

A Process Model of Co-Creation as an Approach to Information Systems Development

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Abstract

This paper investigates the development of a digital game on a social media platform which involved primarily youths as co-creators. We applied a process model for crowdsourced development as a framework to understand information systems development (ISD) as co-creation in a not-for-profit environment. Using innovation theory we further discuss why co-creation fostered the co-creators to successfully carry out the investigated project. On this background, we provide lessons learned for practical use.

Keywords: Co-creation, information systems development, process model.

1. Introduction and Research Setting

The research presented here is part of a larger project that investigated the concept and the role of co-creation in information systems development (ISD) based on different frameworks. In this article we report on the application of one of these frameworks. The overall objective of our research is to contribute to a better understanding of ISD in practice. ISD is traditionally recognized as a technical process and dominated by normative techno-centric and engineering approaches [9]; however, research has recognized that ISD is not just a rational, methodical and controlled process, but more an adaptive, agile, and emergent process [7]. Recently, co-creation in ISD, in particular in open source software and community-based service systems [11] has also gained some wider interest as web technologies enable businesses, governments and people alike to collaborate [1]. Much of the literature on co-creation reports on research conducted in commercial, predominantly e-commerce environments [6,16]. In such environments co-creation has been used in a variety of ways to develop new products and services, to evaluate ideas and to propose solutions [6].

There is limited research on Non-Government Organisations' (NGO), organisations that are neither a part of a government nor conventional for-profit businesses, utilisation of information technology (IT) compared with for-profit organisations [3]; their use of IT generally is less advanced compared to for-profit organisations [3]. The United Nations Children's Fund (UNICEF) is one such NGO for whom it is vital that their information reach as many people as possible. UNICEF (Pacific)¹, a UNICEF chapter, has recognised social media's value particularly for distributing important information on matters such as health, emergencies, education and climate change [14]. UNICEF (P) were challenged by Pacific youth to be 'younger and less boring' in using social media. UNICEF (P) thus invited Pacific youth to participate in different roles in the co-creation of an information system, a Facebook-

¹ For the remainder of the article we will refer to UNICEF (Pacific) as UNICEF (P).

based game [5]. In this paper, we present this project as a case study of co-creation as an approach to ISD in a NGO environment with limited resources, with a number of youth, on a social media platform to answer the research question ‘how is co-creation as an ISD approach performed, in particular in a NGO environment with limited resources and with a number of youth on a social media platform?’

For this purpose we use the metropolis model, a process model for the management and development of crowdsourced information systems [11] as an analytical framework. The framework emphasizes characteristics, principles, roles and relations of as well as implications for the co-creation process. We analyse the project in terms of the metropolis model and specifically discuss the actual occurrence of its elements and their impact on the course of the project and its outcome. The remainder of the article is structured as follows: Section 2 introduces the theoretical background and analytical framework. Our research approach is explained in section 3, and the case narrative is provided in section 4. Section 5 includes the analysis of the co-creation process in the case setting. Section 6 discusses our findings and their implications for research and practice. We conclude with our conclusions and a summary of our contributions in Section 7.

2. Theoretical Background

We take our starting point in the work of Kazman and Chen [11] who focus on the co-creation process. They identify two major forms of crowdsourced systems, open source software development and community-based service systems and propose a process model for the management and development of co-created and crowdsourced information systems. They call this model the metropolis model as they liken this form of producing systems to constructing a city rather than a single building, cities are not built by a single organisation, have no or only little centralized control concerning the building process, and are continuously evolving. The characteristics of the co-creation process of crowdsourced systems are [11]: (1) open design and development teams with little or no central control and management, (2) unstable resources where contributors come and go and work is not necessarily assigned but chosen by mostly self-selecting participants, (3) creation by composition, known as mashability, (4) conflicting, a priori unknowable requirements, (5) continuous evolution of the systems under development, (6) a focus on operations, (7) a settlement for sufficient correctness and acceptance of ongoing incompleteness, and (8) complex emergent behaviours of the systems under creation beyond the vision of their co-creators. Different stakeholders have different roles within such co-creation processes and the authors distinguish three realms of roles within their model, kernel, periphery, and masses. Examples for roles involved in the kernel include designer, architect, business owner, or policy maker. Roles at the periphery include developer and prosumer, someone who both produces and consumes the outcome of the co-creation process. Roles for the masses include customer and end user. These characteristics are underpinned by seven principles of development:

