Digital inclusion requires a business model too

Sustainability analysis of value webs in rural Sarawak

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ABSTRACT

In this paper we discuss how to improve business sustainability of services for digital inclusion through value modeling and analysis using the e^3-*value* method. Two questions come up: is this method understandable and useful in practice for ICT4D practitioners and developers, and is this method instrumental for development of sustainable services for digital inclusion? To answer this, three ICT4D student projects were carried out, that aim to improve digital inclusion in communities in Sarawak, Malaysia. Results show that the e^3-*value* method is easy to learn and use in practice. It is instrumental (i) for visual conceptualization, facilitating discussion and co-construction of different business scenarios; (ii) it allows to assess potential profitability in the value web; (iii) for optimization of the system design (iv) to analyse strengths and weaknesses in the value network in terms of digital inclusion.

KEYWORDS

Digital inclusion, low resource environments, value webs, e^3-*value* methodology, business sustainability

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1 INTRODUCTION

As the recent global crisis is showing us vehemently, digital inclusion is now more important than ever before. Digital inclusion refers to idea that everyone has access to information and communication technology (ICT), and more importantly, that everyone can provide and use services provisioned by that technology. Unfortunately, large part of the world population, about 3 billion people, are still digitally excluded. Often, these people live in low-resource environments, where nevertheless many useful applications of ICT, often information services, can be envisioned. Examples of information services for digital inclusion we developed in the past include messaging services, weather monitoring services, trading services, and services for citizen journalism [1]. These are in line with the Sustainable Development Goals, notably SDG10, the goal to reduce inequalities.

ICT-services need a business case, which justifies why the ICT service at hand should be developed and offered at all. We formalize such a business case in terms of a conceptual model using the e^3-*value* language [3], and call the resulting model the *business* model of the *eco-system*. The business model shows all relevant actors (economically independent parties) as well as what they exchange of *economic* value with each other. A business model is *viable* if *all* actors can create a profit by participating in the business model. An eco-system is a collection of actors that work cooperatively and competitively to satisfy customer needs [8, 11]. Taking an eco-system perspective leads to inclusion of *all* required actors for the business case, and not just a single enterprise providing a service. It makes it possible to analyze the effects for all actors in the value web.

Many digital inclusion projects are funded by national or international development agencies or private donors (e.g. the Worldbank, UNESCO, USAID, DFID, SIDA, Postcodeloterij etc). Donor funds are valuable to kick-off digital inclusion projects, but as at some point in time donor funding will stop, the project should then become 'self-supporting' in the sense that it generates sufficient cash-flow to keep the service up-and-running after donor funding disappears. In practice, this is often problematic. Many donor-funded projects are designed according to global policies, and not directly by the actual service needs of the to-be included beneficiaries. Donor-funded projects for Digital Development have a track record of not surviving after the project period [4, 6, 7]. Once donor funding is not available anymore, the technology becomes useless because the funds required to operate and maintain it are not taken care of anymore.

In this paper we argue that in order to achieve *financially sustainable* digital inclusion, the eco-system and its business model of the inclusion project should be understood, and moreover should convince that each actor in the eco-system can participate in a financially sustainable way. Ideally, the design and analysis of the business model should happen at the beginning of the digital inclusion project, and not in the aftermath, because the business model significantly influences the design of the system's architecture.

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In sum, when we talk about business sustainability of projects for digital inclusion, we have three things in mind: (i) that the envisaged solution keeps running after the end of a pilot phase/ initial funding phase (ii) that it can exist/survive as a service over a longer period of time (with or without input financing) or (iii) that it is adopted/adapted/diffused and starts to expand in number of users, i.e. that it becomes part of an eco-system.

This may be different, depending on the sector. For example: ICT services in the educational and health domains may always have to rely on public funding schemes, whereas projects for social entrepreneurship will have to look for customer funds. Given the lack of sustainability of many projects for digital inclusion in low-resource regions in the world, the question is, how to develop for sustainability, knowing that success of a service depends on a combination of the immediate benefit a service brings to its user/customer, and on its affordability.

