spatially (e.g. being played in any public space), temporarily (e.g. merging with events in the everyday life) or socially (e.g. including outsiders in its dynamics or blurring the distinction between designers and players) (Montola 2005).

These expansions are reinforced when we consider the third hallmark in Stewart's (2008) definition: the use of ICT by players. This includes computers and the internet, but also mobiles and other tools of pervasive computing. However, space is not a "passive container" of actions, and forces ICTs to negotiate with many infrastructures and social practices that give it meaning and shape actions (Dourish and Bell 2007). But, for pervasive games, these obstacles are features. The games give new meanings to existing infrastructures, attach stories to them, use them as game elements and allow bystanders or non-players to interfere in the story (Montola and Waern 2006).

And, finally, in ARGs, the story is collectively built by game designers and by the actions of the play-

ers (McGonigal 2006). In every step of the game, designers must embed the content in online and offline environments and suggest courses of action through affordances. However, it is up to the players to ultimately make sense of them and relate them to other tools, spaces and people. The players must also create their own rules for deciding what is valid or not, what is inside or outside the game. The result is the creation of a universe that responds to player's actions and makes them feel part of it.

The research on motivations of ARG players is very scarce. However, we can get some insights on studies about motivations in video gaming. Yee (2007) found ten components that account to motivation in Massively Multiplayer Online (MMO) game players, which he divided in three clusters – achieving goals, socialising and immersion – that vary in importance according to each player. Another research on single and multi-player videogames (Ryan et al. 2006) concluded that motivation to play is related to increased perceptions of autonomy, competence and relatedness and the resulting feeling of "presence" in the gameplay.

Both authors consider the importance of immersion – Yee (2007) as a motivator, Ryan et al. (2006) as an outcome of successful games. It is relevant because immersion is frequently considered a central theme in the literature about ARGs. One of its expressions is the phrase "this is not a game". It summarizes the idea that ARG designers should deny their involvement in the game in order to blend reality with fiction and improve the player's experience, although this is not a strict requirement for an ARG (McGonigal 2006; Szulborwsky 2005). However, the perception of this immersion is much more complex than mere belief in an alternate reality. Few players, if any, believe in the game's reality. According to McGonigal (2006), the immersion in the game's fictional universe requires simultaneous belief (so as to enjoy the immersion) and disbelief (to find pleasure in murders, kidnappings and other elements of the story).

Hypothesis, Research Methodology and Design

The theory that F/OSS development is mostly an enjoyment motivated activity opens many questions, which will be studied through an analogy with Alternate Reality Games. The analogy will be built according to the definitions presented by Juthe (2005). He postulates that it is possible to assign a predicate from A to B if, and only if, the relationship between elements that determine or influence the predicate in A has a counterpart in B. The assumptions about ARGs that sustain the analogy will be tested in a case study of a large scale Brazilian ARG called Zona

Incerta. The two research questions are structured in the following way:

Research Question 1: Can F/OSS software development be explained even with no obvious extrinsic motivator in the form of career or pay?

The requiring condition is that the elements that justify the player's activities in ARGs even with no obvious extrinsic motivators have counterparts with similar relations in the F/OSS development communities.

Research Question 2: Is it possible that motivators in gaming – specially the concept of immersion – play important roles for developers in F/OSS projects

Fun and immersion in F/OSS has been analysed in terms of flow (Luthiger and Jungwirth 2007; Lakhani and Wolf 2005). But, as we have seen, it is a much more complex concept in ARGs: it involves the story, the way the community collectively builds it and also the fun of gaming. In order to create this analogy, a reasonably large set of elements of ARGs must have counterparts in F/OSS communities.

