Integrating value modeling and legal risk management: an IT case study

(Article begins on next page)

20 April 2024

Integrating Value Modeling and Legal Risk Management: an IT case study

Anonymized version

Abstract: Companies need to be able to demonstrate compliance with rules and regulations, especially start-ups who typically do not have the legal expertise to identify, assess and address legal risks of initial business ideas, nor do they have the resources to hire such expertise. Tools could help them identify and deal with legal risk at an early stage. Existing research in BPM focuses on compliance verification of a consolidated business model by checking the ability of a company to comply with the standards. The challenge is to apply a 'continuous improvement' by steering the business on values. Moreover, legal choices typically sit at the strategic level, and not only at the operational level. In this paper, we therefore propose an approach to handle legal risks as part of business model development. The approach makes use of Continuous Business Model Planning method, a value-driven modeling approach for strategic planning, and legal argumentation. The suitability and potential usefulness of the approach is illustrated by a study of the Kenyan court case Lipisha & BitPesa vs. Safaricom.

Keywords: Legal compliance; Technology management; Legal risk management; Strategic planning

1 Introduction

Organisations are facing significant IT compliance challenges. Companies increasingly need to demonstrate that their technology conforms with relevant rules and regulations. In general, the management of production systems involves Compliance Management (CM) to address organizations' IT processes in order to see whether they conform to the law.

However, the law may sometimes be vague, i.e. designed to fit a number of scenarios [1]. That is why legal officers engage in an interpretive process when applying legal rules. Such a process may require legal argumentation to determine the prevailing interpretation in a particular instance. Black [2] defines these regulatory conversations. A regulatory conversation may prove problematic especially for firms which leverage technology to innovate on areas which are yet to be legislated on, or for whose jurisprudence is not as developed. This is also known as the ITxLaw misalignment, a phenomenon commonly highlighted by innovation and technology lawyers, that the law is unable to keep pace with technological innovation. Lawyers may lack the technical expertise to assess the impact and flexibility of general legal principles to fit new business process innovations and solutions. Conversely, while technical experts may be able to appreciate overarching legal principles, e.g. privacy or copyright, they may not be able to condense them to fit new scenarios.

Technology management concerns regulatory frameworks for defining the general legal doctrine of a particular domain. Where such doctrine is mature, its rules procedures and tests may be prevalent and therefore directly applicable to the business processes of the firms in that domain. However, with the continued growth and complexity of the law, this

will increasingly be the exception. Besides, new agile methods from IT have popularized "uberisation" and disruptive innovation [3]. This results in fast-evolving business models wherein most domains will require new doctrine to be developed. Such doctrine is not always directly applicable as it may not be particularized enough to apply directly to a firm's business processes. It needs to mature through interpretation by lawyers, regulators, legal scholars and other jurists.

The developing frameworks in the AI and Law space are crucial towards solving the IT-law misalignment from different perspectives, e.g. for *legal reasoning* [4], *management of legal knowledge* [5], acquisition and specification of legal requirements in *Requirements Engineering* [6]. Nevertheless, these approaches seem to somewhat overlook the role of legal interpretation [7, 8]. As Susskind predicted [9], demonstrable results, for instance on time and cost savings from applying neural networks to legal discovery, have moved the legal domain quickly from reticence and ambivalence, to gradual adoption of these new techniques. These so-called deep learning techniques leverage a robust pattern matching apparatus. However, they introduce a black box architecture which is not transparent for regulatory purposes. We still need systematic methods to explore the solution space in terms of the possible interpretations that could result from applying a given legal provision.

Coding the law in order to make it machine readable and actionable (and thus automate the law and enforce rules and regulations a priori) is a difficult and cumbersome task [10]. This process can be even more difficult when trying to match precise business processes within the elaborate linguistic semantics of the legislative language. Legislative drafting is a complex task because it must also address issues that are difficult to predict. This may lead to ambiguities in certain instances that will need to be interpreted to the circumstances of the case. To overcome this problem the *regulation by code approach*[11, 12] proposes a joint development between legal drafters and coders: laws in human language are produced together with their coded version. Unfortunately, the mechanics of legal interpretation do not come defined with the law, they remain with the legislative theorists and other legal experts. This is even more crucial in the case of disruptive technologies. Moreover automatic systems that implement a single "official" view of the rules may suffer from a lack of transparency. A lot of effort is needed to show how the governing rules were interpreted and applied for a given technology to be compliant and to overcome the traditional view of compliance as a binary split that you are either compliant or not [13]. We position our approach among those "*that can interpret and code legal rules with sophistication and transparency, advancing the objectives of the rules while supporting the complex rights of individuals. This is a future vision that requires, among others, the development of mechanisms to determine when to interact with human regulators and domain experts, as well as institutions that would ensure the integrity of the outcomes*" [12].

We start from a recent work presented in [14] which addresses these issues by proposing a comprehensive approach to compliance, the *Compliance Pattern Framework* (CPF), which should help firms manage their legal risks. The method is expected to help business owners investigate a business model's legal risks, select and interpret the relevant laws to understand how to handle those risks, and formulate common patterns [15, 16] that can be used to check the business model for compliance. The CPF focused on the development of a robust module for legal interpretation by applying informal logic to bridge the gap between the principles of interpretation in legal theory with the legal rules that determine compliance of business processes.

The approach proposed in [14] exploited conceptual diagrams taken from value modeling (e.g. business model canvas, strategy maps) to represent the legal context and

problem of a dispute in a way which is accessible and usable by the target audience of entrepreneurs. The authors also used the Value Delivery Modeling Language (VDML) that has been proposed as a standard business modeling specification by the Object Management Group (OMG) [17]. In the meantime, due to the lack of practical guidance for applying value modeling with VDML, the Continuous Business Model Planning (CBMP) method has been introduced [18]. CBMP is a value-driven modeling approach for strategic planning whose semantics is based on VDML.

In this paper we illustrate how to synthesize the CPF into CBMP to help firms in understanding how they can achieve compliance. In addition, we explored a practical application of CM at a more operational level. To this end, we adopted Business Process Modeling Notation (BPMN) [19] to represent organisation's business processes. While VDML is at a higher level of abstraction, BPMN offers a concrete view of the process from start to end events. Such specification of the workflow has proven useful for compliance and risk management [20, 21]. This is a step towards digitizing compliance, i.e., "the use of suitable business process compliance technologies, methods, and tools to support CM along each of its individual life-cycle phases"[22]. In particular, our research question is: how to identify and assess the impact of a legal risk on a business model in order to apply a specific legal interpretation to mitigate the risk?

The remainder of the paper is structured as follows: next Section describes background and related works, while Section 3 introduces our methodological framework by introducing value modeling, CBMP and the compliance patterns framework. Section 4 describes the case study on a fintech startup based in Nairobi called BitPesa, while last Section 5 provides some concluding remarks and future works.

2 Background

Several solutions have been proposed to address organisations in their IT compliance [23]. Existing compliance checking approaches differ according to the application time criterion. Forward compliance approaches check the compliance after the execution (e.g., based on process logs). On the contrary, backward compliance techniques focus the checking before the process execution [24]. In our work we refer to the latter type of approaches to prevent compliance violations by analyzing corresponding process models. In particular, we operate in the design phase of business processes lifecycle [25]. To improve the level of IT compliance and manage an auditing project effectively, a recent effort proposed to involve IT staffs and managements in an auditing methodology. The approach consists of an auditing target, checklist, process model, evaluation indices and reference model [26].

In addition, most of the work in the compliance area concerns existing organisations, to which different methods and techniques are applied. For instance, [22] proposed a method for assessing the level of compliance in business work practice based on formal language, while [27] explored a graph-base algorithm to automatically detect compliance pattern within process models. As a novelty aspect, the here presented framework aims to provide a solution suitable to organisations in their early-stage. In fact, while our approach to compliance may be applicable to all firms, we illustrate a case study in the application domain of startups. The disruption refers to new, innovative technologies that periodically emerge and fundamentally transform companies, industries and markets by leveraging such technologies and the Internet to create new markets and offer products and services across transnational borders at lower costs.