We have used an eco-system, and business model-oriented approach for digital inclusion in three projects in Sarawak, Malaysia. To make this paper self-contained, in Sec. 2 we summarize the e^3-*value* method for business modelling of eco-systems. In Sec. 3, we present the setup and contexts of these projects. Sec. 4 illustrates the projects. Finally, Sec.5 provides a discussion and our conclusions.

2 VALUE MODELING

To understand and assess value models (informally called business cases) of ICT-services, which are offered in eco-systems – networks of actors who create value for end-users – the e^3-*value* value modeling method was developed. This method was inspired by the dot.com bubble in 2001, a period in which many new ICT-services were set up, a large number of which without solid business case, which led, in various cases to bankruptcy. Over the years the e^3-*value* method has been applied in a variety of sectors and industries. It proven useful for the development of commercial ICT services, amongst others in the field of Internet Service Provisioning (ISP), energy supply, clearing of intellectual property rights, and government services like e-customs. Recently the e^3-*value* method has been applied for sustainability evaluation of digital inclusion projects in poor regions of the world. Since digital inclusion projects in the Global South are situated in a completely different setting, this is an additional validation for the e^3-*value* methodology.

Fig. 1 briefly explains e^3-*value* for a project we executed in Africa. *Actors* (profit-and-loss response parties or end-users who want to enjoy services to satisfy a goal) are represented as rectangles (e.g. Telco). If there are many actors of the same kind (e.g. Customer, Village Reporter), we use the notion of *market segments*, depicted as three stacked actors. Actors may have a *need* (visualized as a bullet eye), for example the customer has the need to do an announcement, e.g. that he lost his cow. To satisfy a need, actors, and thus also market segments, can exchange things of economic value, called *value objects* with each other. For example, the customer *receives* the right to place a (broadcast) announcement via the radio, and pays money for this to the village reporter. This reporter is a representative of the radio station, who broadcasts the announcement and pays a fee. Value objects are exchanged via *value ports*, as visualized by triangles that connect the *value transfers*. These represent the *willingness* to transfer (in terms of ownership or grant the right to enjoy the service outcome) the value object from the one actor to the other, provided that there is a *reciprocal* transfer that compensates the providing actor with someone else of higher perceived value. Reciprocity is modelled by the concept of *value interface*, depicted by the rounded rectangles, enclosing the value ports. The value interface prescribes that in case of a value transfers, *all* other ports should transfer value objects too, or none at all. The double bullet eye in the FB (voice platform) service provider models that no additional value transfers are considered anymore. Value transfers relate to actors, whereas the *dependency path* relates to value interfaces, needs and boundary elements inside an actor. If that path is followed, starting by the need and ending at the boundary element, and traversing to the next actor by means of the value transfers, all required value transfers to satisfy a particular customer need can be found.

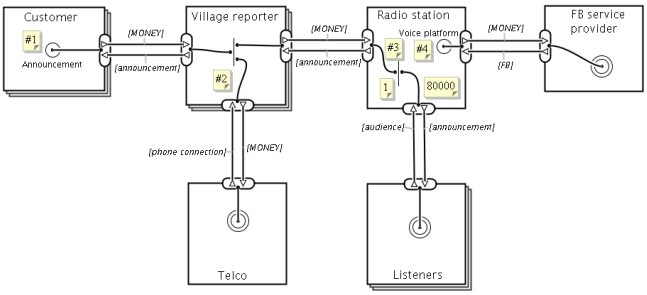

Figure 1: An e^3-*value* business model of a broadcasting eco-system for announcements in Africa

In terms of sustainability assessment for the eco-system in Fig. 1, a few observations can be made.

(1) In order for parties to be sustainable, the fee to be paid by the village reporter by the radio station should be lower than the fee to be paid by the customer to the village reporter. If this is not the case, the village reporter will not generate a positive cash flow, as he has only outgoing cash flows, and hence the business model will not be sustainable.
(2) The money that the village reported earns by collecting announcements from inhabitants of the village he lives in, should at least outnumber the fee he has to pay to the Telco for having and using a mobile phone subscription.

