INTERNATIONAL JOURNAL ON INFORMATICS VISUALIZATION

Value-based Modeling and Simulation for Sustainable ICT4D

Akindoyo Oluwatosinloba Omotola [a], Cheah Wai Shiang [a,*], Muhammad Asyraf bin Khairuddin [a], Nurfauza binti Jalil [a], Eaqerzilla Phang [a]

[a] *Faculty of Computer Science & Information Technology, Universiti Malaysia Sarawak, Sarawak, 94300, Malaysia*
Corresponding author: *wscheah@unimas.my

Abstract—**ICT4D is an acronym for information and communication technologies for development. This acronym represents the many initiatives that are now being carried out in underdeveloped countries all around the globe. These technology-oriented initiatives aim to promote the growth and prosperity of the regions they serve. People from the local community often volunteer their time to serve as program managers when NGOs or governments give funding. The term "sustainability" describes an information and communications technology's capacity to carry out a development project even after the initial funding has run out. The e3value technique will be broken down in this article so that we may better understand how it works. Using various tools for value-based modeling, this method is utilized to create an e-Business model. However, one of the main problems with e-business technologies is that they often get insufficient data to be effective. This study aims to examine the procedures that must be followed to learn more about an e-Business concept and mold it into a form that would allow for its implementation in a technologically and commercially practical manner. In order to gather information on the Long Lamai community's economic activities, a survey is being used in this research. The net value sheet for each of their businesses is then stimulated utilizing the data using E3 value. Initial findings indicate that 5 out of 13 enterprises' net incomes are negative, and each of those five businesses has its roots in a local enterprise. However, the figure does not consider labor costs, taxes, or long-term investments made with government money. We continued the stimulation with sensitivity analysis and scenario-based analysis, which results in total revenue of 1,410,000 for the five enterprises in the fourth year after accounting for taxes and fees in the sensitivity analysis. This opens the door for further research into how discrepancies in wealth and income may arise in the simulation of an economy due to the right use of ICT for long-term development and prosperity. Profitability sheets may be created if certain business model assumptions are specified, such as the monetary value of the commodities produced, distributed, and consumed. These may be used to decide if the project can become profitable for all parties concerned.**

Keywords—**ICT4D; financial sustainability; value-based modeling.**

I. INTRODUCTION

Failure and lost resources are the results of investing time and effort into the construction of something only to find out that it cannot be maintained after it has been built [1]. The topic of sustainability in information and communication technology (ICT) projects and services has been noted as a problem in a number of studies [2]. The current generation's requirements must be met for projects that use ICT for sustainable development to succeed. However, this must be done at the expense of the potential to satisfy the needs of future generations. The study of information and communications technology (ICT) for development should cover not only the technology but also the people involved, their needs, and the implementation approach [3]. Concerns relating to the environment, the economy, and society must

also be considered for the project to succeed, be carried out, and be viable over time. A feedback loop, innovations, continual evaluation of the link between the project and society, and progress monitoring are all components of a sustainable information and communication technology project, all contributing to the project's continued sustainability and influence. It is necessary to assure the economic feasibility of ICT activities if one wants to guarantee the financial sustainability of such efforts [4].

Every ICT for Development project must be conceived with the paradigm of financial sustainability in mind. This necessitates considering the project's monetary effect before and after its deployment. Recent happenings have made it evident that several different attempts at e-business have been unsuccessful [5]. As part of our study, we are acting out a model of the ICT4D organization's financial situation to conduct an economic analysis of the organization. The E3

value obtained via value-based modeling is used here. Our e3-value ontology is grounded, on the one hand, on an analysis of how various network participants produce, transmit, and consume economic value [6]. The e3-value ontology, on the other hand, is predicated on requirements engineering and the conceptual modeling approaches that it underpins, both of which were developed in the field of information technology [7].

II. MATERIAL AND METHODS

The methodology adopted in this research is an action research approach. Action research is a process where researchers and practitioners are actively involved in activities like problem identification, action intervention, and reflective learning [8]. It explains what happens in an organization or business and can be used for ill-structured problems, of which an e-commerce project is one. The first step in developing e-Business ideas is to understand such an idea thoroughly. In the recent past, the industry has demonstrated that such an understanding lacks or at least is insufficient, resulting in failures and sometimes bankruptcies [9]. In this chapter, we present an approach to designing an e-Business model called the e3-value approach.

A. Construction of E3 Value Model for Financial Sustainability Analysis

The baseline value model for the idea will be constructed first. The steps involved are listed below:

1) Operational scenario identification: It is possible that the first thing that must be done in order to reach an agreement on a certain concept about e-commerce is to define and record that concept using operational scenarios. Use Case Maps, often known as UCMs, provide a graphical depiction of the many scenarios that we have developed [10]. The progression of a situation is often represented in UCMs via the use of the idea of a route. Junctions, triggers, and control nodes connect route segments. A route describes which value interfaces must carry valued items in response to an initial stimulus or past exchanges [11].

