Tool Support for Value Modeling and Risk Analysis of e-Services*

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Abstract. We demonstrate a set of tools to design and test business models for new IT. These models can be used to design business processes and specify use cases for IT systems.

1 Motivation

Today's IT infrastructure is inextricably intertwined with business models. Customer information is acquired online, marketing uses social networks, ordering and payment is performed using web-enabled applications, physical products are sorted and tracked by smart logistics systems, e-services such as music or books are delivered online, and helpdesks are integrated with online support functions. Production and shipping of physical goods is done in coordination with suppliers and partner companies whose IT infrastructures are connected through public or private networks. In such a context, IT requirements engineering is a continuous process that involves optimization of business models in order to take advantage of IT developments.

A business model is a description of how a business earns money, or more generally, how a profit or nonprofit organization creates value [6]. An increasing number of organizations create value with IT, in a change process often referred to as the "digital transformation." In this process, the classical problem of business-IT alignment has evolved into the problem of business-IT integration. This means that requirements engineering for IT must be integrated with business modeling.

A popular business modeling method today is the Business Model Canvas (BMC) [6], which is a template to create a high-level overview of the core value proposition of a business, of what is needed to produce this value proposition, of the customers to which the proposition is sold, and of the cost structure and revenue of doing all of this. Such a high-level model helps to create a shared picture of how the organization will create value, but leaves open what the quantitative market assumptions are under which the business will be profitable,

what the risks of financial loss and online fraud are, and what business processes and IT infrastructure are needed to implement this business model. The e^3*value* method is intended to fill this gap between abstract business model and concrete business processes and IT infrastructure [2, 1].

2 e^3*value*

The techniques and tools of e^3*value* allow one to model a network of organizations and customers who exchange items of value with each other, called *value objects.* Value objects may be products, services, experience (such as music), or money. Value exchanges are modeled as economic transactions, in which each of the transacting partners receives one or more value objects from the other.

A *value model* represents the network of business actors as a graph, and is taken to be valid for a *contract period.* It represents how these actors have agreed to exchange values during this contract period. A value model includes the representation of one or more *consumer needs* and shows which connected set of transactions among actors in the network takes place to satisfy this consumer need, and what the logic of this set of transaction is. The method is supported by tools for

- the computation of profitability for each of the actors in the model, given market assumptions about the price of products and services and the number of occurrences of consumer needs in the contract period.

It is possible to make a sequence of value models, for example for a startup phase, a growth phase, and a consolidation phase of a new business idea. e^3*value* contains tools and techniques to

- the discounted net present value for actors to participate in this network for this sequence of phases.

e^3*value* has been extended by tools and techniques to model and analyze financial risks and online fraud [5, 4, 3]. Fraud is an activity in which one of the actors in the model takes unfair advantage of the others by, for example not paying, colluding with other actors, or performing secret transactions that are profitable for the fraudster but create a loss for other actors. In the rest of this paper, the name "e^3*value* " refers to this extended method. The extended e^3*value* method is supported by tools and techniques for

- the analysis of sensitivity of profitability to changes in market assumptions,
- the generation of possible fraud scenarios, and for
- the ranking of these scenarios on profitability for the fraudster and loss for the victim.

Fraud scenarios cannot be modeled in the e^3*value* notation, because they contain invalid constructs such as non-reciprocal transactions. We model them using a notation called e^3*fraud* , and we call these models *subideal,* to distinguish them from valid e^3*value* models, which represent the ideal state of affairs.

3 The *e*^{3}*value* method

Positioning the e^3*value* approach as a way to manage the digital transformation of a company, we define the following method.

1. **Envision the business potential of new information technology**

   Make a map your business network and explore what new services or products you could deliver with new technology, and what this would mean for your relation with partners in your network
2. **Design a peer-to-peer business model**

   Design a peer-to-peer business model, i.e. a value model, in which you specify who delivers what to whom and what they receive in return.
3. **Make market assumptions**

   Quantify the value of services and products delivered, make assumptions about frequency of transactions, and estimate required investments.
4. **Do quantitative simulations of profitability and of vulnerability of fraud**

   Simulate different scenarios to compute profitability and assess sensitivity to your market assumptions. Automatically generate vulnerabilities to fraud, and rank them on severity. Revise your business model accordingly.
5. **Map to business processes and IT architecture**

   Once you are satisfied with your peer-to-peer business model, map this to your business processes and IT architecture.

The following cases illustrate steps 2, 3 and 4.

4 Cases

There are two tools available for e^3*value* , freely available at `https://www.e3value.com/software/`. The following cases will be used in the tool demo.

- Figure 1 shows a screenshot of an e^3*value* model of community radio journalism in rural Mali, and figure 2 shows an estimate of profitability for the actors in the model generated by the tool.
- *Sensitivity analysis of ideal and subideal models.* This is illustrated by a case from copyright clearing where we are interested in quantifying the evolution of a risk based on several parameters (figure 3).
- *Automated generation and ranking of subideal value models.* This is illustrated by a case from telecom where we are interested in generating and ranking fraud scenarios for a given telecom service (figure 4).