OSS	ARG
Similarities	
Open access to the source code; right to modify and redistribute it (Open Source Initiative)	Rules of the game collectively built by players (McGonigal 2006)
Large community of developers collaborating primarily through the internet (Feller and Fitzgerald 2002)	Large community of players collaborating primarily through the internet (Kim et al. 2009)
Parallel development / debugging (Feller and Fitzgerald 2002)	Distributed problem solving (Kim et al 2009; IGDA 2006)
Independent peer review (Feller and Fitzgerald 2002)	Negotiations between players
Rapid and incremental release cycles (Feller and Fitzgerald 2002)	Rapid prototype and test of experimental solutions (McGonigal 2008)
May be viewed as tools for sense-making (Iannacci 2005)	May be viewed as tools for sense-making (McGonigal 2007)
Reliance on emails, forums, web-based tools and informalisms (Scacchi 2002)	Creation of an "information space" that includes online and offline spaces (Kim et al. 2009)
Built around coding / programming (Roberts et al. 2006)	Built around collectively building and performing a story (McGonigal 2006)
Differences	
Participation may increase career prospects / signaling (Lerner and Tirole 2002)	No clear career related to the activity
Profit from secondary activities (Lerner and Tirole 2002)	Occasional rewards in form of prizes. No profit involved.
Coding skills required	Coding skills optional, but desirable (McGonigal 2006)
Open problems and requirements (Scacchi 2002)	Problems proposed by game designers, but interpreted collectively (Kim et al. 2009)

Table 1: Comparison table between F/OSS development and ARG communities

The first element of the analogy – the story – has a counterpart in F/OSS development: code. It may sound strange, but it is a reasonable pairing considering the way both relate to other elements. Both are at the centre of their communities and are result of the collective work. They are also the measure of successes and failures: participants are successful in F/OSS development if their code works, just like ARG players are successful if they help to interpret the story or push it forward. They are also the way to achieve the final goal: the project vision in F/OSS development or the solution of the game.

The second element is the way the community behaves and interferes with the story. Scacchi (2001) found how programmers in F/OSS development create tight-knit communities that communicate through of a large number of web-based applications. The requirements and responsibilities in the software development are emergent and informal results of these interactions. This is a good counterpart to the rules of the game emerging through ARG player's interactions in many online spaces.

The third element is the motivations and the fun itself, which we've already seen to be central in both ARGs and F/OSS development projects. But Ryan et al (2007) have broken down the intrinsic joy of playing games in terms of autonomy, competence and relatedness. Verifying the extent of these elements in ARGs will be one of the topics of the case study.

Table 1 summarizes some of the similarities and differences presented in the literature about these two topics.

The Zona Incerta Case Study

The Brazilian ARG Zona Incerta lasted for five months in 2007 and was a marketing campaign for a soft drink. It told the story of a dispute between a Miro, a biologist, and Arkhos, a multinational biotechnology company who wanted to turn the Amazon rainforest into an internationally controlled territory. The participants interacted with characters and story elements through several media, such as blogs, online videos, mobile phone messages, hidden objects, stencils and live events. The blurring between the real and the fictional life was also strengthened by unforeseen events, such as an ill-advised plenary speech by the leader of the opposition party in the Brazilian Senate against Arkhos Biotech, widely reported by the Brazilian media (G1 2007). According to the organizers, the game had 400,000 participants. However, the number of hardcore players – those who interacted with characters and solved the challenges proposed by the game designers – is way smaller. The case study was done through semi-structured interviews with 10 of these most active

players, done through Instant Messaging (IM) services.

Findings

The case study resulted in some insights about the elements required in the analogy. We will present them here in three groups: extrinsic motivations, intrinsic motivations and the configuration of the work itself.

Extrinsic Motivations

The Zona Incerta ARG didn't have any productive outcome that lasted once it was over, and most of the discussions and players activities have since been deleted. However, many participants mentioned getting extrinsic rewards for playing. The first one is learning, such as acquiring management and problem solving skills and knowledge in a topics related to the puzzles. The second is friendships and social contacts. The third, surprisingly, is career benefits: one player mentioned the game as a source of business networking and another, as a good story to tell in job interviews.