2) Actor identification: The concept's creators and their (ultimate) consumers were used to generating a list of possible participants. After a few rounds, we may eliminate or add names when we understand the different sorts of e-commerce players. Named actors have publicized corporations, whereas role players are end consumers (non-named actors). At this point, environmental agents may be identified. It is not important to us whether or not they make a profit (although we do anticipate that they will), but their participation is required for the value model to function properly. When another actor in the model requires a value object source, this kind of environmental actor is brought into the model [12].

3) Actor versus market approach: If a standard cast of characters is provided, we examine their mutual aid. Both "market-driven" and "actor-driven" tracks are advantageous in this sense [13]. The actor-driven route in e-commerce starts with a single central actor and describes its offers to and from its surroundings, as well as value interfaces, value ports, and

objects. The value transaction parties are identified. This method is used when one person starts an online transaction. Market-driven channels begin with a comprehensive e-commerce proposition [14]. After deciding which actors and items to trade, we may define the value transfers inside the wider actor-network. These interactions provide value interfaces, offers, and access points for many parties [15]. The market-driven method works effectively when a group comes up with a proposal, which is increasing.

4) Value object identification: Value items reveal what an actor provides or accept in return for something else in the actor and market tracks (market track). One player values the goods. Therefore, a transaction does not need equal values. Assigner affects item value greatly [16]. To locate riches, we follow three rules: This three-part series discusses economic reciprocity, causal value objects, and e-commerce scenario analysis [17]. Online commerce and diverse situations should provide attractive items. If anything valuable is found, stakeholders may be invited to contribute. Healthy economic conduct requires trading goods or services of equal or higher value. We may call any value-containing object as a result. We look for value relationships with a shared cause. A player needs a causally connected source of value to affect its surroundings—similarly, a company. Everything must be bought [18].

5) Grouping value ports into value offerings and interface: Actor-oriented value ports supply or request value objects [19]. Ports should indicate whether they supply or request objects. People exchange valuables in a market-based track. Value ports end transactions. Grouping value port options. Object exchange can only occur simultaneously by combining all value ports into one offering. Value offering considers several things. Some things are only valuable when combined. Inbound offerings include port trades. In their settings, actors can only put connected items—exportable ports. Mixed packing means leave. This suggests a person wants to sell stuff together to make more money. Value interfaces combine an actor's value. Economics has models. We may combine value offerings using the reciprocity heuristic [20]. Value interfaces don't include causal ports and offers. A value interface might have two meanings. Port guidance equals guidance. A fair individual merely swaps items, o_{in} must be greater than o_{out}.

6) Scenario path identification: Along with hypothetical events, customers are supplied with value components to trade. Starting with this prerequisite. We link the first stimulus to a section with a responsibility element that interacts with the value interface to show that an actor must exchange value via a value interface. When an actor has many options to meet demand, an OR-fork connection element and segments link the initial stimulus to each value interface's obligations. Linking the OR-fork to the necessary segments does this. Two actors must use both value interfaces while exchanging value objects [20]. The scenario chain uses a second scenario segment and a responsibility element. No additional transactions are needed when the scenario path reaches an end-stimulus [21].
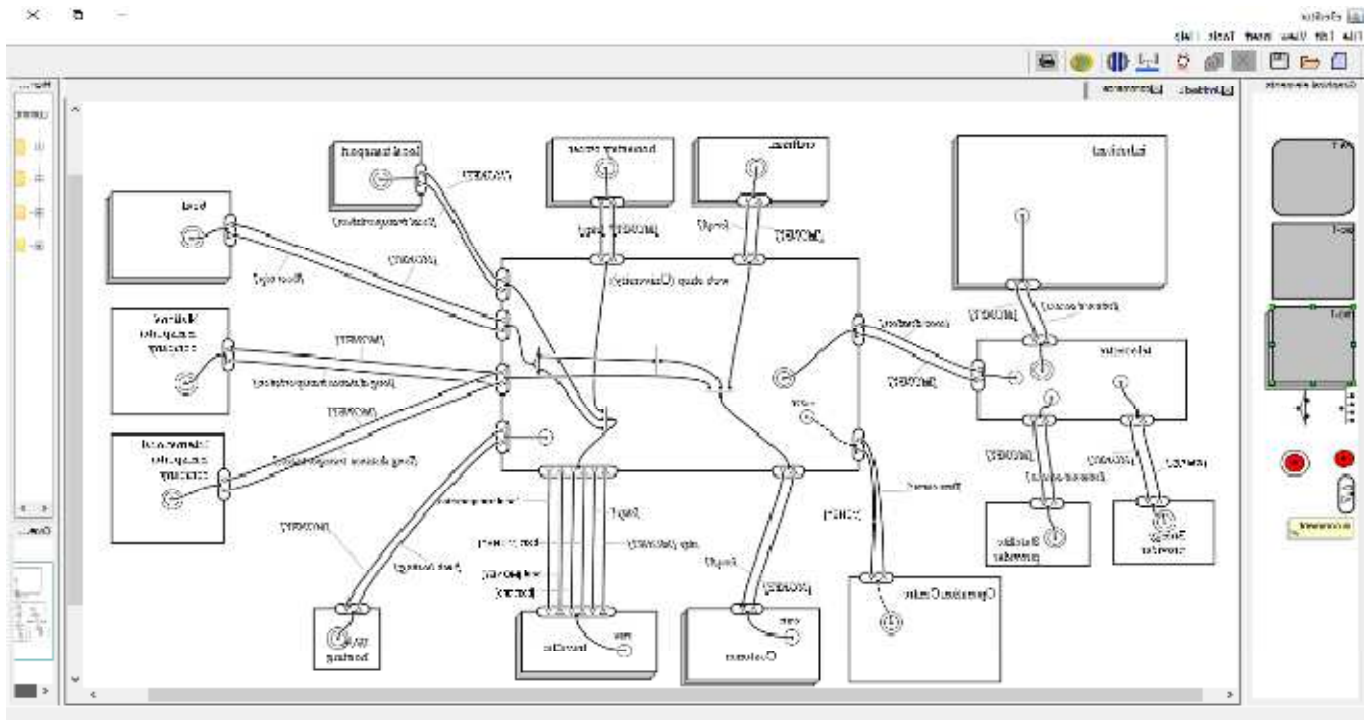
Fig. 1 Ecommerce model using e3value for financial sustainability.