The model shows the importance of considering the business case *at the beginning* of the use case development. In the case the project would be donor-funded (e.g. by subsidizing the village reporter), the project would possibly survive the pilot phase, but fall apart apart once donor funding ends, because the village reported would suddenly stop to receive an income.

The e^3-*value* method can be used to make *qualitative* observations about financial sustainability, like above, but all elements in the business model can also be quantified. For example, the number of customers can be estimated, the number of times they want to do an announcement, and the fees to be charged. In practice however, it takes already some effort to produce a correct qualitative model, which then can be followed by a quantitative model.

3 SETUP AND CONTEXT

The past few years, we had the unique opportunity to explore new business models for digital inclusiveness in Sarawak, Borneo, Malaysia. A group of about twenty master students from the Netherlands and Malaysia, were divided into groups of 5-6 students. Each group had to explore and design an information service to improve digital inclusiveness of the poor in Sarawak.

One of the first steps was to envision (which is actually the creative and usually the hardest part) for which they had to develop a business model using the e^3-*value* methodology. Before they started, they were lectured for two hours about the e^3-*value* method for business model design of eco-systems. Also, during execution of the method, they were actively supervised by us. At the end, they had to deliver a report, amongst others including the e^3-*value* model for their case, as well as a textual explanation. We were interested in the following questions:

- Can the students, within a limited time period of four weeks come up with a reasonable e^3-*value* of the case at hand? In this same period, they also had to come with an ICT design and working prototype supporting the eco-system they had designed. Specifically, we are interested if the model is syntactically correct, if the model is from an e^3-*value* modelling perspective complete, and finally if the model is an adequate representation of the application domain at hand.
- Is the e^3-*value* method instrumental in developing a service addressing the digital excluded persons? In other words, does it help to make these models, and what is its added value in the development of services for digital inclusion?

4 THREE CASES FROM THE FIELD

In this section the use of the e^3-*value* method in three ICT4D student projects is discussed: Bannatree [10], Appong [5] and Majunet [9], carried out in one month, two of which in 2018 and one in 2019. The projects were carried out according to a collaborative, iterative, adaptive method which is dubbed ICT4D 3.0 [1]. They consisted of one month of context analysis, needs assessment, requirements analysis, prototype design and testing, evaluating and business sustainability analysis, i.e. the full life cycle of information system development. The sustainability analysis was only one of the various tasks of the project [2].

4.1 The Bannatree project

This project consists of design and deployment of an information system to increase the income of banana farmers in Sarawak, Malaysia by enhancing efficiency in the banana value chain. In Sarawak, Malaysia, the government has started a contract farming program as a means of improving export of local products, while increasing the standard of living and income of farmers. Contract farmers plant and harvest bananas called 'pisang sekaki', which are sold to a small local factory, where they are being processed into banana chips for export. A brief context analysis showed that, coordination between farmers and factory and planning are inefficient due to lack of timely and accurate information. Poor planning leads to harvest loss, unnecessary waste of product and disinvestment, especially for the farmers. The BannaTree application consists of a platform to balance supply and demand between farmers and factory, and enhance planning.

Case description. As the main purpose of the project was to facilitate the governmental project to support contract farmers, the costs of the envisaged platform would be, in its start-up or pilot phase, covered by the government, as a government-funded ICT-project. However, if the platform leads to increased efficiency and production while leading to a higher income for the farmers and factory, a clear business case for the banana factory would exist. The students built three different models of the current situation (without information system), the (government-funded) pilot situation and the envisaged sustainable situation.

The constructed model. Figs. 2 and 3 represent two alternatives with respect to the Bannatree eco-system. In Fig. 2 the assumption is that the project is of interest to the people of Sarawak and hence the government funds. In the second model (Fig. 3), the factory funds.