1. Crowd engagement and egalitarian management of open teams - which typically consist of volunteers - through an infrastructure and rules to create the social and technical mechanisms to engage in long-term participation, encourage community custodianship, recognize merits of individuals, and to protect the community from malicious participants. Crowd management supersedes conventional project management and is hardly top down.
2. A bifurcated architecture divided into a kernel infrastructure and a set of peripheral services created by different groups through different processes. Kernel services are designed and implemented by a select set of highly experienced and motivated developers who are themselves users of the product. These services provide a platform on which subsequent development is based. The architecture of periphery components is enabled and constrained by the kernel, it is otherwise unspecified.
3. Bifurcated requirements are split into kernel service requirements that deliver little or no end user value and periphery requirements contributed by the peer network of prosumers that deliver the majority of end-user value. The nature of the requirements is different,

kernel service requirements concern technical quality attributes and their trade-offs, while periphery requirements mostly concern end user functions.

4. Fragmented implementation where a distinct group, not a crowd, implements the kernel, while the periphery develops at its own pace, to its own standards, using its own tools, releasing outcomes as it pleases, and co-creators contribute their own resources and adhere hardly to any deadlines but their own. There is no overarching implementation plan and schedule and no coordination of the activities of the periphery.
5. Distributed testing through a dispersed network of testers where verification differs. The kernel must be highly reliable, highly controlled, and slow to change whereas the reliability of the periphery is indeterminate with sufficient correctness acceptable.
6. Distributed delivery and maintenance where these activities differ for kernel and periphery. The kernel must be stable and backwards compatible. At the periphery there is no stable system state, gradual and fragmented change is typical with a constant stream of independent, uncoordinated releases.
7. Ubiquitous operations to allow for continuous access to the outcomes of the co-creation process.

The implications of these principles are to [11]: (1) focus on crowd management, (2) separate kernel from periphery, (3) increase attention to architecture, (4) change the requirements process, (5) plan for distributed testing, (6) create flexible automated delivery mechanisms, and (7) plan for high availability operation.

3. Research Approach and Method

Our research follows the interpretive paradigm. Given the limited literature concerning the role of co-creation in ISD and how it unfolds in our particular context, our investigation is based on an exploratory, qualitative, single case study [4]. While it is often stated that it is not possible to generalise and certainly not to theorise from a single case study, Walsham [15] suggests that it is possible to generalise case study findings among others in the form of a contribution to rich insight. On this background we used the features of the process model for our data analysis. The roles and length of stay in the field varied for the four authors of this paper. The fourth author has been involved in the project as a reflective practitioner [13] throughout the whole period. As the UNICEF (P) communications specialist and project sponsor, he was involved as the overall project co-coordinator at all stages of the project. He shared correspondence and provided reflections on the process. As an employee and insider he enhanced the depth and breadth of understanding the case setting that may not be accessible to a non-native researcher [8]. The third author also participated during the whole project, as an involved, accompanying [15] researcher impacting the design and development of the game. Given the background of these authors the purpose of the research presented here was to investigate in a less unbiased manner how co-creation takes place in practice. Thus, the first and the second author acted as outside observers [15] and were included in the reflective process. They conducted interviews with the involved researchers and independently analysed all available empirical material. The combination of intervention, interpretation, and collaboration between the three academic researchers and the fourth author was chosen to bring interpretive rigor to our analysis. In line with the research topic and the interpretive approach, our understanding of co-creation in the game development project has come about through an iterative process of interpretation, comparison and connecting of prior research and empirical data. Our data collection and analysis were guided by the framework which allows studying the co-creators, their roles and relationships, their interactions, and the process by which co-creation unfolds.

Given the distributed location of the co-creators the extensive email trail between the different co-creators was the main data source. These emails contained status information, reflections before, during and after the development and implementation of the game, conceptual feedback, reflections and recollections concerning input into the design of the

game, the elements of climate change which it was addressing, test results as well as technical feedback. The empirical data also comprised social media postings by the four Fiji adolescents who served as facilitators between the technical development team and the juvenile Pacific crowd and their responses to the request for input. Project documentation such as the UNICEF (P) strategic plan for digital engagement, its project description, brief and evaluation as well as a terms of reference document were included as valuable data sources as were the field notes by the sponsor and the accompanying researcher.