We aim at a preventive approach considering compliance from the early stages of the business process design, thus enforcing compliance by design [28]. The main focus of this paper is on design-time aspects of business compliance as a first key step towards preventive compliance support, in a usable and comprehensible way.

To gather requirements for the framework, we conducted a survey ([29], Chapter 4) of how firms manage their legal risks i.e. how they make compliance decisions and how they interpret the law in that process. We focused on startups and SMEs who may not afford to maintain compliance, legal or internal audit departments, a typical feature in mainstream corporations. The following themes were investigated:

1. How accessible is the law to the firm domain?

    - Access to legal services: affordability, value – legal certainty;

    - Complexity: identifying legal provisions, interpreting and reconciling multiple interpretations, applying legal interpretations to business models;

2. Role of technology in aggravating access to the law by firms:

    - Place of compliance in business model formulation.

    - Prioritization of legal advice: time and other constraints, adaptation of the business model to avoid legal risks.

The *research methodology* includes the following steps: identification of a sample of startups of interest; administration of a semi-structured questionnaire, i.e. a mix of open-ended and closed-ended questions; analysis of results. The study was conducted by approaching startup founders with an online questionnaire, which has been considered more convenient to facilitate the participation.

As a matter of fact, business owner founders are typically very busy and difficult to reach. The majority of those startups were housed in technology incubators and accelerators. For our purposes, a small sample is sufficient for appreciating some macro trends. In any case, the survey has a diversified view involving entrepreneurs of startups from different countries. In particular, 12 startups were based in Kenya, 4 in Luxembourg, 2 in France, 1 in Brussels and Luxembourg, and 1 in Italy. The startups considered are relatively young: most have been open for less than two years (42% for less than a year and 32% for one to two years), while 21% have been open for 2 to 5 years, and only one case (5%) for more than 5 years.

The questionnaire, which is available in the Appendix [1], includes also a 5-Point Likert Scale question, about ten items concerning compliance decisions at the early stage entrepreneurship. By aggregating positive and negative polarity answers, we already observe a certain degree of uncertainty in compliance decisions, as legal services are expensive for startups: "We have taken a crucial decision about the business model without knowing exactly what the law is", "Compliance related decisions are often refined at a later stage", "Time constraints do not allow us to consider all decision alternatives". Nevertheless, the issue is very much on the minds of business owners, who recognize its importance. The solution is typically sought in the existence of similar cases as well as in the involvement of legal experts: "We prefer discussions with lawyers or (other stakeholders) to base our compliance decisions", "We prefer to base compliance decisions on other business related data", "Compliance decisions often have to be reconsidered, which also affects other decisions". Finally, our sample of entrepreneurs considers themselves in difficulty due to

the lack of clarity of the subject matter. In fact, the problems occur in several cases: "To interpret what rules the legislation provides and how they affect our business model", "To determine which legislation is applicable", "To make a compliance decision". There is a large consensus that "the law is not clear as regards our business model".

The survey obtained the following main results:

1. Existing regulatory frameworks are insufficient for regulating emerging technologies, particularly those driven by disruptive technologies. Resources are necessary to help legislators to understand and legislate sufficiently for such technologies.

2. Additional resources are necessary to help firms, especially startups, identify and manage the legal risks facing their business models.

3. Additional resources are necessary to help lawyers, compliance officers, regulators and related stakeholders apply existing regulations to firms in a practical manner.

We were therefore able to reach the following requirements for developing the framework:

1. It is imperative to develop a compliance formulation method that is tailored for, and equally agile to the rapidly evolving business models and one that lawyers can understand.

2. The module on legal analysis needs to identify the risk and deliver clear and specific requirements tailored to manage it.

Finally, our work considers a design science approach [30, 31]. The effort is pursued by appropriately applying existing foundations and methodologies to address strategic planning, legal informatics, and technology management. Accordingly to [32], we analyze risks in business process models both at the activity level and the overall process level, whereas risk is "an important business phenomenon, which increasingly has to be considered in the (re-)design of business processes". We integrate risk analysis in business process model for mitigating operational risks and achieving legal compliance. To summarize our approach, we draw on the resources and tools of the design science framework [33] described in Figure 1 to model the core business of the company in order to assess how it will be impacted by the law.

3 Methodological framework

3.1 Continuous business model planning

Roelens and Poels [34] analysed enterprise modeling languages as a mean to foster a better understanding of the underlying business model to overcome differences in background between stakeholders and identified the VDML as the model needed to represent these components and proposed it as a standard for enterprise modeling that can be used to provide a complete business model representation. CBMP is a value-driven modeling approach for strategic planning whose semantics is based on VDML. Furthermore, the use of CBMP is fully supported by the Value Management Platform (VMP), a tool that provides visual interfaces to support different kinds of business canvas/map templates and storytelling/mapping techniques. As a result, the complexity of the underlying VDML models is hidden for the end-user, which is expected to facilitate adoption by business stakeholders. CBMP is organised in three stages:

Figure 1   A Design Science Research Framework for IT Compliance Management
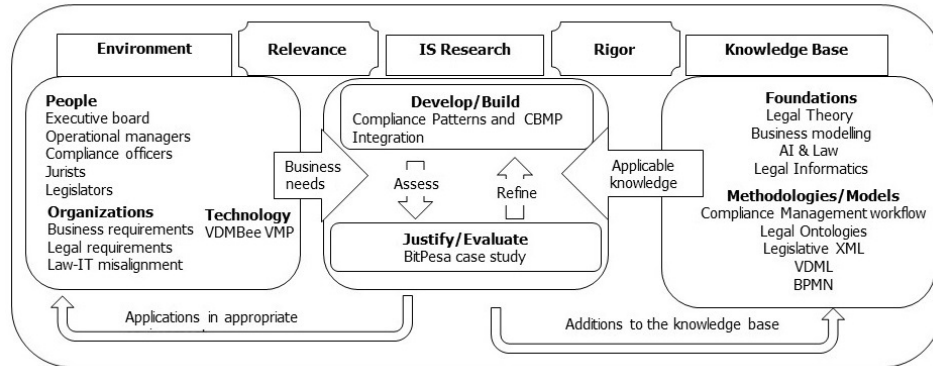
1. **Discover**, in this phase the context of the strategic planning initiative is determined. The parties, problems, constraints and assumptions and the strategies to be pursued are identified at this stage.

2. **Prototype**, the aim of this step is to develop the business model from multiple perspectives. This is accomplished by elaborating the interrelated business models from the previous stage, for each of the phases and alternatives in the plan.

3. **Adopt**, in this phase the aim is to present the prototyping results to strategic decision-makers, allowing them to decide on adoption and initiation of the required changes.

The business model concept embraced by CBMP is inspired by Lindgren's Business Model Cube [35], a conceptual instrument that helps the definition of: customers, value proposition, value formula, network partners, capabilities and activities.

3.2   The compliance pattern framework

The Compliance Pattern Framework (CPF) is organised in the following steps:

1. takes a business model as input;

2. outputs that model's main activities through a value model;

3. facilitates a legal-knowledge engineer to find and interpret the relevant legal provisions;

4. applies an argumentation framework to reconcile the resulting prescriptions;

5. formulates applicable compliance patterns for the business model.