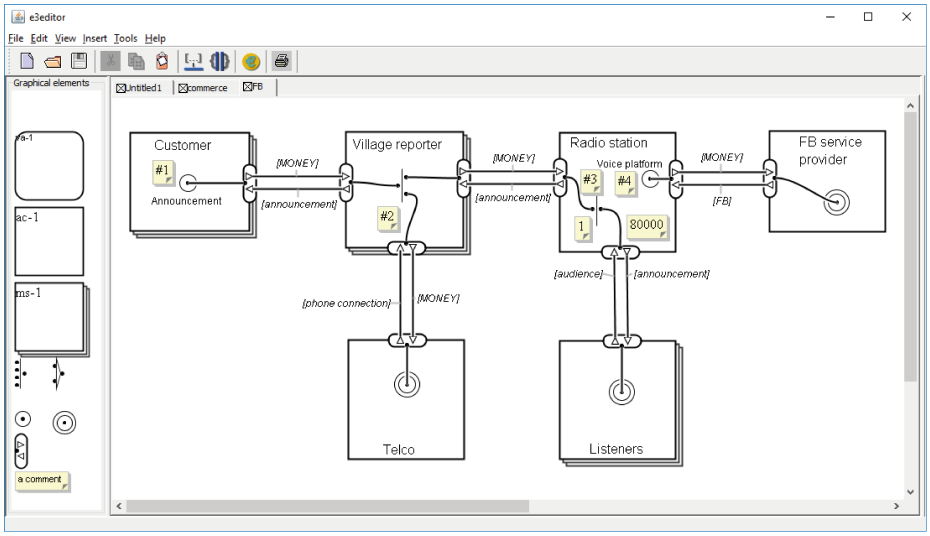
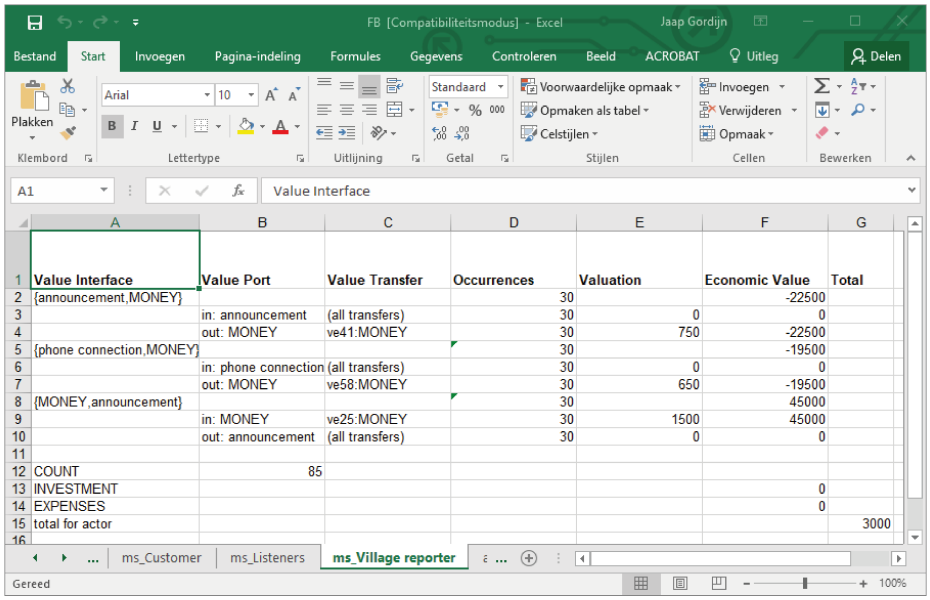


Fig. 1. e^3value model of community radio journalism in rural Mali.



	A	B	C	D	E	F	G
1	**Value Interface**	**Value Port**	**Value Transfer**	**Occurrences**	**Valuation**	**Economic Value**	**Total**
2	{announcement,MONEY}			30		-22500	
3		in: announcement	(all transfers)	30	0	0	
4		out: MONEY	ve41:MONEY	30	750	-22500	
5	{phone connection,MONEY}			30		-19500	
6		in: phone connection	(all transfers)	30	0	0	
7		out: MONEY	ve58:MONEY	30	650	-19500	
8	{MONEY,announcement}			30		45000	
9		in: MONEY	ve25:MONEY	30	1500	45000	
10		out: announcement	(all transfers)	30	0	0	
11							
12	COUNT	85					
13	INVESTMENT					0	
14	EXPENSES					0	
15	total for actor						3000
16							

Fig. 2. A profitability sheet for the model in figure 1 generated by the tool.