Money transfers from one person to another are shown in Figure 1, together with returns of commodities and services. It detects and analyzes the process by which value could be formed, then exchanged and consumed by numerous parties to indicate what was transferred, and it does so to identify what exactly was transferred. Every agent makes a transaction that transfers some kind of economic value, such as money, goods, services, or abilities, back to the original sender. Actors participate in value exchange with one another via the use of value ports and the transmission of value objects to one another. Actors each have unique links and events, such as the beginning of a valued stimulus, the midst of a value transaction, and the conclusion of the stimulus itself [22]. We surveyed and interviewed community people to gather information about the region's existing financial and commercial activity.

B. Assessing Economic Sustainability

Some of the topics that are discussed in this chapter include. On a per-actor basis, economic sustainability is determined by:
- Counting how many values transfers there are.
- Assigning monetary value to items of value gained and made available.
- Multiplying the number to get a net value flow, the number of value transfers multiplied by the value objects transferred.
- Creating a net value flow sheet by combining various value flows.
- Discounting net value flow sheets to correctly account for the sake of temporal value
- Sensitivity analysis of value structures

III. RESULTS AND DISCUSSION

A. Net Value Sheet for each Actor in E3 Value

Table 1 illustrates that 'online shopping (university)' and 'consumer' exchange value. The prior transaction suggests a product-for-money exchange. The artist expects 200 people to buy something for RM76. The analysis will indicate that clients who are inclined to buy things in Long Lamai are prepared to pay for the villagers' services. In return for money, they received crafts worth RM-76.

TABLE I
NET VALUE FLOW SHEET FOR 'CUSTOMER'

Value Interface	Value Port	Value Transfer	Occurrences	Valuation	Economic Value	Total
vi94:{MONEY, craft}			1		-76	
	vp37: out: MONEY	ve100: MONEY	1	76	-76	
	vp38: in: craft	(all transfers)	1	0	0	
COUNT	200					
INVESTMENT					0	
EXPENSES					0	
Total for actor						-76

Table II shows one of the means through which villages might create income while simultaneously achieving financial independence. It is customary for you, as a traveler, to spend money on certain items and services, such as transportation,

food, hotel, and other conveniences that will make your time away from home more enjoyable. Therefore, a stay of this time in Long Lamai will cost on average RM560 per person (boat trip = RM260, local transportation = RM50, and lodging = RM250). This table shows that the economic value is negative, which indicates a loss for the community. The sensitivity analysis will assist turn this loss into a profit by factoring in all investments and administrative fees [23].

TABLE II
NET VALUE FLOW SHEET FOR 'TRAVELER'

Value Interface	Value Port	Value Transfer	Occurrences	Valuation	Economic Value	Total
vi354:{MONEY, MONEY, MONEY}			1		-560	
	vp64: out: MONEY	boat: MONEY	1	260	-260	
	vp87: out: MONEY	local: MONEY	1	50	-50	
	vp43: out: MONEY	stay: MONEY	1	250	-250	
	vp62: in: boat trip	(all transfers)	1	0	0	
	vp86: in: local transport	(all transfers)	1	0	0	
	vp38: in: stay	(all transfers)	1	0	0	
COUNT	40					
INVESTMENT					0	
EXPENSES					0	
Total for actor						-560

Table III presents inhabitants of this town possess and enjoy all government, institution, and organization social facilities. The rural development fund would rebuild electricity and shelter in isolated areas. Internet and government resources are free. They do not need dwellings, transportation, or money in their native environment.