The objective is to design compliance that is focused on a firm's innovative business model. As seen in Figure 2 the framework is divided into three phases: The Compliance Pattern Framework (CPF) is organised in the following steps:

1. **Legal risk analysis.** The first step is to establish what the business context is, hence, the type of business, the analysis of the processes of the business, so the activities for each processes, and finally the requirement for each activities. The activities are the

Figure 2 The compliance pattern conceptual framework.
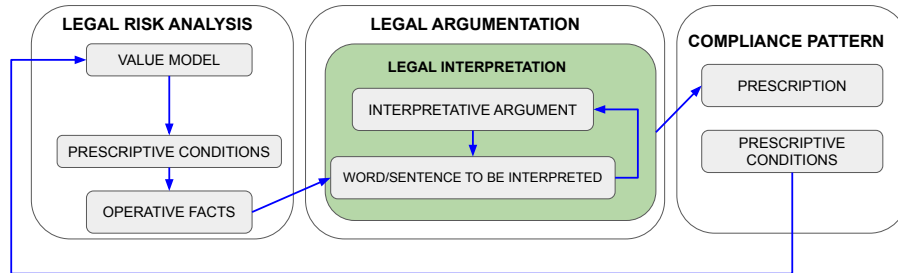
general interaction between the stakeholders, so they are the indicators to understand what is the legal domain that governs the model. From this domain is possible to extract the rules that determine if the processes of the business are compliant. Traditionally, once a lawyer determines the legal domain involved, they will select the relevant provisions and then narrow down to the most pertinent provision applicable to the case. It is the prescriptive conditions in the rule that relay the nature of compliant behavior expected of a firm. However, sometimes the real facts in their specific context lend themselves to more than one interpretation. They need to be interpreted to determine the behavior required.

2. **Legal interpretation.** This part helps us explore the space of legal interpretation that is possible for a given real case. Canons from legal theory are applied to work out the possible interpretations. This may generate conflicting or even complementary interpretations and we need a way to resolve which interpretation prevails in the former case, or which take precedence in the latter.

   To explain the importance of this point there are some general premises:

   - The law cannot foresee and regulate in detail every single situation that in reality could happen in the reality. Therefore, the law describes and regulates general typology of cases. Hence, general prototype of cases, not real cases.

   - The more the laws are of superior source (for example a European norm or a Constitutional norm), the more the cases described are generic and applicable to many different situations.

   - Interpreting means giving meaning to the words themselves, to the **words** in the sequence in which they are written (hence to the **sentence**), and finally, to the sentences in the normative context in which they are written.

   Therefore, in the end, a regulatory system can be imagined as a spider's web with many different paths and which connects many different general cases described in the different norms. This net with different paths are the so called **legal argumentation**. There is not one right path, but one or more possible paths applicable in the real case that we want to analyze.

   After having analysed the real context of the given operative fact (for example, the specific business), the **legal interpretation** is the tool that allows to choose the possible paths suitable for the real case. It is easily understood that there may be a

need to reconcile different interpretations of a legal rule regardless of whether they complement or conflict with each other. For doing this, the CPF applies the general model for interaction of **interpretative arguments** proposed in MacCormick and Summers [36]. This model exploits the foregoing general distinction of argument types into four broad categories of linguistic, systemic, teleological-evaluative and trans-categorical arguments.

3. **Compliance patterns.** This last part ties the interpreted rule to the business model in a pattern. The pattern summarizes the business context, the potential risks, the possible solutions and the relevant penalties that the company could face. This then allows the firm, in consultation with other stakeholders, to determine possible ways of altering the value model to achieve compliance. Similar to design patterns [37], compliance patterns consist of a *context-problem-solution* structure. *The context* is summarized by the competences and consequent activity driving the value model. We will model the business in order to understand the competencies it enables. Such competencies are the inputs of the legal analysis. *The problem* is identified as a legal risk arising from a certain activity or competence of the model. The analysis process will help us understand the legal risk the firm faces. Legal rules will be analyzed to determine the requisite compliance behavior expected. We characterize this process using argument schemes. The interpretive arguments used in this process will also be represented using argument schemes. The final interpretations will be recast onto the original rules to form prescriptions applicable to the value model. Such prescriptions will also be translated into systems requirements for easier mapping onto business processes in the value model. *The solution* is given by listing the final requirements that have to be applied.

3.3   Business process modeling

One of the main issue of Business Process Management (BPM) concerns the analysis of compliance to norms [38, 39]. The necessity of satisfying regulations or laws forces organizations in redesign business processes, in the context of change management [40]. During the context analysis of the business one of the important aspects to investigate is the organization of these processes, by considering an holistic and systemic approach. In this direction, computer science gained a relevant role for technical hardware and information systems improvements [41] and for decision-making [42].

Modeling usually adopt standard languages and one of the most used is the "de facto" standard Business Process Modeling and Notation (BPMN) language [43]. In this perspective, process analysis facilitates the detection of inefficiencies, bottlenecks, constraints, and risks [44, 45, 46, 47].

The BPMN standard language has the characteristic of being easily readable by stakeholders. It allows you to graphically illustrate the flow of activities in their sequence and with the decision points within the process. The final result is that, while the cube illustrates the activities in detail but in an alphabetical list, the flowchart in BPMN show an easy and intuitive high-level view of the sequence of activities and to the gateway (decision points). This also allows to have a graphic view of which activities at the origin of the process may impact on subsequent activities or subsequent sub-processes.

Figure 3 The diagram of the methodological phases
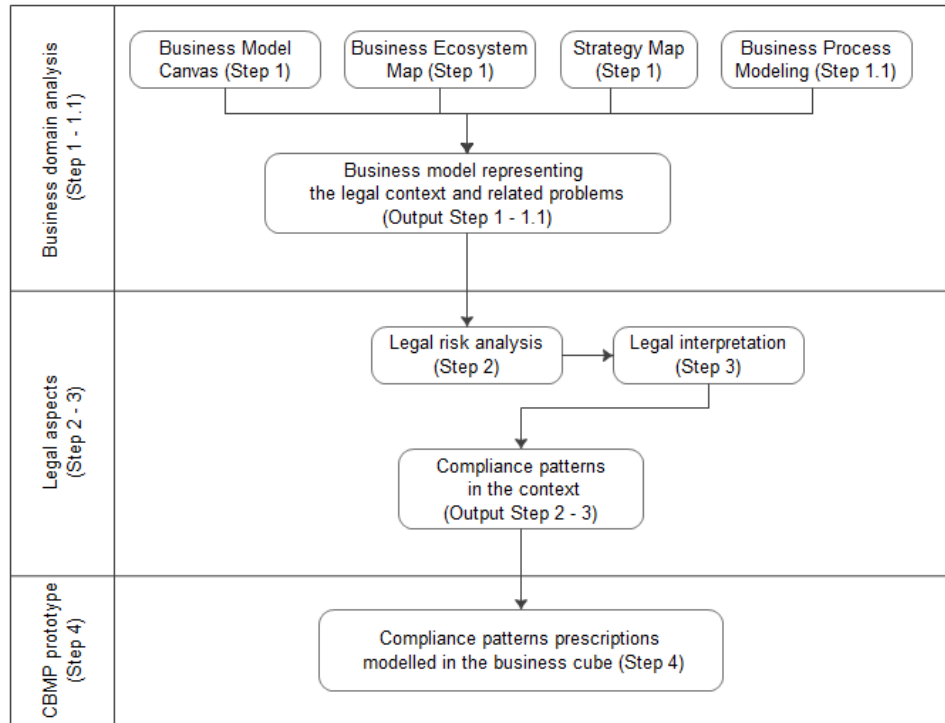
The intent of VDML and CBMP is to address the needs of business leaders to define, manage and transform the design of the enterprise. This requires a broad perspective to incorporate multiple aspects of the enterprise. The focus of BPMN is defining and managing repeatable, reliable processes with an emphasis on automation and is much more specific but much deeper in detail addressing many exceptions and variations with a "forward engineering" approach as described by the Model Driven Architecture [48]. In terms of the draft MDA Guide, VDML supports a business model and BPMN supports a logical system model. We take a step toward this next level of detail by presenting the result of the CPF application also at a business process modeling level.