Further empirical data for the study was collected through semi-structured, open-ended interviews conducted by the accompanying researcher with the three members of the technical development team and by the outside researchers with the accompanying researcher concerning her role and experience during the co-creation project. The developers were interviewed for about 45 minutes in length with the interviews focusing on the issues around the co-creation process and their reflections as co-creators on the project. The issues included how they undertook the development process, how they managed the interactions with the other co-creators, the mechanisms for communication and how they incorporated new ideas and change requests. The interviews also explored how the developers generated and refined their ideas particularly in relation to the sponsor's brief and explored their motivations for becoming involved apart from the modest amount they were paid.

We wished to achieve an interaction between the existing literature and our observations from the case setting to explain interrelationships and contribute to theory with new insight from practice that might be useful for scholars and practitioners. Our analysis takes its starting point in September 2010 when the project was conceived and ends in August 2011. As a first step in the analysis, we produced a timeline spanning that period and a case narrative which is included here in a condensed form. We then returned to the literature and identified the metropolis model as one of two suitable conceptual frameworks². It provides a perspective which views co-creation as a dynamic process where the co-creators and the organisational setting in which they operate impact on each other and cannot be separated from each other to make sense and provide an understanding of the nature of co-creation. The next stage involved revisiting the narrative and the empirical data. By mapping the co-creator concept on the roles and relationship concept, we identified the co-creators and their relationships. Then we mapped the data onto the management and development process model's characteristics and principles and categorised our findings accordingly. Using the metropolis model as a framework helped us to increase our understanding of ISD practice and to identify and characterise co-creation as significant in the context of the development process in the case setting. Before providing a more detailed analysis, we next present a narrative account of the investigated project.

4. A Narrative of the Co-creation Process

We identified five phases of the project: 1 Initiation of the idea and funding; 2 Establishment of the team; 3 Conceptual design of the game; 4 Development of the consolidated game; 5 Launch of the consolidated game.

Phase 1 – Initiation of the idea and funding

Mid 2010 the communications specialist at UNICEF (P) proposed a project to the organisation. He was concerned that although UNICEF (P) had a strong social media presence and was regularly communicating with their audience via social media, two-way interaction was very limited. His vision was to engage youth through encouraging them to participate in a co-creation project via social media. Given the threats posed to small Pacific Islands from climate change the proposal was to develop a co-created game which would help Pacific youth to learn more about how to respond to climate change. He put this proposal to

² The other framework was Zwass' taxonomy for an integrated research perspective on co-creation [16].

Commonwealth of Learning (COL), a Commonwealth of Nations organisation, in November 2010 which provided modest funding early January 2011. The communications specialist who was located on the Pacific Islands immediately approached the third author of the paper in Melbourne, Australia who was known to him from previous collaboration with a request to join the project to help establish and manage if necessary a development team. This led to the second phase.

Phase 2 – Establishment of the team

In January 2011 the third author approached three research students in her network who fulfilled the position requirements. These accepted the invitation and were in the same month appointed as the developers for a period of 30 working days with an original project runtime from February 1 to April 15, 2011. Two of them were Chinese by birth and one was from Bangladesh. One developer was living in Hong Kong, another lived in regional Victoria, Australia and the third member was living in Melbourne. The latter two knew each other, but they did not know the third developer on beforehand, nor did they meet this developer in person during the project. The sponsor's first e-mail to the development team described his vision and what he wanted to achieve: the game was not to be about climate change, but about how people could respond to its impact. In January 2011, the Sponsor identified and contacted four adolescents from Fiji to be social media facilitators for soliciting and gathering ideas from Pacific Youth about the game. The Social Media Facilitators posted a photo with a message inviting input on the game and launched this as a Facebook album with text encouraging UNICEF (P) Facebook fans to participate and to contribute to the design of the game. Input and comments came from 16 fans, as well as 15 fans hitting the 'like' button. During the same period the accompanying academic facilitated a process among the members of the core development team and the Sponsor who also acted as project co-ordinator where protocols for how the development team would operate were agreed on. The Sponsor was happy for the developers to manage the project themselves in terms of ideas for the game and how the work was undertaken. The developers' first meeting was a telephone conversation about how they would manage the process given they were geographically dispersed. They agreed that they would email each other every couple of days to cater for the quite short timeline for finalising the game. They also planned to use Skype to talk regularly and instant messaging and chat to communicate. Although there was no formal team leader, the student from Bangladesh quickly became the person who took charge. She kept minutes of the meetings including the decisions that were taken, the next discussion topics and who would be responsible for determining what the tasks would be. The tasks were reviewed at each meeting confirming what had been done and establishing the next tasks and responsibilities. At the end of each meeting an email summarising progress was sent to the Sponsor by the informal leader. He reviewed the progress, and if he thought there was something that needed to be changed or wanted to provide feedback, he would email the informal leader or alternatively he called her using Skype. Brief notes were taken from the Skype meetings focusing on any requested changes.