TABLE III
NET VALUE FLOW SHEET FOR 'INHABITAT'

Value Interface	Value Port	Value Transfer	Occurrences	Valuation	Economic Value	Total
vi94:{MONEY, internet access}			1		0	
	vp71: out: MONEY	$=0: MONEY	1	0	0	
	vp70: in: internet access	(all transfers)	1	0	0	
COUNT	200					
INVESTMENT					0	
EXPENSES					0	
Total for actor						0

B. Sensitivity Analysis for E3 Value Transaction

In this phase, sensitivity analysis is restricted to products, meaning that money is exchanged for locally produced items and services. This money will produce cash for the community and support the continuance of community activities, which will supplement government funding for services. Table below shows the estimation or a 12-month investigation of the sensitivity of goods prices. To generate the net value sheet for a product, we may determine its unit cost using e3 value [24]. Every year, we set the net income value to a predetermined amount (see analysis table) and let the analysis calculate how much the community must sell, the price per unit sold, and the cost per unit sold. After completing the computations, we may determine the items' total revenue, profits before taxes, and net income (boat, craft, homestay, international transport, and local transport)

Due to the fact that my interpretation of the e3 value did not include a sensitivity analysis, I devised the method that is given below by drawing inspiration from the field of financial analysis. The instructions for the website say that the functionality is present, but the sensitivity analysis scenario is still not there. This is despite the fact that the feature is there. Even though a normal net value sheet will only show one service transaction, there is still a possibility that some of the transactions could have a value that is negative [25]—that is, they would result in a loss. During the course of the sensitivity analysis, the total annual net income will be calculated by taking into consideration the effects of various factors such as taxes, investments, and fees. Because of this, we are able to foresee the needs of the community and assist them in planning how to meet those needs so that they may achieve the level of profitability required [26] to roll their revenue.

TABLE IV
SENSITIVITY ANALYSIS FOR 'BOAT'

Sensitivity analysis Boat			
Assumptions		Income statement	
Units sold	7,274	Revenue	1,891,335
Price per unit	260.00	COGS	(1,091,155)
Cost per unit	150.00	**Gross profit**	**800,180**
SG&A	180	SG&A	(180)
Tax rate	25%	**Earnings before tax**	**800,000**
Constraints		Taxes	(200,000)
Net income	600000	Net income (loss)	600,000
Unit sold	10000		
Price per unit	260		

12-months boat sensitivity estimate. The community must sell 7,274 boats every year to generate RM600,000 net. The community must charge RM260/unit and spend RM150. I have limited the number of units sold to 10,000 since anything

more will drop the price per unit, nearing the cost of manufacturing the boat.

TABLE V
SENSITIVITY ANALYSIS FOR 'CRAFT'

Sensitivity analysis craft			
Assumptions		**Income statement**	
Units sold	1,953	Revenue	36,774
Price per unit	18.83	COGS	(23,438)
Cost per unit	12.00	**Gross profit**	**13,336**
SG&A	3	SG&A	(3)
Tax rate	25%	**Earnings before tax**	**13,333**
Constraints		Taxes	(3,333)
Net income	10000	Net income (loss)	10,000
Unit sold	5000		
Price per unit	35		

We try to optimize crafts' profit margin. Because it's a community-made handicraft, the unit pricing is RM18.83. At RM12 per unit, the community would need to sell 1,953 units each year to break even. According to estimates, the community would require RM36,774 in first-year craft sales to earn RM10,000 the following year.

TABLE VI
SENSITIVITY ANALYSIS FOR 'HOMESTAY'

Sensitivity analysis Homestay			
Assumptions		**Income statement**	
Units sold	4,850	Revenue	1,151,983
Price per unit	237.51	COGS	(485,017)
Cost per unit	100.00	**Gross profit**	**666,967**
SG&A	300	SG&A	(300)
Tax rate	25%	**Earnings before tax**	**666,667**
Constraints		Taxes	(166,667)
Net income	500000	Net income (loss)	500,000
Unit sold	6000		
Price per unit	250		

The homestay company should generate RM500,000 this year at RM273.45 per homestay and up to RM100 per night. Homestays cost RM100-RM273.45 per night, with a RM100 cap. Based on sales, the neighborhood must sell 4,850 homestay flats by December. The homestay generates RM500,000 after taxes. Homestay earns RM1,151,983.