3.4 Integrating CBMP and CPF

The contribution of the present paper consists in the integration of CBMP and CPF to handle legal risks as part of business model development. CBMP will be used to define i) CPF context, that will be used as an input to legal risk analysis and ii) the solution by specifing compliant behavior for the business model on the VMP based on the output of legal risk analysis.

In the image 3 we describe the resulting methodology and we explain the details in the following steps.

Step 1. Business domain analysis (CBMP discover and prototype phases). We need to develop an agile compliance formulation method that delivers actionable prescriptions and

specific requirements. We therefore use CBMP discover and prototype tools in order to represent the legal context and problem of a dispute. In particular we propose:

1. the *business model canvas* which addresses our need to model the business in a manner that will represent the interests of the stakeholders from business, IT and law by adopting the notion of value as a unifying factor for all the stakeholders. Business model canvas can be used to capture ideas, or other information, also in a business innovation or transformation initiative.

2. the *business ecosystem map* to quickly visualize the possible legal relationships in the network; It can be designed to graphically specify how participants in business model(s) collaborate by exchanging value propositions with each other. This map is typically used to provide a big picture of the Business Ecosystem in which business models live. It will also help to oversee and understand relationships in complex domains.

3. the *strategy map* to depict how the strategy is implemented within the firm. A strategy map is used to specify key values and to visualize cause-effect relationships between these values and factors that influence them. In the value management platform elements in a strategy map can be mapped to elements in structured business models and their related values, activities and competencies. Based on such mapping, elements in structured business models, as well as plan values, can be created and existing ones can be selected for visualization.

4. All the above models can be filled in the VMP. Finally, all values that are related to the value proposition or performed activities can be visualized in a dedicated Values tab.

Step 1.1 (Optional) Business process modeling the cube model used to represent business models in the VMP illustrates the activities in detail but in an alphabetical list. On the other hand the flowchart in BPMN show an easy and intuitive high-level view of the sequence of activities and to the gateway (decision points). This also allows to have a graphic view of which activities at the origin of the process may impact on subsequent activities or subsequent sub-processes. At this point we can take a step toward this next level of detail by presenting the domain at a business process modeling level.

   Output: a prototype of the business model representing the legal context and related problems.

Step 2. Legal risk analysis (CPF phase 1) This phase has as input the output of Step 1. Therefore, starting from the business model, it begins by identifying the relevant legal domain and then, more in detail, the specific possible applicable norms and rules.

   Output: the selection of one or more possible group of norms that could be applicable in the specific business situation.

Step 3. Legal interpretation (CPF phase 2) this phase takes as input the output of Step 2. The aim of this step is, thanks to interpretation, analyse and identify the business competencies and activities against the group of norms selected as output in Sper 2 and show the possible risks scenarios.

Output: Compliance patterns in a context - problem - solution structure. The context is stated using the value model's competencies and activities, the problem is a restatement of the legal risk, and the solution is described in the system requirements clarifying the compliant behavior expected.

Step 4. Compliance patterns prescriptions modelled in the business cube used in CBMP prototype and adopt phases. The legal risk is managed by applying the compliance patterns to the cube model adopted in CBMP prototype and adopt phases. These changes correspond to an evolution of the business that can be modeled by using two phases of the business model, one for the As-Is version (before legal risk analysis) and another for the To-Be version (compliant to the generated patterns). In order explain the necessary conditions for compliance in a way that is much more intelligible to requirements engineers, business executives, business analysts and other stakeholders, we also modify the strategy map and the value model as explained in section 4 thorough the Bit Pesa case study.

Moreover, if it was decided to use also the BPMN in step 1.1, in this last step it can be used again to see the changes of the sequence of activities within the process in the various scenarios.

In the following section we apply the above methodology step by step to the Bit Pesa case study.

4 The BitPesa case study

Data for this case study was collected in [29] by means of a survey interview and a review of publicly available sources of the study subject. We chose a startup for this case study because they provide this research with a rich application area. The online startup environment is empowering many young and vibrant innovators to become entrepreneurs with much leaner resources compared to traditional brick and mortar stores [49]. However, startups rely on private investors and venture capitalists to fund their ventures through to a successful IPO, merger or buyout. Indeed, resources in this domain are constrained and there are barely any compliance officers or an internal audit department as such. Nevertheless, they are confronted by hyper-regulation just like any other mainstream business entity.

BitPesa is a universal payment and trading platform for Africa head-quartered in Nairobi, with offices and staff in Lagos, London and San Francisco. It provides an online platform to convert digital currency such as bitcoin into local African currencies. Founded in 2013 by Elizabeth Rossiello and Duncan Goldie-Scot, the goal of BitPesa is to allow individuals and businesses to send payments to and from Kenya, Nigeria, Uganda, and Tanzania. The legal analysis of this study is informed by a Kenyan court case *Lipisha Consortium ltd & BitPesa ltd vs. Safaricom ltd*[2] which involved the manner in which BitPesa would settle its transactions. To settle transactions BitPesa would convert Bitcoin using Lipisha's payment gateway to Safaricom's MPesa, the mobile application that would deliver Kenyan shillings to the recipient. MPesa is an award-winning mobile money platform run by Safaricom that delivers mobile money services to 10 million Kenyans.
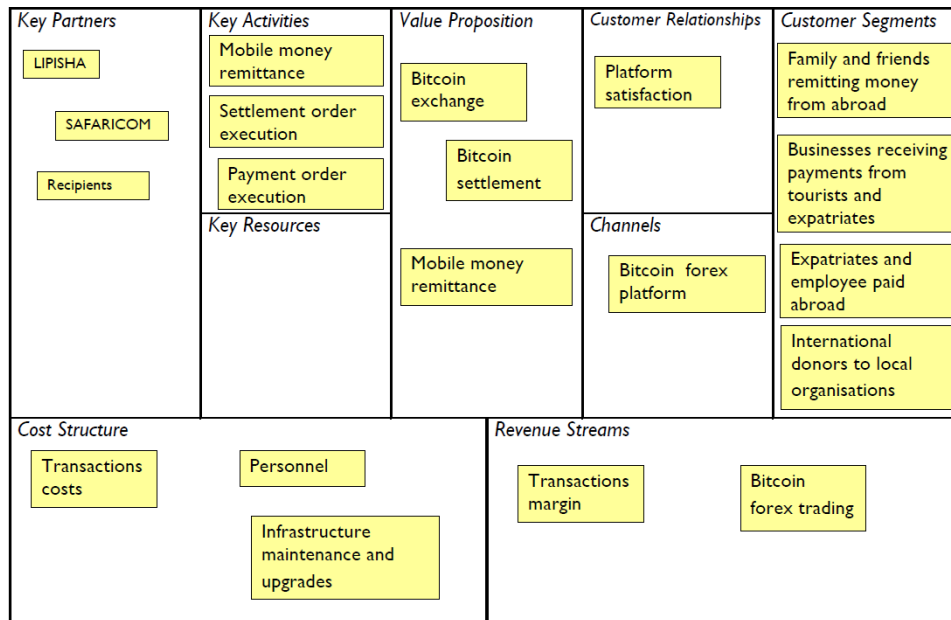
4.1 Step 1: BitPesa discover/prototype

The purpose of the *Discover stage* is the discovery of the As-Is and To-Be business models to be further elaborated in the *Prototype stage*.