The model for the Bannatree project is not a free and open value network, hence, not a classical example of a value network in which independent actors interact to provide a service to the market. Still, the model provides insight in the value network and makes it possible to conceptualize the process in terms of value exchange and operational goals of each actor.

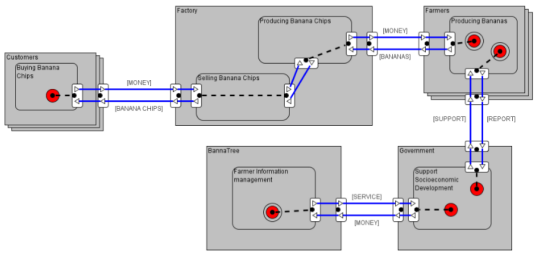

Figure 2: An e^3-*value* business model for the Bannatree project with government funding.

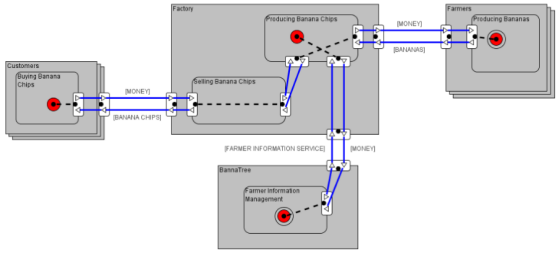

Figure 3: An e^3-*value* business model for the Bannatree project funded by the factory.

Quality of the model. The two e^3-*value* models for the Bannatree project (Figures 2 and 3) are syntactically correct. In terms of completeness, a so-called *cardinality dependency element is missing.*

Concretely, one (cardinality) banana results in many (cardinality) chips. This is not adequately represented in the models.

Although the models are not very complicated from a business perspective, there is however a complex story behind it of diverging interests between the different stakeholders, that is uncovered by the process of construction of the models. Through knowledge elicitation interviews of the developers with the stakeholders, during the analysis of the case, the e^3-*value* methodology helped to clarify these diverging interests to the farmers. Additionally, the model showed through various scenarios that the dependency of the contract farmers on a single point of sales holds a risk for them of being exploited.

Is the model instrumental in addressing digital inclusion? The e^3-*value* method in this project gave room for discussions about the barriers experienced by the contract farmers in the value network. Although the e^3-*value* models for this use case are very simple, analysis and group discussions about the different business scenarios provided insight into the – sometimes conflicting – operational goals of the different actors, and the implications for the most vulnerable actors. The ethical aspects of the process were discussed and considered.

4.2 The Appong project

Case description. *Gula apong* is a traditional Malaysian sugar, produced in the public mangrove forests, along the shores in Sarawak, Malaysia, by independent smallholder farmers. They do the harvesting of the juice from Nipa palms in the forests. Gula apong is produced and packed manually at home, in the small suburban communities and sold locally. A farmer produces on average 20 kg gula apong per day. This gives a family a modest but steady income. Since the local demand for gula apong seems to exceed current production, the government of Sarawak wants to stimulate production, as this type of small-scale farming has a positive effect on the conservation of the forests [5] and provides poor communities with an income. To do this, the government needs more insight in the extent of the mangrove forest that are used for production and the area which is not being exploited. With this information, the government will be able to assign new producers to the unused areas in the mangrove.

From the perspective of the farmers, and given the local demand for gula apong, the community-based sales is inefficient. The sales is dominated by middlemen who buy at the community and sell the gula apong at a much higher price. A (mobile) digital platform that could replace the middlemen, might help to connect buyers and producers directly. The Appong platform consists of a combined mobile web-shop and monitoring system to analyse the business case. The web-shop aims to increase sales of gula apong. The monitoring facility allows the government to monitor the commercial process in order to support and expand the production area for gula apong.