Important as they may be, these extrinsic rewards were more a post hoc evaluation of the benefits than a determinant of hours spent in the project. However, they are frequently mentioned as reasons for still being engaged in the genre (for many, Zona Incerta was the first ARG they've played). In subsequent ARGs, these extrinsic rewards may play a stronger component as motivators.

The analogy is strengthened by the comparison of the way work is performed in both communities. First, most players reported that their ARG activities were very similar to what they do in their day jobs. Second, they reported the existence of a core group responsible for a great part of decision-making, similar to hierarchies that emerge in F/OSS projects. Other secondary groups were also formed, which occasionally generated conflicts – similar to parallel versions of software (or “forking”) in F/OSS development. The main group gathered most of the information about the game, evaluated contributions of players and assigned tasks to some of them. Reputation also played an important role: the more commitment you showed, the more decision-making authority you receive, which mirrors Weber's (2005) analysis of coordination problems in F/OSS projects.

Intrinsic Motivations

Many intrinsic motivations were mentioned during the research:

Psychological benefits: Some credit the game for giv-

ing them thirst for knowledge or making them overcome shyness, lack of self-confidence, depression or phobias. However, the most mentioned motivator for playing was the joy of solving puzzles and following the story.

Autonomy, competence and relatedness: The main motivators in videogaming according to Ryan et al (2007) were also present in the player's statements. Autonomy was a strong motivator. Players said that they were able to "specialize" in activities where they had more skills or to try new things, because "the limits were different from the real life" and it was done voluntarily. The concept of competence was also present: being able to solve problems, accomplish tasks and influence the story was mentioned by all interviewees as motivators. And, finally, the social bonds and the identification with the community are also mentioned as strong factors driving participation, which confirms relatedness as a motivator.

Immersion: The perception of immersion was as strong a motivator. The ARG participants were well aware that it was only a fabricated reality, but they made an effort to perform it. One of them said "it was even more real than what I see in news programs, because I could influence the events." The live events were also frequently mentioned as something that increased the feeling of immersion, but the same did not apply to the appearance of the story in newspapers, suggesting the feeling may work only in a situated way. There is also a strong subcomponent of escapism: players reported frequently longing to "switch to the alternate reality" or losing track of time while playing.

Discussion

Our answer to the first research question is that it is possible to assume that F/OSS could exist even in the absence of extrinsic motivators in the form of career prospects or pay – enjoyment-based motivations account for most of collaboration. However, controlling for these factors turned out to be more difficult than imagined at first. The emergent results of participant's activities and interactions influence their education, networking and life experiences, which may bring extrinsic rewards. In F/OSS development, this may help us understand Hann et al (2002) finding that salaries from Apache developers correlate with rank, but not with participation itself: some of the extrinsic benefits from collaboration emerge from the experience as a whole, and not only from developing more lines of code.

Regarding the second research question, we can conclude that gaming elements – and particularly immersion – also might play a role as motivations for F/OSS development. Optimizing for fun (as proposed

by Luthiger and Jungwirth 2007) means not only providing optimal challenges for developers and a clear and understandable project vision (to generate "flow") but also taking immersion into account and considering the way the programmers may influence the outcome (even if through collective negotiations) and the feelings of autonomy and relatedness. Some of these elements are already being taken into account in F/OSS development practices. For instance, prototyping and short release cycles are ways in which programmers may exercise their autonomy and creativity by testing (and even possibly discarding) new ideas.

The research also showed that one side of the immersion in ARGs is in the concept of escapism, which may also play a role in F/OSS development. Just like stories in ARGs create a reality with a clear and engaging meaning, Lerner and Tirole's (2002) notion of career signalling implies that collaboration in F/OSS reduces the complexities of social and technical skills and aptitudes to a proxy: code. For those with enough programming skills, it might be tempting to "escape" to a universe where the rules favour their aptitudes.