Figure 4   Bit Pesa Business Ecosystem Map
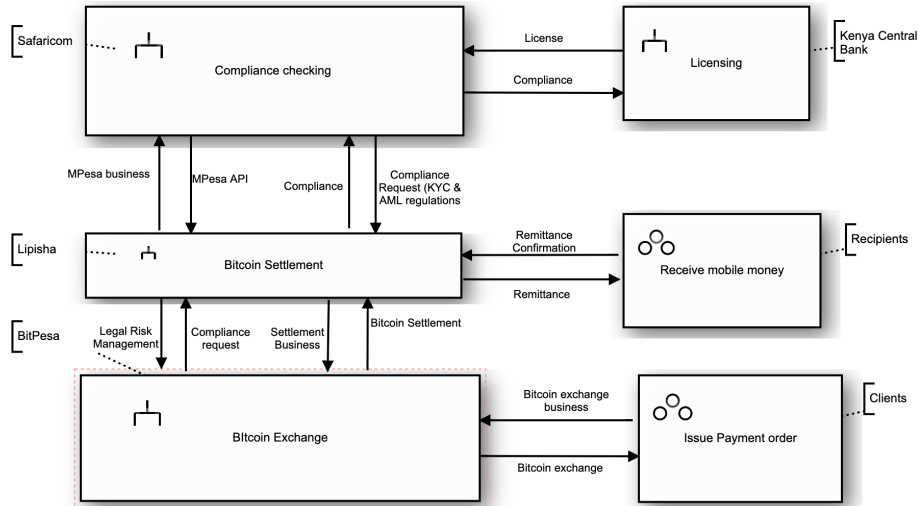
The business ecosystem. The business ecosystem is sketched and key participants are identified through the *business ecosystem map*. The value network captured in Figure 4 depicts the flow of value between BitPesa and its partners to create value. It shows three participant networks at work for: forex, settlement and remittance. Clients wishing to trade or remit foreign currency place an order on the site and BitPesa exchanges this for local currency via the Forex platform. For the Kenyan case, this involves the settlement procedure via Lipisha to exchange Bitcoins into Kenyan shillings.

Key participants and activities. The *business model canvas* [50] in Figure 5 helps to summarize the main aspects of the business. The goal is to deliver cheaper international money transfers to African countries using digital currency as opposed to Society for Worldwide Interbank Telecommunication (SWIFT) or other traditional money transfer systems. This delivers a number of customer segments: a) family and friends remitting money from abroad, b) businesses receiving payment from foreigners (expatriates and tourists) c) individuals and SMEs receiving business loans from donors and d) businesses purchasing goods and services from China. The money is delivered via BitPesa's web platform which operates a forex exchange service in the background. The entire service is automated and one has to register an account on www.bitpesa.co, give an id, name, and address. When these are verified, you are allowed onto the platform. We're able to identify the following value propositions: bitcoin exchange, bitcoin settlement, and mobile money remittance. The key activities are: payment order execution, bitcoin settlement, and mobile money remittance. The key resources are: a blockchain-driven forex platform, and anti money laundering (AML) and know your customer (KYC) policies. Key partners are: Lipisha, a startup operating a payment gateway and Safaricom, a telecommunications company that also operates M-PESA, the award winning mobile money platform that delivers mobile money services to 10 million Kenyans.

Figure 5 Bit Pesa Business Model Canvas.

Key Partners	Key Activities	Value Proposition	Customer Relationships	Customer Segments
LIPISHA	Mobile money remittance	Bitcoin exchange	Platform satisfaction	Family and friends remitting money from abroad
SAFARICOM	Settlement order execution	Bitcoin settlement		Businesses receiving payments from tourists and expatriates
Recipients	Payment order execution			
	Key Resources	Mobile money remittance	**Channels**	Expatriates and employee paid abroad
			Bitcoin forex platform	International donors to local organisations

Cost Structure	Revenue Streams
Transactions costs Personnel Infrastructure maintenance and upgrades	Transactions margin Bitcoin forex trading

The business values. The values to steer on are decided upon and other values, which influence them or are influenced by them, are identified by relating them through cause-and-effect relations. The strategy map in Figure 6 traces how BitPesa's high level goals are implemented in the firm's business processes. Its goal is to focus on adaptive, web technologies to connect with a strong, international network to ease the flow of funds. For the business, this involves the development of robust platforms for forex trading and cross-border money transfers to deliver good profit for the business. Remitters are also able to enjoy low-cost transfers while recipients enjoy prompt and convenient access to their money. Forex traders can also avail the Bitcoin platform. The internal processes driving these values include bitcoin exchange, settlement and mobile money remittance. The exchange is conducted on BitPesa's web platform, which leverages blockchain technology and the Forex trading platform. The settlement involves compliance checking using AML & KYC policies to verify the identity of the customers requesting services and the legitimacy of the transaction (the part in the thick box which will be added after the prototype stage and the CPF application).

The value model: phases, alternatives. In the final step of the discovery phase the plan for the mission is defined. The values to steer on are defined as plan values while the other values are related to the business model. Moreover phases in the plan are defined to add specific milestones for the plan values. Phase alternatives can be used to describe scenarios that analyse risks, assumptions, and strategic choices. In our case the two phases of the business model are the current status (As-Is model) and the compliant phase (Goal model). The first phase represents the original business model while the second phase incorporates the amendments that mitigate the legal risk involved. The purpose of the *Prototype stage* is to develop a multi-perspective business model ecosystem by further elaborating the interrelated business models from the Discover stage, for each of the phases

Figure 6   BitPesa strategy map, the thick box will be added as a result of the application of the CPF
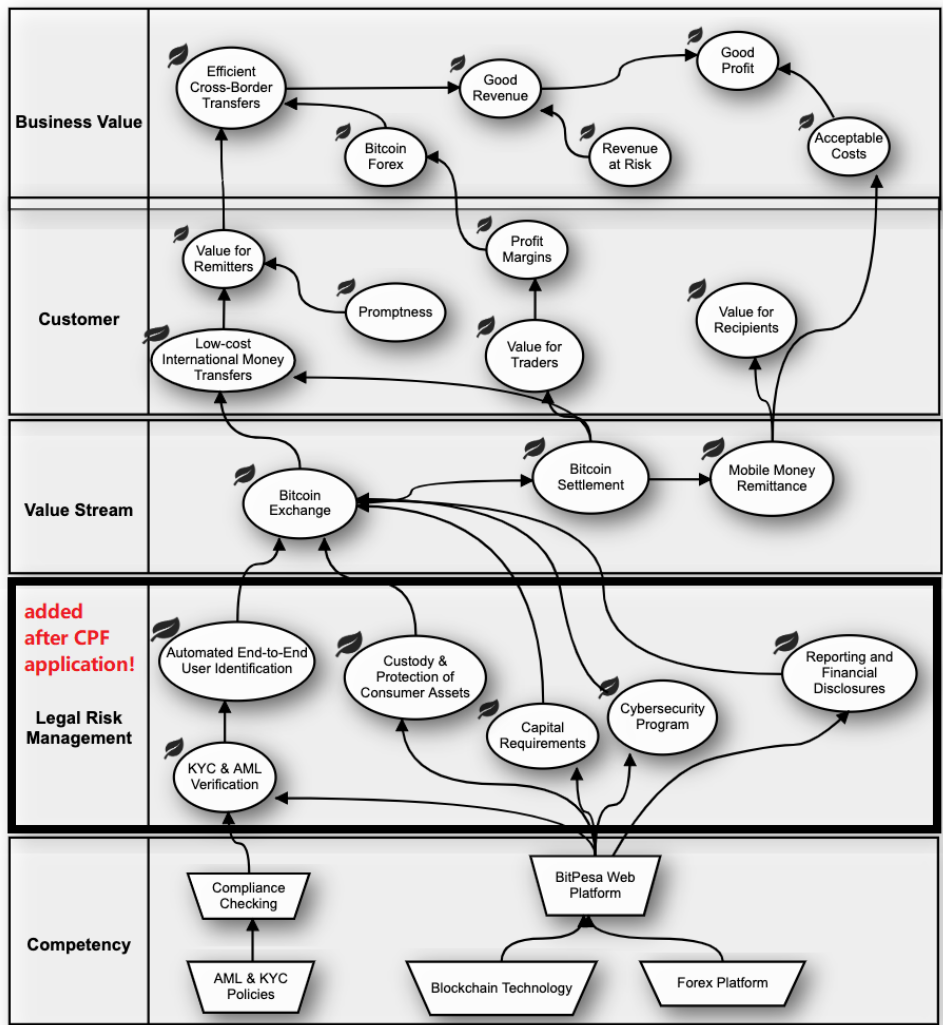
in the plan. This allows comparing plan values and business model values across phases to evaluate the effectiveness of the business ecosystem and, in the case of our approach, to decide upon the most appropriate course of action according to the outcomes of the CPF application. In this phase business models are described in a structured way through the following elements: (i) the participant network of the business model owner (i.e., customers and partners); (ii) incoming value propositions (from customers or partners), outgoing value propositions (to customers), and my propositions (i.e., the results of the business model for the owner); (iii) the values that are expressed by the value propositions; (iv) the activities needed to deliver the outgoing value propositions; and (v) the competencies (i.e., capabilities and resources) that the business model owner applies in the activities. All these elements are interrelated in the VMP (see Figures 7 and 8). Much of the data above can be filled during the discovery phase: based on the business ecosystem map the participant networks is identified so are customers, partners and value propositions. Based on the business model canvases we can fill the remaining gaps in the model. The VMP provides business-friendly interfaces: Figure 7 shows an example of a form for the 'Bitcoin exchange business' value proposition in the BitPesa business model, asking for who (and in what role) offers this value proposition to whom (and in what role), delivering what values.