TABLE VII
SENSITIVITY ANALYSIS FOR 'INTERNATIONAL TRANSPORT'

Sensitivity analysis Transport			
Assumptions		**Income statement**	
Units sold	7,844	Revenue	470,615
Price per unit	60.00	COGS	(203,933)
Cost per unit	26.00	**Gross profit**	**266,682**
SG&A	15	SG&A	(15)
Tax rate	25%	**Earnings before tax**	**266,667**
Constraints		Taxes	(66,667)
Net income	200000	Net income (loss)	200,000
Unit sold	15000		
Price per unit	60		

Visitors arrive via plane and bus. Assuming these products create RM200,000 per year, the unit price will be RM60 or more; lesser will not be viable for the community. 7,844

tickets at least RM60 must be sold yearly. Pre-tax profit is RM266,682.

TABLE VIII
SENSITIVITY ANALYSIS FOR 'LOCAL TRANSPORT'

Sensitivity analysis Local Transport			
Assumptions		**Income statement**	
Units sold	6,035	Revenue	254,048
Price per unit	42.10	COGS	(120,700)
Cost per unit	20.00	**Gross profit**	**133,348**
SG&A	15	SG&A	(15)
Tax rate	25%	**Earnings before tax**	**133,333**
Constraints		Taxes	(33,333)
Net income	100000	Net income (loss)	100,000
Unit sold	80000		
Price per unit	50		

Taxis, vans, and buses are expected to earn RM100,000 annually. This table's sales suggest that 6,035 people utilize local transportation annually, resulting in a price per ticket of more than RM42.10.

C. Scenario-Based Analysis for E3 Value Transaction

Scenario analysis estimates the future value of an investment by considering possible changes to current factors [27]. Considering how different market circumstances affect a project or financial commitment is important. Sensitivity analysis examines how inputs affect a decision's conclusion. When using one or more input variables. Inflation, interest rates, and credit ratings may impact government bond prices [28].

Scenario analysis needs three scenarios [27]. The base-case situation is typical (also known as scenario 1). One would presumably use the discount rate and tax rate to determine an investment's net present value. The worst-case scenario (sometimes called scenario 2) is the worst possible outcome if things go wrong. For the aforementioned case, the highest tax rate or discount rate would be used [27]. The best-case scenario is the most desirable event (also known as scenario 3). Using the previous example, this would mean using the lowest tax rate or discount rate. Next is a scenario-based study of each product.

My projects include three years of scenario analysis, with each scenario showing the best and worst possible outcomes for revenue and costs. Scenario analysis is useful for C-suite executives in understanding the external elements that are likely to affect their business [29] since it includes anticipating future events. Therefore, businesses may be able to better manage their resources, lowering the likelihood of bad outcomes in the scenario analysis for the current year and the next two years. We included just the best case from our full report as a summary for this area of our paper.

D. Scenario Based Analysis

The spreadsheet suggests that scenario 2 is the most likely to result in a net income for Boat that is high enough to be considered acceptable. However, scenarios 1 and 3 utilize wasteful quantities of income and costs, while scenario 2 uses irrelevant amounts of revenue and costs, thus, none of them can keep the firm afloat for the whole year. Scenario 3 provides the most appropriate analysis for each year since we must consider that the cost of craft is not very high and that

all proceeds go to the villagers' talents. As a result, we conclude that this is the best analysis.

TABLE IX
SCENARIO 1

$	2022E	2023E	2024E
Scenario analysis			
Revenues	300,000	400,000	500,000
Costs	(250)	(290)	(330)
Net income (loss)	**299,750**	**399,710**	**499,670**
Choose scenario >		2	
Revenue scenarios			
1.Best case	600,000	800,000	1,000,000
2.Base case	300,000	400,000	500,000
3.Worst case	150,000	200,000	250,000
Cost scenarios			
1.Best case	(260)	(300)	(340)
2.Base case	(250)	(290)	(330)
3.Worst case	(240)	(280)	(320)

TABLE X
SCENARIO 2

$	2022E	2023E	2024E
Scenario analysis			
Revenues	2,500	75,000	12,500
Costs	(8)	(13)	(18)
Net income (loss)	**2,492**	**74,987**	**12,482**
Choose scenario >		3	
Revenue scenarios			
1.Best case	10,000	30,000	50,000
2.Base case	5,000	15,000	25,000
3.Worst case	2,500	75,000	12,500
Cost scenarios			
1.Best case	(12)	(17)	(22)
2.Base case	(10)	(15)	(20)
3.Worst case	(8)	(13)	(18)

TABLE XI
SCENARIO 3

$	2022E	2023E	2024E
Scenario analysis			
Revenues	250,000	350,000	450,000
Costs	(150)	(300)	(350)
Net income (loss)	**249,850**	**349,700**	**449,650**
Choose scenario >		2	
Revenue scenarios			
1.Best case	5000,000	700,000	900,000
2.Base case	250,000	350,000	450,000
3.Worst case	125,000	175,000	225,000
Cost scenarios			
1.Best case	(100)	(200)	(300)
2.Base case	(150)	(300)	(350)
3.Worst case	(250)	(400)	(500)

The spreadsheet suggests that homestay may make a yearly profit in Scenario 2, which has the most realistic revenue and costs. While Scenario 1's revenue and costs are high, Scenario 3's are not enough to keep the homestay business afloat for the whole year. Therefore, it is clear that none of these options is viable.