The constructed model. The e^3-*value* model for the Appong use case, see Figure 4 showcases the interaction between consumers, producers, and service providers. It demonstrates that Appong platform can provide a web-shop service, which in turn will give gula apong producers bigger market visibility. Producers have to

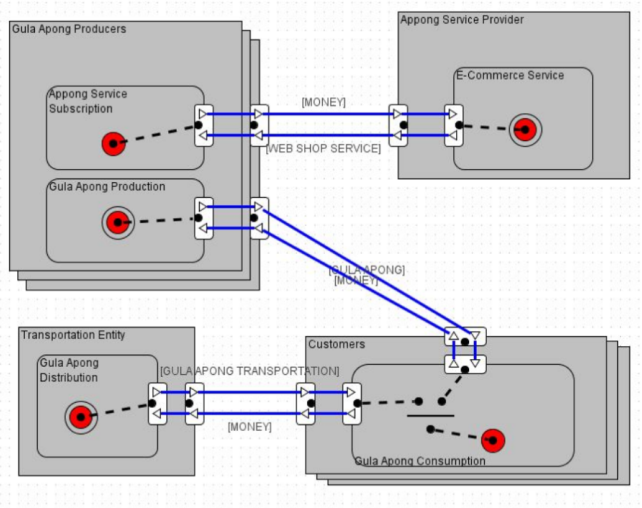

Figure 4: An e^3-*value* business model for the gula apong value chain.

pay a fee or subscription to get access to this service (to help the project remain sustainable). The middlemen are left out of the model, as the platform assumes such a role.

Quality of the model. The model is syntactically correct and in terms of completeness, it gives an impression of the high-level ecosystem business model. If the model would be put into operation, it would useful to include more actors in the model, e.g. the government, who has a societal interest in the gula apong production, and e.g. payment service providers.

The rounded rectangles inside the actors are in e^3-*value* called *value activities*. These activities are not just operational activities that we know from process modelling, but require that at least one actor can execute them in a financially sustainable way. This requirement holds for nearly every displayed activity, except for the 'Appong service subscription'. This activity could better be merged with the 'Gula Apong Production' activity as the 'Appong service subcription' is only a cost (and not a revenue) activity for the 'Gula Apong Production' activity to do its work.

Is the model instrumental in addressing digital inclusion? As in the Bannatree project, the methodology to construct the e^3-*value* models was instrumental to analyse the network of stakeholders, their operational goals in this business. The methodology also made room for discussions about different future scenarios, that might provide the farmers with a better market position, about the current barriers (e.g. lack of digital access, a middlemen dominated market due to digital exclusion of the communities in rural Sarawak.) Discussions with the stakeholders showed that the platform, when scaled up, would also facilitate better cooperation between gula apong producers in Sarawak. This shows the advantage of e^3-*value* method to inform decisions in future business development.

4.3 The Majunet project

Case description. The Majunet project aims to improve income of women in small communities in Sarawak, who are starting up a

new value activity: packaging of local farming products for export, through user-centered design of an efficient, web-based management information system that also functions as a communication platform for different internal and external stakeholders of this business. The business analysis for the Majunet project has therefore a larger scope than just the envisaged information system.

The constructed model. The *e*^{3}*-value* model for the Majunet project is exemplar for a donor-funded project (in this case the local government of Sarawak is the donor). It shows the value activities of all suppliers and their operational goals but it still lacks customers. The envisaged packaging business could run only because there is donor funding involved, which can be useful, also as a learning project. The *e*^{3}*-value* model is useful as a thought experiment, in which different future business scenarios can be evaluated, with donor funding and without.