Figure 7   VMP screenshot showing the filled form for the 'Bitcoin exchange business' value proposition

4.2   *Step 2: BitPesa Legal Risk Analysis*

On 12 November 2015, Safaricom suspended its services to Lipisha and by extension its counter-services to third parties including BitPesa. Safaricom required Lipisha to provide regulatory approval or a license from The Central Bank of Kenya (CBK) allowing it to transact or make bitcoin settlements. Safaricom reinstated Lipisha on 17th November

Figure 8 Activities needed to pursue Risk proposition in the VMP prototype of the BitPesa business model.

2015 on condition that it delinked BitPesa from its services. Lipisha and BitPesa sued Safaricom for conservatory orders i.e. orders to maintain the *status quo*, which would reinstate BitPesa's business until the matter was heard and determined by the court. The legal risk is that CBK had declined to recognize let alone authorize BitPesa as a payment service provider which could potentially vitiate the startup's business model in Kenya. The court indicated that BitPesa is governed by the Money Remittance Domain whose regulator is CBK. This results in a legislative gap as the CBK is mandated to protect BitPesa's clients in its jurisdiction. The legal risk here is that CBK could be prevailed upon to enforce the relevant penalties on BitPesa for operating foreign exchange dealings without a license. This entails a fine not exceeding five hundred thousand Kenya shillings, or imprisonment for a term not exceeding three years, or both. However, they did not moved to enforce any penalties against the startup and there is a likelihood that an exemption applies as above. However, is it sufficient? Figure 10 shows how we model the attendant legal risks on VMP as value-at-risk represented here through the risk proposition.

Legal Issue Identification. In the ruling Safaricom's main claim was that BitPesa was dealing in Bitcoin without a license from CBK contrary to the Money Remittances Regulations and Section 12 of the National Payment Systems Act. It asked BitPesa to obtain formal approval of its business from CBK pursuant to Section 13 of the National Payment Systems Act and the Money Remittances Regulations 2013. As BitPesa was conducting bitcoin business through Safaricom's systems, Safaricom contended that it had the right to protect its own business by terminating such illegality. On its side, BitPesa reported that it has implemented AML and KYC policies that comply with Kenyan legal and regulatory requirements. They claimed to have freely submitted them to CBK, as well as regulators in other jurisdictions in which they operate stating that they hold themselves to the highest standards when it comes to AML and KYC compliance. The court noted that BitPesa had approached Safaricom to access its payment gateway directly but it requested BitPesa to get CBK approval first given that it had revealed it dealt in bitcoin.

However, CBK responded that as long as BitPesa dealt in bitcoin, it could not use the words 'money remittance' or 'money transfer'. It also stated that it does not regulate virtual currencies. Lipisha and BitPesa agreed with this view but Safaricom did not. The court also noted that the controversy as to whether approval and regulation by CBK is necessary in the circumstances of BitPesa is certainly a substantive point which requires a deeper interrogative approach at the petition hearing. For one, the requirement for a license under Section 33A of the CBK Act also provides for the possibility of an exemption. However, it is not clear whether such an exemption can be inferred CBK's conduct, or whether it must be given expressly.

As shown in Figure 2, once analyzed our real case, the legal interpretation help to chose the norms involved, explores the different possible interpretations with the aim to identify the risks involved and in which activities they can occur.

4.3 Step 3: Legal Interpretations Generation.

According to a legal interpretation at literal level, we have two competing interpretations as follows:

1. Case against: $VM_{BitPesa}$ is potentially liable to penalties because *permit* in section 33A ought to be interpreted as requiring volitional conduct of the CBK to permit $VM_{BitPesa}$ to transact in virtual currencies.

2. Case for: $VM_{BitPesa}$ is not potentially liable to penalties because Section 33A of the Central Bank Act ought to be interpreted as meaning CBK has no power to regulate $VM_{BitPesa}$ where no specific laws on virtual currencies have been promulgated.

BitPesa's legal argumentation. Arguments are then developed from the themes of interpretation. The case for BitPesa has the following arguments:

Argumentation 1: CBK ought to regulate $VM_{BitPesa}$ in the following terms: a license usually referred to as a bitlicense, capital requirements, custody and protection of consumer assets, reporting and financial disclosures, an anti-money laundering program, and a cyber-security program.

Argumentation 2: Because VM_{MPesa} and $VM_{BitPesa}$ are substantially similar, $VM_{BitPesa}$ also ought to be allowed to be trialled without a license in this initial phases of its business model despite the opposition by Safaricom.

These two cases with their two argumentations are the two juridical situations that can be applied to our case. Once identified, they represent the two risk situations to be analyzed.

The second interpretation is the most plausible and therefore it is the one chosen for analysis.

Prescription generation. The prescriptive rule in this case is section 33A(3) of the Central Bank Act: Notwithstanding the provisions of subsection (1), the Bank may permit such person or class of persons as it may specify, to transact foreign exchange business without a license, subject to such conditions as it may impose. Deriving the appropriate prescriptions, we will define the compliance behavior[3].

Figure 9 A view of the BitPesa business model in the compliant phase.

Pursued	Participant (Role)	Activities	Values
Bitcoin exchange	Bitpesa (Payment handler *(Business)*)	Confirm payment order , Execute payment order , Verify clients	order confirmation (Confirm payment order) Transaction margin (Confirm payment order) Verified clients (Verify clients)
Bitcoin exchange business	Client (Payer *(Customer)*)	Send payment order	Bitcoin (Send payment order)
Bitcoin settlement	Lipisha (Gateway provider *(Customer)*)	Confirm settlement order , Execute settlement	Settlement confirmation (Confirm settlement order) Settlement receipt (Execute settlement)
Bitcoin settlement business	Bitpesa (Settler *(Business)*)	Send settlement order	settlement order (Send settlement order)
Remittance	Lipisha (Payment provider *(Partner)*)	Forward receipt confirmation , Send mobile money	E-receipt (Send mobile money)
Risk proposition	Bitpesa (Remittance provider *(Business)*)	Maintain a cyber-security program , Maintain capital requirements , Protect consumer assets , Submit reports	Quarterly audited financial statements (Submit reports) Report on change of methodology for calculating virtual currency in fiat currency (Maintain a cyber-security program) Report on violation of regulations related to remittance transactions 0.00 KeS (Maintain a cyber-security program)

4.4   Step 4: BitPesa prescriptions prototype/adopt

To explain the necessary conditions for compliance we show the changes in some of the diagrams used in section 4.1 and in the business model prototype in the VMP. First, we modify the strategy map shown in figure 6 with an additional 'legal risk management perspective' directly below the internal processes section. We place the patterns in the legal risk management perspective so we can map them onto their respective value streams. We then link those to the revenue-at-risk, e.g. a fine or bankruptcy. This gives us a place-holder for the compliance patterns and from which we can see the corresponding actions taken at the internal processes perspective of the strategy map. We tie the legal risk to the revenue-at-risk because it could negatively affect revenue partly (a fine) or fully (bankruptcy). The strategy map goals represent desired changes to the current state of the business. These changes correspond to an evolution of the business that can be modeled by using two phases of the business model, one for the As-Is version (before legal risk analysis) and another for the To-Be version (compliant to the generated patterns).