Each actor's entire net revenue is shown in Table XXI when only monetary exchanges for goods or services are included. These statistics result from a sensitivity study performed on an actor's profit and loss during the previous 12 months, and this analysis considers the costs of administration and taxes. In order to prevent the community from incurring a total loss due to the exchange, a link to the original net sheet value created by the E3 value tool will continue to have the same price per unit [28]. However, this price will be subject to certain adjustments and constraints.

TABLE XII
TOTAL NET INCOME FOR EACH ACTOR

Actor	Revenue (RM)	Gross Profit (RM)	Earnings Before Tax (RM)	Net Income (RM)
Boat	1,891,335	800,180	800,000	600,000
Craft	36,774	13,336	13,333	10,000
Homestay	1,151,983	666,967	666,667	500,000
International Transport	470,615	266,682	266,667	200,000
Local Transport	254,048	133,348	133,333	100,000

TABLE XIII
SIGNIFICANT OF SENSITIVITY ANALYSIS & SCENARIO BASED

Actor list	Economic value (net value sheet)	Gross profit (Sensitivity analysis)	Net income (Scenario-based analysis (best case))		
			Years		
			2022	**2023**	**2024**
Customer	-76				
Traveler	-560				
Inhabitant	0				
Boat	3120	800180	599740	799700	999660
Craftsman	400	13336	9988	29983	49978
Homestay owner	2000	666967	499900	699800	899700
Local transport	400	133348	99950	299935	499920
Web hosting	269				
Telecentre	-3300				
Energy provider	2000				
Web shop	-269				
Long distance transport	6000	266682	99940	299920	499900
Satellite provider	1300				

Table XIII provides a summary of my study's conclusions, derived from the E3 value, followed by the gross profit from sensitivity analysis and the net income from the scenario-based analysis. The anticipated cash flow for the next three years may be determined using a scenario-based method by averaging the cashflows from many scenarios with varying probabilities (such as the worst-case, best-case, and base scenarios). Table B's cumulative cash flow depicts e3timeseries as increasing and decreasing value fluctuations. As long as the worst-case scenario is not realized, the situation is under control, and the best-case scenario serves as a counterbalance to the negative information in the worst-case scenario [30]. Table XIII depicts an undiscounted cashflow time series for the worst-case scenario, which is intended to reassure investors if cashflows do not materialize as anticipated in the base case. Both the best- and worst-case figures depict an undiscounted time series. e3-value permits a consumer and supplier profitability study and a game-theoretic analysis [31] in section I of a networked business

model to optimize profits for all stakeholders. This is a significant advance over conventional marketing strategies, which concentrating only on the demand side.

Investors have the option to get further information about the major drivers of the company as well as the influence of projected changes, which may be either positive or negative, by participating in scenario and sensitivity assessments. It is possible that significant shifts may occur, and these shifts may include not just company- and business-specific concerns [30] but possibly broader economic and political factors as well. The purpose of doing a scenario analysis is to study the myriad of potential outcomes that a company or effort may attain in light of alterations to the macroeconomic setting as a whole. By doing sensitivity analysis, a company can narrow in on the elements that have the most important influence on its bottom line, improving its ability to make business decisions.

IV. CONCLUSION

E3-value often centers its attention, from the point of view of strategy analysis, on the settings of companies. The initial scope of e3-value is expanded to include creating firms that need to compete in a competitive market via the use of sensitivity analysis and scenario-based research. Our study is an ongoing effort to make ICT sustainable within the community by setting out the finances for at least three to four years to stimulate how they plan for their local enterprises. This is done as part of an attempt to make ICT sustainable within the community itself.

A previous study conducted on Long Lamai village found that after developing ICT for the community, the researchers discontinued their work. The purpose of sensitivity analysis is to determine, based on a predetermined list of assumptions, how different levels of influence from an independent variable have an effect on a certain dependent variable. Tests of sensitivity are carried out [32] to determine the extent to which the several sources of uncertainty in the E3 value model contribute to the overall uncertainty of the model. The implementation of this tactic takes place inside a set of parameters, the values of which are determined by one or more input variables.