One of the most important conclusions is the importance of building communities, services of infrastructures based on fun. Enjoyment-based motivations have been shown to be the most important driver for collaboration in Wikipedia (Nov 2007) and the second most prevalent motivator for customizing and inventing new products for personal use in the United Kingdom (Von Hippel et al. 2010). It is possible that many of the psychological, political and social elements that emerge in ARGs and F/OSS development communities also play an important role in a wide range of communities that are based on intrinsic motivations. Some examples includes the concepts of "commons-based peer production" (Benkler 2006), "cognitive surplus" (Shirky 2010), Wikinomics (Tappscott and Williams 2006) and crowdsourcing (Howe 2008).

This research has some limitations. First, the case study was focused on the most active participants of the ARG. A more comprehensive analysis of the players could yield other kinds of insights and even different analogies. And second, the results of this research could be perfectly assigned only for a subset of all contributors in F/OSS development projects and the analogy would not be work less for programmers that are paid to develop F/OSS, for instance, are known to rely less on enjoyment-based intrinsic motivation.

The findings also suggest some topics for future research. It is important to verify these findings with empirical research in F/OSS communities. We also

need a more comprehensive theory of the foundations of the concept of fun in collaborative and pervasive projects, its foundations and its dynamics with extrinsic motivators (“Is the fun really gone when you pay people to collaborate?”). This way, we can not only have a better understanding of what is behind F/OSS development and other online productive communities, but also create new infrastructures able to maximize the potential of these groups.