Phase 3 – Conceptual design of the game

The first stage of development was to reach agreement on what the game would be and its look and feel. One developer researched relevant aspects of climate change, another looked at different approaches to and types of Facebook games and the third investigated appropriate technologies, tools and development approaches. As the development of ideas for the game progressed the Sponsor was sharing these ideas with experts from the funding organisation, climate change experts and UNICEF staff. Input from these groups was sought on the direction of the game. Further information on climate change was also provided on a regular basis by relevant experts to the Sponsor. The Sponsor provided the feedback including the ideas of the involved Pacific youth provided through the Facebook page and facilitated by the

four adolescents from Fiji to the developers. The requirements of the Sponsor and ideas of the key stakeholders, Pacific youth, and UNICEF (P) staff, guided the developers. The team used the following process to decide on their final game: At the beginning the Sponsor asked the developers to think about some ideas. They gave themselves a week to open their minds to brainstorm and think about every idea without technology constraints, and then collected their ideas to see which of these ideas could be combined together. This led to three major ideas; each with a particular focus from one of the developers which reflected what they individually thought what the youth and UNICEF (P) should concentrate on. This resulted in the game which consisted of three sub-games. Each sub-game was quite different in the way that the players would interact; the CO2 Reducer Challenge requires players to identify potential CO2 emitters; the Evacuate Life Challenge requires players to understand the climate change threats and initiate action; the Flood Tales Challenge highlights the causes of floods and the need for flood mitigation. An important design principle was to ensure that each game was not too complicated. The developers found the fan page postings very helpful. The responses from the Pacific youth had suggested that the game needed to be very interactive, interesting and colourful; it should have graphics, be fun and focused on action, something which promoted to be positive and to make change.

Phase 4 - Development of the consolidated games

After the developers and the Sponsor had agreed on the consolidated game's design, development proper, including detailed design, coding, testing and evaluation could begin. The development team took an active role in ensuring input in the form of further information. Feedback was managed effectively and encouraged further participation by the Sponsor and UNICEF staff. As there was no opportunity to discuss, elaborate and clarify ideas and concerns face to face with anyone except the Sponsor every piece of information and communication had to be very concise. As the team members were working independently and each component of the game was developed separately, several issues concerning the different build and layout of the consolidated game arose during this phase. The Sponsor and UNICEF staff reviewed the first version of the consolidated game and provided feedback; this included the colours, fonts and graphics, the text and help provided with the game. He highlighted that further work was needed on standardisation and how the three components linked together to be one game. The Sponsor also reinforced the need for the links to further information be embedded in each game. Technical testing and evaluation were iterative. The developers each first conducted technical unit and system testing to uncover programming errors. Each developer tested the work of the other two and provided feedback. The game was functionally tested by UNICEF (P) staff that played the game and provided feedback to the Sponsor. A technical person within UNICEF also tested the consolidated game and provided technical feedback once the team had incorporated the earlier feedback. The developers were asked by the Sponsor to find a platform to run the game on, and they decided on Google which had a free service. Further user evaluation similar to user acceptance testing was undertaken by three friends of the developers in China who were young and used Facebook. They played the game and provided advice, suggesting that the graphics and artwork needed to be still more attractive. They thought players would be encouraged to play longer if the game was even more interesting. The social media facilitators also provided feedback along these lines, suggesting the game be more colourful and easier to play. All feedback was considered, further changes made and the final version of the game was ultimately accepted by the Sponsor.

Phase 5 - Launch of the consolidated game

An email to various international UNICEF groups announced the launch of the game in July 2011. The game had a favourable reception as many positive comments on what had been achieved were made by UNICEF worldwide, Pacific youth and Facebook fans. A press release [14] showed UNICEF's positive assessment of the initiative. Postings on the UNICEF

(P) fan page highlighted how successful the game was with requests for the game to be translated into Pacific languages and to include it on the Madagascar UNICEF page. Voices of Youth, a UNICEF organisation designed to support young people requested that they embed the game on their website. Lastly, the launch event marked the end of the project for the development team and sparked the developers' pride about their achievement. The consolidated game is now in use and distributed through three other Facebook sites.

5. Analysis

We now apply the metropolis model [11] as a framework when appreciating the game development project as a co-creation process.