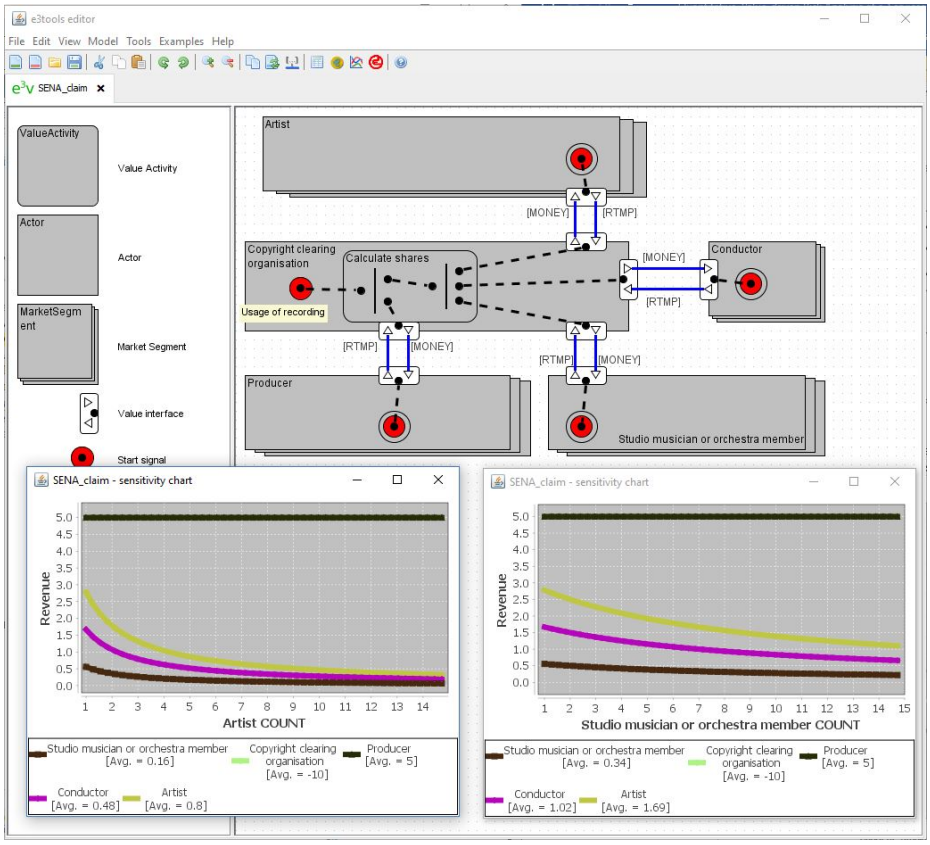


Fig. 3. Screenshot of a sensitivity analysis for assumptions in a rights clearance model. The top right pane shows the value model, two small windows overlaid at the bottom shows two sensitivity analyses.

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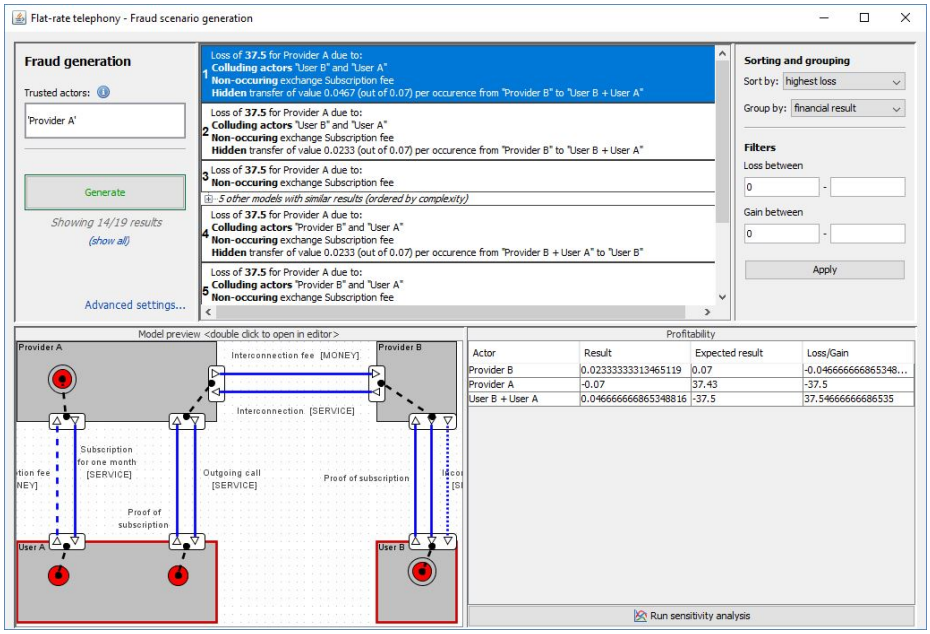

Fig. 4. Screenshot of a fraud generated for a flat-rate business model combined secretly by the fraudster with a revenue-sharing business model. The top pane in the middle shows possible frauds ranked on gain for the fraudster and loss for the victim. The highest ranked fraud is shown on the bottom left and the quantities of money gained or lost are shown on the bottom right

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