References

- Benkler, Y. (2006) *The Wealth of Networks: How Social Production Transforms Markets and Freedom*. New Haven, London: Yale University Press.
- Benbya, H. and Belbaly, N. (2010) Understanding Developers’ Motives in Open Source Projects: A Multi-Theoretical Framework. *Communications of the AIS*. Forthcoming.
- Csikszentmihalyi, M. (1991) *Flow: The Psychology of Optimal Experience*. New York, NY: Harper Perennial.
- Deci, E. and Ryan, R. (1985) *Intrinsic Motivation and Self-Determination in Human Behavior*. New York, NY: Plenum Press.
- Dourish, P. and Bell, G. (2007) The Infrastructure of Experience and the Experience of Infrastructure: Meaning and Structure in Everyday Encounters with Space. *Planning and Design* 34(3). pp. 414-430.
- G1 (2007) Em plenário, senador critica empresa fictícia. <http://g1.globo.com/Noticias/Politica/0,,MUL16083-5601-6017,00.html>. (accessed 22 August 2010).
- Hemetsberger, A (2004) When Consumers Produce on the Internet: The Relationship between Cognitive-affective, Socially-based, and Behavioral Involvement of Prosumers. <http://opensource.mit.edu/papers/hemetsberger1.pdf>, Working paper.
- Howe, J. (2008) *Crowdsourcing: How the Power of the Crowd is Driving the Future of Business*. New York, NY: Crown Business.
- IGDA ARG SIG (2006) Alternate Reality Games. <http://igda.org/arg/resources/IGDA-AlternateRealityGames-Whitepaper-2006.pdf>. Whitepaper. (accessed 27 August 2010).
- Juthe, A. (2005) Argument by analogy. *Argumentation* 19(1). pp. 1-27.
- Kim, J., Lee, E., Thomas, T. and Dombrowski, C. (2009) Storytelling in new media: The case of alternate reality games, 2001–2009. *First Monday* 14(6). <http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/2484/2199>.
- Krishnamurthy, S. (2006) On the intrinsic and extrinsic motivation of free/libre/open source (floss) developers. *Knowledge, Technology & Policy*. 18(4). pp. 17-39.
- Lakhani, K. R. and Wolf, R. (2005) Why Hackers Do What They Do: Understanding Motivation and Effort in Free/Open Source Software Projects. In Feller, J., Fitzgerald, B., Hissam, S. and Lakhani, K. (Eds.) *Perspectives on Free and Open Source Software* (pp. 3-22). Cambridge, MA: MIT Press.
- Lerner, J. and Tirole, J. (2002) Some simple economics of open source. *The Journal of Industrial Economics* 50(2). pp. 197-234.
- Lindenberg, S. (2001) Intrinsic motivation in a new light. *Kyklos* 54(2-3). pp. 317-342.
- Luthiger, B. and Jungwirth, C. (2007) Pervasive Fun. *First Monday* 12(1). <http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1422/1340>.
- Mcgonigal, J. (2006) This Might Be a Game: Ubiquitous Play and Performance at the Turn of the Twenty-First Century. Ph.D. Thesis, University of California, Berkeley.
- McGonigal, J. (2007) Why I Love Bees: A Case Study in Collective Intelligence Gaming. http://www.avantgame.com/McGonigal_WhyILoveBees_Feb2007.pdf. White paper. (accessed 22 August 2010)
- McGonigal, J (2008) Making alternate reality the new business reality. *Harvard Business Review* 86(2). p. 29.
- Montola, M. (2005) Exploring the edge of the magic circle: Defining pervasive games. Proceedings of DAC. IT University of Copenhagen, Denmark.
- Montola, M. and Waern, A. (2006) Participant roles in socially expanded games. PerGames workshop of Pervasive Conference. University College Dublin, Ireland.
- Nov, O (2007) What motivates wikipedians? *Communications of the ACM* 50(11). pp. 60-64.
- Open Source Initiative (2010) The Open Source Definition. <http://www.opensource.org/docs/osd>. (accessed 23 August 2010).
- Raymond, E. (1999) The cathedral and the bazaar. *Knowledge, Technology & Policy* 12(3). pp. 23-49.
- Roberts, J.; Hann, I.-H. and Slaughter, S. (2006) Understanding the motivations, participation and performance of open source software developers: A longitudinal study of the apache projects. Marshall School of Business Working Paper No. IOM 01-06.
- Scacchi, W. (2002) Understanding the requirements for developing open source software systems. *Software, IEE Proceedings* 149(1). pp. 24-39.
- Shirky, C. (2010) *Cognitive Surplus: Creativity and Generosity in a Connected Age*. London: Penguin Press.
- Stewart, S (2008) Alternate Reality Games, <http://www.seanstewart.org/interactive/args>. (accessed 23 August 2010).
- Szulborski, D. (2005) *This Is Not a Game: A Guide to Alternate Reality Gaming*. Raleigh, NC: Lulu Press.
- Tapscott, D. and Williams, A. D. (2006) *Wikinomics: How Mass Collaboration Changes Everything*. New York: Portfolio.
- von Krogh, G., Spaeth, S., Haefliger, S. and Wallin, M. (2008) Open source software: What we know (and do not know) about motives to contribute. DIME working papers on intellectual property rights. http://www.dime-eu.org/files/active/0/WP38_vonKroghSpaethHaefligerWallin_IPROSS.pdf. (accessed 27 August 2010).
- von Hippel, E. and von Krogh, G. (2006) Free revealing and the private-collective model for innovation incentives. *R&D Management* 36(3). pp. 295-306.
- von Hippel, E., de Jong, J. and Flowers, S. (2010) Comparing business and household sector innovation in consumer products: Findings from a representative study in the UK. <http://ssrn.com/abstract=1683503>.
- Weber, S. (2005) The political economy of open source and why it matters. In Latham, R. and Sassen, S. (Eds.) *Digital Formations* (pp. 178-211). Princeton: Princeton University Press.
- Ye, Y. and Kishida, K. (2003) Toward an understanding of the motivation of open source software developers. *25th International Conference on Software Engineering*. Portland, Oregon.
- Yee, Nick (2007) Motivations of Play in Online Games. *Journal of CyberPsychology and Behavior* 9. pp. 772-775.