The activities that are added to the business model in the compliant phase are shown in Figure 8: they all contribute to pursue risk proposition and to set legal risk values (fine and years of criminal penalty) to zero. Figure 9 shows all the elements of the BitPesa business model in the compliant phase (To-Be), the elements in gray are the one added w.r.t. the non complaint version (As-Is). Finally, Figures 10 and 11 compare the effect of the value-at-risk on profit in the compliant business model w.r.t. the As-Is version.

4.5   BitPesa: BPMN

The diagram in Figure 12 describes the difference between the As-Is and To-Be model in terms of flow of activities in the firm. The white activities show the ordinary process, the two red activities are the ordinary compliance checking that already exist in the As-Is process. The green activities are the extra checks that would apply with the CPF. At first, the customer need to access the service with an account. If the customer does not already have an account

**Figure 10** BitPesa value propositions. As-Is version

My Proposition	From (Role)	Values
Cost proposition	Payment handler	Annual costs 27000000.00 KeS Personnel 24000000.00 KeS/Yr Platform maintenance and upgrades 3000000.00 KeS/Yr
Revenue proposition	Remittance provider	Annual revenue 30000000.00 KeS
Risk proposition	Remittance provider	Legal risk (Criminal penalty) 3.00 years imprisonment Legal risk (fine) 500000.00 KeS

Figure 11 BitPesa value propositions. To-Be version

My Proposition	From (Role)	Values
Cost proposition	Payment handler	Annual costs 27000000.00 KeS Personnel 24000000.00 KeS/Yr Platform maintenance and upgrades 3000000.00 KeS/Yr
Revenue proposition	Remittance provider	Annual revenue 30000000.00 KeS
Risk proposition	Remittance provider	Legal risk (Criminal penalty) 0.00 years imprisonment Legal risk (fine) 0.00 KeS

Figure 12 Bit Pesa Business Process.
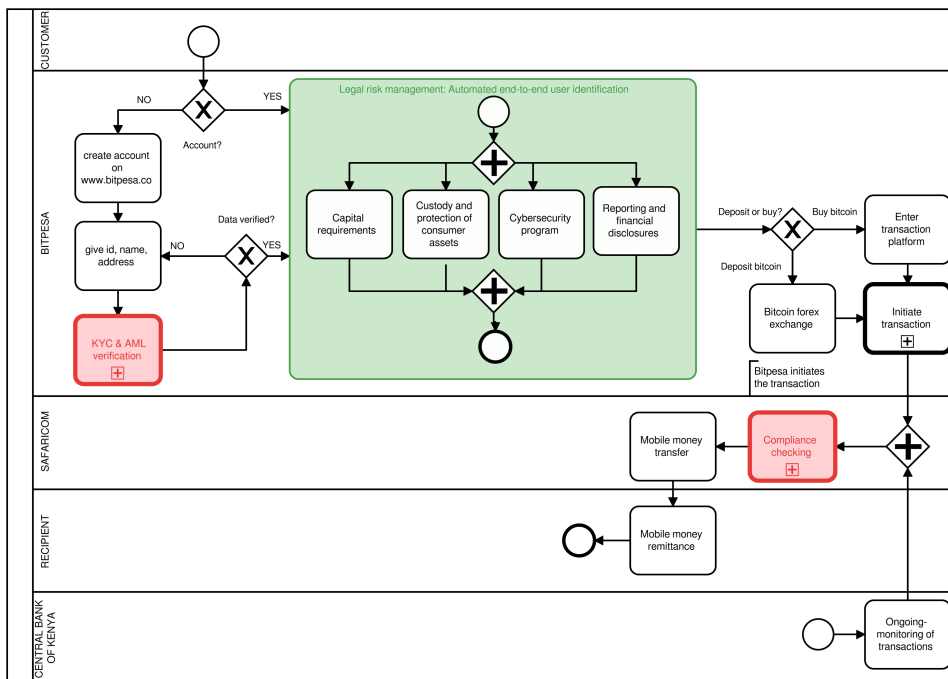
(Gateway *Account?*), he must create it (*Create account on www.bitpesa.co*). To do that, you have to fill the profile form with your personal data (Give id, name, address). The data are verify (subprocess *KYC AML verification*) and, eventually, refilled and corrected until they are validated (Gateway *Data verify?*). At this point, if the data are verified or the customer already have an account, there are the difference:

In the As-Is process, the customer can choose directly what kind of operation to conduct, buy or deposit bitcoins, and then follow the different procedures.

With the addition of the CPF, there are four parallel check about capital requirements, Custody and protection of consumer asset, Cybersecurity program and Reporting and financial disclosures. Only after this checks the customer can choose if buy or deposit bitcoin and continue with its different activities.

5   Discussion and conclusions

The objective behind the approach presented in this paper is to make the law more accessible in specific contexts of usage particularly for non-experts. This helps firms to identify and handle legal risks in order to ease regulatory risk management and compliance.

5.1   Practical applications

Beside Bit Pesa we examined other three cases [29, 14]: First Life (a civic social network whose technology is applied to plan and coordinate civic events using open data), Aereo (a media technology startup) and TVC (a live tv website). Firstlife's technology [51] is applied to plan and coordinate civic events using open data. This raises data management concerns, and the risk of copyright infringement while using public sector information. Aereo was involved in a legal dispute in the area of copyright: it had violated copyright laws by capturing broadcast signals on tiny antennas stored in warehouses and transmitting them to paying subscribers. Given the decision, the company was forced into bankruptcy in November 2014. TVCatchup Ltd (TVC) run a website which allows ordinary viewers to watch live UK television including broadcasts by a number of free-to-air broadcasters on their own computers, smart phones and game consoles. This case is analogous to the Aereo case but even more complex as it involves multi-level jurisdictions between the European Union and a Member State. The Aereo and TVC cases showed how our methodology can successfully be used to i) help legal knowledge engineers apply final interpretations to manage business risks by mapping them onto business models, ii) transform business models from high-risk to low-risk models, and iii) establish the legal risks in a startup's business model resulting from its disruptive technology. The cases of BitPesa and FirstLife showed the need for a flexible approach to fill gaps in scenarios where the regulatory framework was non-existent and uncertain. We were able to develop a compliance pattern based on other jurisdictions that are already regulating virtual currencies. The case of FirstLife highlighted the need for an agile approach to manage their data collection algorithms. These cases show that our approach is expressive enough to capture the essence of the legal debate. In particular, the choice of using CBMP in order to represent the legal context and problem of a dispute, turned out to be very efficient. Value modeling has been proved to be accessible and usable by the target audience of entrepreneurs. It is precise enough to capture legal choices, while avoiding the operational details of a business process model. On the other hand, as shown in this paper, we can also apply prescriptions in a notation like BPMN.

5.2   Concluding remarks

In conclusion, our investigations show that:

- It is not always clear what the law is and even for a single term, it may take significant evaluation with several appeals delving into the legislative history and purposes of the legal framework to ascertain the correct meaning.

- This is further complicated where a number of jurisdictions are involved. In the lower court cases, Aereo won in some states and lost in others. Firms may therefore base their business models on decent but erroneous presumptions from the legal perspective.