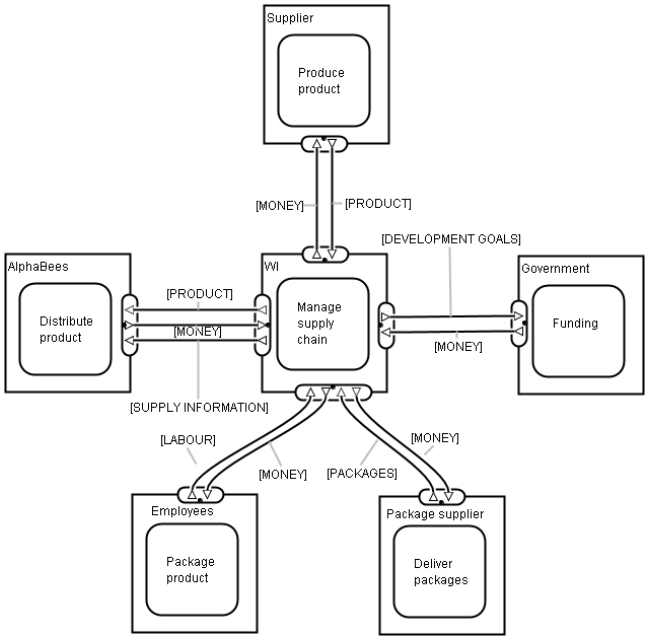

Figure 5: An *e*^{3}*-value* business model for the Majunet project and platform.

Quality of the model. The model in Fig. 5 is syntactically correct but not complete. Specifically, it lacks customer needs, boundary elements and dependency paths. As a result, the model does not represent which value transfers happen as a result of a customer need. Therefore, the model is only useful for a global understanding of the business model of the eco-system, for doing qualitative observations, but does not allow for quantitative analysis. Also, it lacks the distinction between market segments (many actors of the same kind) and individual actors For example, the actor 'employees' should have been modelled as a market segment because the eco-system includes many employees instead of just one.

Is the model instrumental in addressing digital inclusion? The *e*^{3}*-value* model in the Majunet project should be considered as a first model that should mature further. From the three cases discussed in this paper, the Majunet case exploration had to start with just a vaguely articulated business idea. The other two cases started with already a better defined business idea, and hence are therefore more refined. So, this model plays a slightly different role, namely the very first exploration of a business idea for digital inclusion. It does at least show the main actors involved as well as the services they provide to each other, which was not at all clear at the beginning of the project. The model also covers a larger scope than the development of an information system in the narrow sense. It makes the students reflect on the total value chain, and ask the important questions to the stakeholders, to understand the different interests of the stakeholder groups (business partners, government, workers).

5 DISCUSSION

The three student projects, carried out in a community-service learning setting in rural Sarawak, achieved their (learning) goals, which were ambitious given the context, which is novel and unfamiliar for many of them. The project reports show that the concept and use of the *e*^{3}*-value* method was easily picked up by the students. The *e*^{3}*-value* method provided them with a light-weight, easy to use approach to analyse sustainability of emerging value webs in low- resource environments. It made them aware of the wider perspective, beyond the user-centered interface design. By visualizing the stakeholders in the network and showing their value exchanges, it made them able to analyse stakeholders' goals. This revealed potential conflicting interests, as shown in the Bannatree project. By doing the analysis in a co-creative setting – involving also stakeholders: farmers, local experts, government) – the method facilitate the discussion about project goal and interests, as shown for the Bannatree and Appong projects. The models allow to compare different scenarios. This can be used to inform decision-making, for example how to act when donor-funding would stop, as in the Bannatree and Majunet projects. The analysis reveals strengths and weaknesses in the value network, for example in the Bannatree project, the vulnerable position of the contract farmers, or the role of the middlemen in the Appong project. This allows to jointly think and discuss the complete ecosystem. In the given examples the quantitative analysis function of the *e*^{3}*-value* analysis tool was not used, but in the future this can lead to better predictions of potential profitability in the value network.

An important aim of this analysis is that it will provide insight to influence actual decision making, and that it may lead to the implementation of better, feasible, but also more inclusive business models. An important question is in particular how this is (to be) done, and how it will benefit most vulnerable of the actors in the network. This obviously requires some more time than in the above described one month projects for a full information system development life cycle. This is on the list for the near future of this ongoing research program in ICT for Digital Inclusion.