5.1 Co-creators roles and relationships

The Fiji-based UNICEF (P) Sponsor held a central role as a co-creator in the kernel of the co-creation process. Not only was he the initiator of the process, he also interacted with all other co-creators with varying intensity except for the Testers and the Pacific Islanders Youth Requirements Contributors. In the kernel he was the ultimate decision maker and approver of the intermediate and final result and he filtered requirements and feedback from the UNICEF Headquarter, the Fiji-based UNICEF (P) staff, and the international Climate Change Experts. His interaction with the COL resulted in the monetary support for the co-creation process. The Developers can also be considered as part of the kernel. They provided the functional and technical design of the consolidated game, its components as well as the programming and technical testing. They interacted intensively with each other, with the Sponsor, as well as with the Social Media Facilitators. They were the only co-creators to interact with the Chinese Testers whom they had attracted, and who can be considered on the project periphery. The Australia-based Facilitator recruited the Developers and provided them both with project management and information systems development knowledge and advice, but after an initial phase did not interact intensively with them until research data after the project were collected. In the initial phase she belonged to the core as she interacted regularly with the Sponsor advising him on the project's feasibility and providing competent developers on short notice and within the available budget. Later she became more of an observer with occasional interactions, having little influence on the process and the product. She thus moved into the periphery of the game development endeavour.

The Social Media Facilitators are difficult to place. They definitively played a crucial role in providing requirements as individuals and as gatekeepers and inter-actors with the Youth Requirements Contributors who were fans of the UNICEF Facebook page established by these facilitators. Their intensive interaction with the Sponsor as well as directly with the Developers with regard to requirement provision and with feedback on the game's intermediate and test versions, might qualify them as kernel members. However, beyond filtering the youth requirements despite their valuable contributions, they had limited decision power and thus confined influence on the ultimate outcome of the process. Therefore they might be considered as being in the periphery. Equally difficult to position is the role of the Pacific Islanders Youth who provided ideas and requirements for the game, but were only to a limited extent actively involved in the evaluation of the intermediate game versions. They might thus be placed in the periphery of the process. However, as they were self-selected, they might also be considered as part of the masses, putting them on the border between the periphery and the masses. Thus, although not developers, the Pacific Islanders Youth represented prosumers, consumers and end users. The other co-creators are easier to categorise. The COL's only contact with the project was the Sponsor to whom they provided modest monetary resources for the development work. They had limited, but important influence on the process and thus can be viewed as members of the periphery. The same is true for the UNICEF Headquarter which provided general advice concerning the game development. Equally involved, but important in the periphery were several international

Climate Change Experts who interacted both with the Sponsor and the other Fiji-based UNICEF staff to provide knowledge that is accessible and interesting for youth about climate change in general and in particular in the Pacific region. Last, the other Fiji-based UNICEF staff interacted with the Climate Change Experts and with the Sponsor. They provided requirements, but were also actively involved in the design and evaluation of the game. Though influential, their involvement was more informal and casual, thus we see them in the periphery of the process. The analysis of the co-creators, their roles and relationships reveals a complex network of geographically dispersed actors which figure 1 depicts.