This part discusses the various assumptions, the volume sold and the price of each item. First, we investigated the restrictions placed on each actor to bring down their excess net income. We can make accurate forecasts of future events by using sensitivity analysis, which makes use of trustworthy data from the past. It is possible to make big judgments that influence the company, the economy, and money if all relevant factors and their ramifications are properly evaluated. This paves the way for the decision-making process.

On the other hand, if we do an analysis based on the predicted results, we will only have one choice available to us. This might result from something catastrophic happening in the stock market or a change in the legislation regulating a particular company. This model investigates how the actor's expenses and income have changed over time. After that, the model's parameters are altered to reflect the most current data gathered accurately.

We engage in analysis in order to have a comprehensive understanding of the present state of the issue. We now have a comprehensive understanding of the whole range of possibilities, including all possible extremes, as well as the repercussions of selecting a particular set of parameters based on real events that have taken place. In addition, we will find out what would take place if a certain set of conditions were satisfied.

REFERENCES

[1] J. S. Schwarz and C. Legner, "Business model tools at the boundary: exploring communities of practice and knowledge boundaries in business model innovation," *Electron. Mark.*, vol. 30, no. 3, pp. 421–445, Sep. 2020, doi: 10.1007/s12525-019-00379-2.

[2] X. Yue, S. Pye, J. DeCarolis, F. G. N. Li, F. Rogan, and B. Ó. Gallachóir, "A review of approaches to uncertainty assessment in energy system optimization models," *Energy Strateg. Rev.*, vol. 21, pp. 204–217, Aug. 2018, doi: 10.1016/j.esr.2018.06.003.

[3] P. Frumkin and J. B. Imber, *In search of the Nonprofit Sector*. Routledge, 2017.

[4] J. A. Laub, "Assessing the servant organization: Development of the Organizational Leadership Assessment (OLA) model," Florida Atlantic University, 2000.

[5] S. Piras, P. Tobiasz-Lis, M. Currie, K. Dmochowska-Dudek, D. Duckett, and A. Copus, "Spatial justice on the horizon? A combined Theory of Change scenario tool to assess place-based interventions," *Eur. Plan. Stud.*, vol. 30, no. 5, pp. 952–973, May 2022, doi: 10.1080/09654313.2021.1928057.

[6] S. Conejos, A. Ubando, and M. Y. L. Chew, "Design for maintainability tool for nano-façade coating applications on high-rise facades in the tropics," *Built Environ. Proj. Asset Manag.*, vol. 12, no. 1, pp. 70–95, Mar. 2022, doi: 10.1108/BEPAM-04-2020-0078.

[7] G. J. Watson, K. C. Desouza, V. M. Ribiere, and J. Lindič, "Will AI ever sit at the C-suite table? The future of senior leadership," *Bus. Horiz.*, vol. 64, no. 4, pp. 465–474, Jul. 2021, doi: 10.1016/j.bushor.2021.02.011.

[8] P. Capros *et al.*, "GEM-E3 Model Documentation," 2013. doi: 10.2788/47872.

[9] F. Pianosi *et al.*, "Sensitivity analysis of environmental models: A systematic review with practical workflow," *Environ. Model. Softw.*, vol. 79, pp. 214–232, May 2016, doi: 10.1016/j.envsoft.2016.02.008.

[10] D. Kundisch and T. John, "Business Model Representation Incorporating Real Options: An Extension of e3-Value," in *2012 45th Hawaii International Conference on System Sciences*, Jan. 2012, pp. 4456–4465, doi: 10.1109/HICSS.2012.139.

[11] H. Weigand, "The e3value Ontology for Value Networks: Current State and Future Directions," *J. Inf. Syst.*, vol. 30, no. 2, pp. 113–133, Jun. 2016, doi: 10.2308/isys-51409.

[12] A. Edwards, "Actors, Scripts, Scenes and Scenarios: Key Trends in Policy and Research on the Organisation of Serious Crimes," *Oñati Socio-Legal Ser.*, vol. 6, no. 4, pp. 975–995, 2016.

[13] J. H. E. Christensen and G. D. Rudebusch, "A New Normal for Interest Rates? Evidence from Inflation-Indexed Debt," *Rev. Econ. Stat.*, vol. 101, no. 5, pp. 933–949, Dec. 2019, doi: 10.1162/rest_a_00821.

[14] D. O. Faith and A. M. Edwin, "A Review of The Effect of Pricing Strategies on The Purchase of Consumer Goods," *Int. J. Res. Manag. Sci. Technol.*, vol. 2, no. 2, pp. 2321–3264, 2014.

[15] M. Afenyo, F. Khan, B. Veitch, and M. Yang, "Arctic shipping accident scenario analysis using Bayesian Network approach," *Ocean Eng.*, vol. 133, pp. 224–230, Mar. 2017, doi: 10.1016/j.oceaneng.2017.02.002.