6 CONCLUSION

The three projects from Sarawak have shown added value of using *e*^{3}*-value* as a methodology for analysis of sustainability of emerging value webs in low resource environments. The *e*^{3}*-value* method,

as used in the three field pilot cases from Sarawak, was easy to learn in a short period and could be used and applied to the cases in the field practice. The method has shown to provide (i) a visual conceptualization of the value network that facilitates the discussion and allows co-construction of different business scenarios, (ii) insight in value for each of the stakeholders in the network; (iii) to inform decision-making as to select the best possible scenario and optimize the service from the stakeholders' perspective (iv) give insight in strengths and weaknesses of a value network in terms of digital inclusion. This shows that it is instrumental and can be added as an integral part of development of sustainable services for digital development.

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REFERENCES

[1] Anna Bon. 2019. *Intervention or Collaboration? Rethinking Information and Communication Technologies for Development.* Pangea, Amsterdam, The Netherlands. 1–255 pages.

[2] Anna Bon, Jaap Gordijn, Hans Akkermans, Victor de Boer, André Baart, Cheah Wai Shiang, and Sze San Nah. 2019. Community-Centered, Project-Based ICT4D Education in the Field. In *15th International Conference on Social Implications of Computers in Developing Countries, ICT4D 2019.* Springer, New York LLC, 386–397.

[3] Jaap Gordijn and Hans Akkermans. 2018. *Value Webs - Understanding e-Business Innovation.* The Value Engineers, Soest, The Netherlands. 214 pages. https://www.thevalueengineers.nl/product-category/publications/e3value-ref/

[4] World Bank Group. 2016. *World Development Indicators.* International Bank for Reconstruction and Development, Washington, USA. https://openknowledge.worldbank.org/bitstream/handle/10986/23969/9781464806834.pdf, retrieved 31-05-2020.

[5] Kuan Huiggy, Giorgi Kikolashvili, Judith Schermer, and Chris Valladares. 2018. APPong, an application that provides an overview of the Gula Apong production in Sarawak. *W4RA Student Papers* II, 1 (2018), 1– 62.

[6] Mario Marais. 2011. Analysis of the factors affecting the sustainability of ICT4D initiatives. In *Proceedings 5th IDIA Conference: ICT for Development: People, Policy and Practice, Lima, Peru, 26 - 28 October 2011.* IDIA, CSIR, Pretoria, South Africa, 100–120. https://researchspace.csir.co.za/dspace/handle/10204/5374, retrieved 31-05-2020.

[7] Isabel Meyer and Mario Alphonso Marais. 2015. Design for Sustainability: Countering the Drivers of Unsustainability in Development Projects. *The Journal of Community Informatics* 11, 3 (2015), 1–21. http://www.ci-journal.net/index.php/ciej/article/view/1169/1161, retrieved 31-05-2020.

[8] James F. Moore. 1996. *The death of competition: Leadership and strategy in the age of business ecosystems.* HarperBusiness, New York. xiii, 297 pages.

[9] Kishan Jayant Nirghin, Alex Zhiluen Fong, Mun Lok Tang, Derek van den Nieuwenhuijzen, and Roz Sabir. 2019. *ICT4D Project: Information Management System for Repackaging Business.* Technical Report 2. Network Institute of Vrij Universiteit Amsterdam. 1–20 pages. https://w4ra.org/wp-content/uploads/2019/08/MajuNet_paper_reducedsize2019.pdf, retrieved 31-05-2020.

[10] Allard Oelen, Aron Van Groningen, Amir Azizi Musa, Deva Ramakrishnan, Hameedat Omoine, and Linh Tran. 2018. *BannaTree: an Information Management System for Banana Contract Farming.* Technical Report 3. UNIMAS, Sarawak, Malaysia. 1– 32 pages. https://w4ra.org/wp-content/uploads/2018/07/ICT4D-Field-Banana-case-use-V2.pdf, retrieved 31-05-2020.

[11] Roel Wieringa, Wilco Engelsman, Jaap Gordijn, and Dan Ionita. 2019. A Business Ecosystem Architecture Modeling Framework. In *Proceedings of CBI 2019.* The Value Engineers, The Netherlands, 1–10.