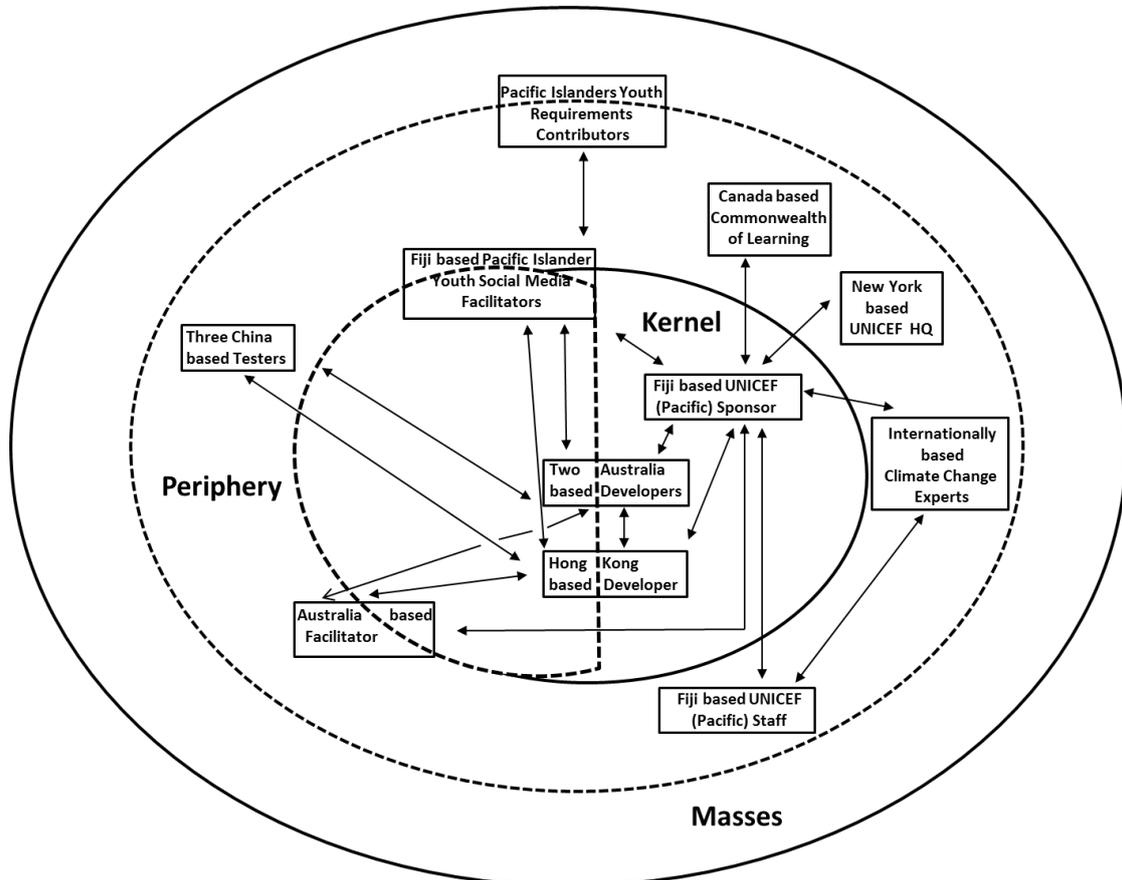


Figure 1. The Roles and Relationships of the geographically dispersed Co-creators

5.2 Co-Creation Process Characteristics, Management Principles, and Implications

The game development exhibits some similarities and attributes of an open team. The UNICEF Sponsor initiated the project, but it was not solely organised around him. Although he was the ultimate decision maker, he was supported by different facilitators and the developers who had been preselected, and who were regularly consulted and took certain decisions independently of him. This might hint at a closed team of dedicated members. This resembles a kernel of a small group of tightly co-ordinated, cooperating and at times controlled collaborators who focus on core tasks and functions which allowed for uncoordinated activities at the periphery as is customary in crowdsourced systems development. The project was open for other co-creators as evidenced by the Requirements Contributors, the UNICEF Headquarter and Fiji-based staff who were not selected or formally appointed. Upon a general call for participation they all voluntarily joined the process to provide requirements, feedback and content. Accordingly, the principle of crowd engagement applied. Facebook was used as a technical infrastructure and mechanism with both the Social Media Facilitators and the Sponsor representing the social mechanism implementing the rules of engagement with the crowd and the links to the Developers. In this respect the project was not managed primarily top-down, but rather egalitarian with regard to the different groups of

youth involved. The same applied for the Sponsor's relationship to the Developers. Although he had the decision mandate, he spent his time more co-ordinating the Developers' work than strongly directing them. The Developers had a flat, egalitarian management structure where one of them, self-appointed and accepted by the other two, co-ordinated their work internally in their team. This implied that though dealing with a small crowd and what could be characterised as a semi-open team, the process had considerable focus on crowd management. The crowd management was executed by the Social Media Facilitators, to some extent by the Developers, and mostly by the Sponsor through communication, negotiation, leadership and guidance. It handled the input from unknown people at disparate locations and the work of the partly self-governing Developers over whom little or no control could be exerted to co-create the game.

The project separated kernel and periphery in the project's organisation with different groups of participants being involved in different development tasks. It did not technically distinguish between kernel and peripheral software and thus did not apply the principles of bifurcated architecture and requirements as described in the original model. However, the project organisation with a kernel of, among others, three loosely collaborating, independent Developers resulted in a modified form of bifurcated architecture. This consisted of three, modular-structured, independent sub-games and bifurcated requirements, in the shape of three sets of varying demands. For the requirements however, the principle of bifurcated requirements with a common kernel for a standardised user interface and diverse, specific requests for the formation of each sub-game was ensured. The principles of bifurcated architecture and requirements were implemented through the described form of separation of kernel and periphery, and separation within the core and implied, if not an increased, as outlined, a focussed attention to architecture.