[16] S. Lakshminarayanan, "Organizational behavior and work: a critical introduction," *Organ. Manag. J.*, vol. 8, no. 2, pp. 132–134, Jun. 2011, doi: 10.1057/omj.2011.20.

[17] E. Nayebi, A. Ashikhmin, T. L. Marzetta, H. Yang, and B. D. Rao, "Precoding and Power Optimization in Cell-Free Massive MIMO Systems," *IEEE Trans. Wirel. Commun.*, vol. 16, no. 7, pp. 4445–4459, Jul. 2017, doi: 10.1109/TWC.2017.2698449.

[18] D. Tolstoy, E. R. Nordman, S. M. Hånell, and N. Özbek, "The development of international e-commerce in retail SMEs: An effectuation perspective," *J. World Bus.*, vol. 56, no. 3, p. 101165, Apr. 2021, doi: 10.1016/j.jwb.2020.101165.

[19] OECD, "OECD Policy Responses to Coronavirus (COVID-19). E-Commerce in the Time of COVID-19," 2020.

[20] M. G. E. Velter, V. Bitzer, N. M. P. Bocken, and R. Kemp, "Sustainable business model innovation: The role of boundary work

for multi-stakeholder alignment," *J. Clean. Prod.*, vol. 247, p. 119497, Feb. 2020, doi: 10.1016/j.jclepro.2019.119497.

[21] M. Holman *et al.*, "Data Analytics in Human Factors," in *Handbook of Human Factors and Ergonomics*, Wiley, 2021, pp. 1351–1384.

[22] T. Binalialhag, J. Hassine, and D. Amyot, "Static slicing of Use Case Maps requirements models," *Softw. Syst. Model.*, vol. 18, no. 4, pp. 2465–2505, Aug. 2019, doi: 10.1007/s10270-018-0680-7.

[23] S. Mayr, C. Mitter, A. Kücher, and C. Duller, "Entrepreneur characteristics and differences in reasons for business failure: evidence from bankrupt Austrian SMEs," *J. Small Bus. Entrep.*, vol. 33, no. 5, pp. 539–558, Sep. 2021, doi: 10.1080/08276331.2020.1786647.

[24] M. Elg, I. Gremyr, Á. Halldórsson, and A. Wallo, "Service action research: review and guidelines," *J. Serv. Mark.*, vol. 34, no. 1, pp. 87–99, Jan. 2020, doi: 10.1108/JSM-11-2018-0350.

[25] A. Nwobi, U. Ngozi, N. Rufina, and K. A. Ogbonnaya, "Implementation of Information Communication Technology in the Teaching/Learning Process for Sustainable Development of Adults in West Africa Sub Sahara Region," *J. Educ. Pract.*, vol. 7, no. 21, pp. 14–19, 2016, [Online]. Available: https://eric.ed.gov/?id=EJ1109414

[26] L. Punchoojit and N. Hongwarittorrn, "Usability Studies on Mobile User Interface Design Patterns: A Systematic Literature Review," *Adv. Human-Computer Interact.*, vol. 2017, pp. 1–22, 2017, doi: 10.1155/2017/6787504.

[27] S. Geiger and H. Kjellberg, "Market mash ups: The process of combinatorial market innovation," *J. Bus. Res.*, vol. 124, pp. 445–457, Jan. 2021, doi: 10.1016/j.jbusres.2020.11.010.

[28] J. M. Akkermans and J. Gordijn, "Value-based requirements engineering: exploring innovative e-commerce ideas," *Requir. Eng.*, vol. 8, no. 2, pp. 114–134, Jul. 2003, doi: 10.1007/s00766-003-0169-x.

[29] P. Söderholm, "The green economy transition: the challenges of technological change for sustainability," *Sustain. Earth*, vol. 3, no. 1, p. 6, Dec. 2020, doi: 10.1186/s42055-020-00029-y.

[30] C. WaiShiang, N. Jali, M. A. Khairuddin, and H. Sharbini, "Understanding technology changes for ICT4D projects through modelling," *J. Telecommun. Electron. Comput. Eng.*, vol. 9, no. 3-3 Special Issue, pp. 147–151, 2017.

[31] Z. Jinqiu, H. Xiaoming, and I. Banerjee, "The Sustainability of Public Internet Access Centers: Lessons from ICT Projects in Rural China," in *Conference on Empowering Rural Communities through ICT Policy and Research*, 2007, pp. 15–17.

[32] C. WaiShiang, C. XingZi, M. A. Bin Khairuddin, N. Binti Jali, and R. Hidayat, "Assessing Financial Sustainability of Community Network Project through e3value Modelling and Simulation," *JOIV Int. J. Informatics Vis.*, vol. 4, no. 4, p. 172, Dec. 2020, doi: 10.30630/joiv.4.4.508.