Although the Sponsor had a very clear vision and overall requirements which he expressed at the start of the project, the project had to deal with the unknowable and unknown requirements of the Pacific Islanders Youth Fans when they independently provided requirements for, and evaluations of, the game under development. The same is to some extent true for the input from the Testers and the contributing staff. Handling such requirements lead to a change in the requirements gathering and analysis process, in which the Social Media Facilitators and the Sponsor largely acted as two layers of brokers who filtered requirements. The Sponsor only handed those requirements which he deemed appropriate over to the Developers. Sometimes this structure however was broken and direct communication between the Social Media Facilitators and the Developers took place to clarify certain requests. Although to a lesser extent than in widely open systems development, with crowdsourced contributions from thousands of participants, unknowable requirements as a characteristic of crowdsourced systems are related to the characteristics continuous evolution and emergent behaviours. Continuous evolution took place in the confines of the project where the game was under constant, iterative agile development which took new requests and changes into account. Eventually it reached a state where it was declared stable and finished and ready to launch with no further immediate development occurring. With regard to emergent behaviours, a particular instance demonstrates this characteristic: Neither the Sponsor nor the Academic Facilitator considered involving other young people such as the Testers or the Requirements Contributors in further feedback cycles on the design and early versions of the game, the idea emerged during the Developers' interactions and was put forward to the Facilitator and the Sponsor. When subsequently applied, feedback such as avoiding finger pointing to what should have been done instead of pointing to future solutions, and depicting people in the game to look like Pacific islanders was provided and changed the game and its behaviour accordingly.

Unknowable requirements as well as continuous evolution and emergent behaviours are related to the principles of fragmented implementation, distributed testing, and evaluation, and distributed delivery and subsequent maintenance. The game development project did not follow the principle of fragmented implementation in its original sense which usually takes place in the periphery of crowdsourced systems development. The periphery did not perform

any technical development work, but rather contributed unknowable, fragmented requirements. Distributed testing, or more precisely evaluation was executed for functional and acceptance testing, while technical testing was performed by the core development group with a few UNICEF staff also performing this type of test. Thus no extensive plan for distributed testing needed to be developed. The game, once approved, was launched on the Facebook platform, the same platform was used to distribute early versions of the game for evaluation, thus again, no further flexible or sophisticated automated delivery mechanism for the game as necessary for large scale crowdsourced systems was needed.

From the outset, the project emphasised reliability and public accessibility, thus it had a focus on operations. That was the reason why Facebook as a platform which was popular with the target audience was chosen. Facebook guaranteed high availability based on the numerous tests and evaluations which also ensured that the game could be played with sufficient correctness. This approach implemented the principle of ubiquitous operations although beyond these measures no extensive plan for high availability was needed or developed.

The co-creation process also had to some extent to deal with unstable and rather limited resources. The instability of resources mostly played out at the periphery where the Requirements Contributors and the various UNICEF staff joined and left the project as they wanted, whereas the resources in the kernel were stable, but scarce given the small amount of monetary remuneration and available time. Here the management principles of crowd engagement and management, bifurcation and distributed testing and evaluation with their accompanying earlier described implications and effects contributed to the positive outcome of the co-creation process.

Finally, mashability, though may be not to the same extent than in large-number co-creation projects, can also be traced in the process. The Developers included links to other information resources and used accessible code from other games. They integrated it into the game and related to the issue at hand from other sources. They also shared code between them.

6. Discussion

Our analysis provided an in-depth understanding of the game development project as a co-creation process in a not-for-profit environment. Ours is a case of genuine co-creation through NGOs and mainly youth in an ISD project of a digital game with which we empirically confirm the usefulness of the metropolis model by Kazman and Chen's [11] as a framework. The analysis of the co-creators reveals a complex network of geographically dispersed actors in a transient project organisation. Placing the co-creators was demanding as some co-creators could not simply be placed in one category; they could be placed in several categories and held ambiguous roles. The principles of as ubiquitous operations were followed as proposed. Others such as crowd engagement and management of open teams were adjusted to the project context of a small crowd and semi-open teams. Some principles such as bifurcated architecture and bifurcated requirements were modified as the project did not distinguish between kernel and peripheral software, but consisted of three modular sub-games based on three sets of varying demands. As the game was not further developed after its launch principles of fragmented implementation and distributed maintenance were not relevant.

In an environment characterised by web-technologies and social media, crowdsourced development is an effective complement to more conventional forms of co-creation in ISD such as selected user representatives when the users are known or personas [2] as substitutes for representatives of a more general unknown user population. As our case shows for ISD projects that want to engage the crowd, it can be beneficial to consciously consider the principles and implications stated in the metropolis model for keeping in mind that a principle such as ubiquitous operations paired with distributed delivery of a constant stream of releases of systems which are continuously evolving is a challenge for ISD.

The project was considered successful by all stakeholders. To accomplish a more exhaustive explanation and to answer why co-creation in ISD played out the way it did and was successful in the presented case as well as to draw more general lessons learnt, we move

beyond mere description. Madsen et al. [12] emphasise the significance of organisational structure, individual participants' characteristics as well as the interplay between social context and social process for the successful enactment of ISD methods as organisational innovation. Considering the described network of organisations and individuals as an organisation and drawing on innovation theory we find that the co-creation process as an approach to ISD bears the characteristics of such an organisational innovation.

From this perspective co-creation worked in this instance because of the distinctly identifiable categories of co-creators and their role distribution. Especially given the UNICEF Communication Expert and the three Developers in the core of the project acted as individual leaders, champions and mediators in terms of the chosen development and design approach and as contact to the other groups of co-creators, a responsibility which has been identified as decisive for the successful utilization of innovations. The Youth Social Media Facilitators were intermediaries for the Youth Requirements Contributors; the Social Media Facilitators comprehended their assignment as true representatives of the Youth Requirements Contributors and backed up by the Communication Expert and the Developers their understanding as facilitators and communicators strongly supported the other youth's pronouncing of opinion and gave them an influential voice.

This had an impact on and led to an effective social process, another facet of thriving innovation, which focuses on the interaction of the engaged stakeholders. The interaction between the different stakeholder groups went well: The Communication Expert had contact with most other co-creator groups especially other UNICEF staff and Climate Experts as additional resources, the Developers included a group of Testers in the project, and the Social Media Facilitators extended the project to other youth and interacted intensively with the Communication Expert and the Developers. The distribution of power, the second characteristic of a well-functioning social process, provides further explanation: The Communication Expert held a clear mandate and authority to ultimately decide on all design matters and used these based on the valued input and work of the Developers and the Social Media Facilitators who themselves exercised a great amount of individual autonomy when performing their individual tasks to the satisfaction of all other co-creators. This led to genuine co-creation and controlled a possible dominance of the development team.

In this setting, good social relations and a social infrastructure consisting of a broad range of different, highly motivated co-creators made up the social context in which co-creation could thrive. This was ultimately supported by a structural context in which a sophisticated governance and project structure had been set up where co-creators could be distinguished as members of a kernel, a periphery, and the masses and which partnered up different co-creator groups. In addition, a communication structure with weekly and further regular virtual meetings had been implemented. In this setting the development approach had been clearly communicated and shared with the principal sponsoring organisation, the Communication Expert, the Developers, and the Facilitators.

This environment helped to overcome project challenges such as the distribution of the co-creators over different geographical and time zones, limited time resources, high change rate, and evolving Developer competences. The Communication Expert's and the Developer's close interaction with each other and the other co-creators compensated for minimal documentation and for the limited number of tests and helped resolving any issues concerning the Developers' growing competences. Together with the communication structure it also managed the high change rate.

7. Conclusion

In this paper, we investigated the question how co-creation as an ISD approach is performed and how it unfolds in the case of a not-for-profit environment. Our analysis shows that the metropolis model can be fruitfully applied as a framework in a new context to understand what co-creation is and how, when and where it can be performed as an instance of ISD practice. By drawing on innovation theory we provide an additional argument of how and why

co-creation contributes to the successful game development project. The presented framework can be used to prepare for co-creation, while recognizing that the actual course of an ISD project will evolve with the situation.

We recognize that our study is exploratory and that the game development project belongs to a special class of development project, which may limit the generality of our findings. We also acknowledge that knowledge gained through case studies may not be formally generalizable but, like others [15], we contend that this does not mean that it does not contribute to the collective body of knowledge, both academic and practical, of a discipline. Further research, which applies and refines the framework, is necessary to allow for more theorising about co-creation in ISD. As the process model refers to concepts such as continuous evolution and emergence complex adaptive systems theory [10] might provide further explanations for how and why co-creation is a viable approach to ISD.

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