- There may be many underlying considerations to factor when each provision is being drafted and sometimes this could inadvertently lead to conflicts where different considerations were not balanced. For instance subsequent EU law annuls legitimate rights of a Member State's entity.

- Judicial interpretation is one of the few clear ways to achieve legal certainty on a matter. However, even the highest courts can shy away from giving some succinct criteria which stakeholders can follow confidently. Even then, we have seen that courts will concentrate on the functionality of the technology enabling a given business model. It will then proceed to determine the appropriate legal rules and evaluate the consequent legal claims. This will then invoke an interpretive process to determine which party's argument will prevail. In doing so, it implicitly, and sometimes, explicitly deploys canons of interpretation to analyze these arguments in order to balance competing interests.

It is therefore imperative to have methods that will begin to help legal knowledge engineers (a) understand the different arguments at play, and (b) apply the different interpretive arguments to legal provisions that they are working with to promote a more accurate reading and application of the law.

The current reality is that we cannot ascertain absolute compliance for firms without the promulgation of a judge or regulator. This forces us to step down from aiming for absolute compliance to legal risk management. So the more realistic objective is to explore the normative space governing a particular technology in order to make it accessible at the information architecture level where non-experts can identify and manage legal risks. This will help firms manage the legal risks they encounter while innovating with new technologies.

5.3   Limitations: quantification of legal risk

Our design of compliance integrates the analysis of value from the business and legal domains. We apply value modeling to avail of the elaborate mechanisms for measuring a firms economic value and the value-at-risk. Similarly, our analysis of legal risk is informed by the ongoing conceptualization of value modeling based on foundational ontologies [52]. To maximise the degree of fit, we focus on the value ascription relationship between executives as agents, and compliance, as a value object. Given that perceived value of compliance is low especially among startups, we concentrate on the theoretical value of compliance. However, even with elaborate value modeling tools such as the VMP, it is challenging to estimate the legal risk. Courts and regulators have the power to

escalate fines where they sense complacency or flagrancy. For instance, The UK Office of Communications (Ofcom) recently fined vodafone £4.65M for non-compliance where previous fines were £250,000 against H3G and £1M against EE. To promote the principles of legal certainty required by our legal systems, we also need to develop elaborate methods of legislative text mining to determine applicable fines and or estimates of such where regulatory discretion is permitted in the laws and regulations governing a particular domain.

5.4   Future works

Our investigation on case studies shows that the methodology proposed in this paper works, and is useful and applicable to the target audience. Since the CPF based on a semi-formalized legal risk analysis process using argumentation schemes from informal logic as a future work we plan a full formalization of the approach with regards to: (a) streamline and automate the compliance patterns generation process; (b) develop a general method for quantification of legal risk in conjunction with either statistical or rule-based NLP methods; and (c) enhance the legal argumentation method in CPF with other models of reconciling interpretive arguments.

In summary, the system we plan to implement could work by applying the following main points:

Step 1. keywords abstraction from the value model on VDMBee Value Management Platform;

Step 2. use of the above keywords as input *for a legal knowledge management system* based on legal ontologies (e.g. Eunomos [5]) in order to retrieve compliance patterns that the model is subject to: the ontology framework will work behind the scenes to identify the legal concepts related to the keywords and hence the compliance patterns attached;

Step 3. the user can also avail a semantic wiki feature to explore the compliance patterns further in order to examine the legal argumentation justifying the pattern and the related legislation and case law and other jurisprudence from the platform.

Appendix: survey questionnaire

How do startups deal with legal risks?

Dear participant,

This study is part of doctoral research into the decision making processes of startups regarding legal uncertainties. We expect that startups have little knowledge of the legal aspects of their novel business models. Consider for instance: regulation of technology; securing your assets; IPR; data protection; contract enforcement, labour law and many other legal aspects. The study will help us to establish whether there is a need to develop a legal knowledge management system to help determine the legal risks and possible solutions in order to be compliant.

Kindly illustrate with examples where possible. If you have any questions or comments, do not hesitate to get in touch on +393283350939 or muthuri.r@gmail.com

What is name of your startup ?

Profile:

What is your position in the firm?	
How many years have you been in the startup industry?	
Where is your startup based?	
In what sector do you categorise your startup?	
How many years has your startup been in operation?	
Is there a designated legal officer within the company, or an external legal expert you consult?	

Business Model

How does your company (intend to) make money? Have you finalized decisions about this business model, or is it still open?

Have you identified the laws or regulations that may affect this business model?

○ Yes

○ No

What are the difficulties associated with this such laws or regulations?

[text box]

What are the main legal risks with regard to your startup's business model?
(We're focusing on the legal risks related to the business model as opposed to others e.g. of setting up a business etc which are common to all)

[text box]

Do you consider these risks when you are designing/changing your business model?

○ Yes

○ No

Were you able to determine the possible ways your business model could have been affected?

[text box]

Were you able to propose appropriate modifications of the business model to solve this?

[text box]

Did you work with an internal or external legal expert or lawyer in this process?

[text box]

What makes legal compliance challenging for you?

[text box]

What are the most important (or critical) aspects of making sure that your business model is legally compliant (hereafter "compliance decision")?

[text box]

To what extent do you agree with the following statements when applied to compliance decisions at the early-stage entrepreneurship?

	strongly agree	somewhat agree	neutral	somewhat disagree	Strongly Disagree
The law is clear as regards our business model.	●	○	○	○	○
It is easy to determine which legislation is applicable.	○	○	○	○	○
We have taken a crucial decision about the business model without knowing exactly what the law is.	○	○	○	○	○
Compliance related decisions are often refined at a later stage.	○	○	○	○	○
When we make a compliance decision, it is final.	○	○	○	○	○
Time constraints do not allow us to consider all decision alternatives.	○	○	○	○	○
We prefer discussions with lawyers (or other stakeholders) to base our compliance decisions on.	○	○	○	○	○
It is easy to interpret what rules the legislation provides and how they affect our business model.	○	○	○	○	○
We prefer to base our compliance decisions on other business related data.	○	○	○	○	○
Compliance decisions often have to be reconsidered, which also affects other decisions.	○	○	○	○	○

Can we get back to you in regard to testing the Legal Knowledge Management System developed with the help of this questionnaire?

○ Yes

○ No

Please indicate your email bellow.

_____

We thank you for your time spent taking this survey.
Your response has been recorded.

References

[1] Ronald Dworkin. *Taking Rights Seriously*. Duckworth, London, 1977.

[2] Julia Black. Regulatory conversations. *Journal of Law and Society*, 29:163–196, 2002.

[3] Michael Naylor. The impact of disruptive technology. In *Insurance Transformed*, pages 47–92. Springer, 2017.

[4] Antonino Rotolo, Guido Governatori, and Giovanni Sartor. Deontic defeasible reasoning in legal interpretation: two options for modelling interpretive arguments. In *Proceedings of the 15th International Conference on Artificial Intelligence and Law*, pages 99–108. ACM, 2015.

[5] Guido Boella, Luigi Di Caro, Llio Humphreys, Livio Robaldo, Piercarlo Rossi, and Leendert. van der Torre. Eunomos, a legal document and knowledge management system for the web to provide relevant, reliable and up-to-date information on the law. *Artificial Intelligence and Law*, 24, 2016.

[6] Silvia Ingolfo, Ivan Jureta, Alberto Siena, Anna Perini, and Angelo Susi. Nomos 3: Legal compliance of roles and requirements. In *Conceptual Modeling*, volume LNCS 8824, pages 275–288. Springer, 2014.

[7] Guido Boella, Guido Governatori, Antonino Rotolo, and Leon van der Torre. A logical understanding of legal interpretation. *KR 2010*, pages 1–1, 2010.

[8] Katie Atkinson, Trevor Bench-Capon, and Danushka Bollegala. Explanation in ai and law: Past, present and future. *Artificial Intelligence*, page 103387, 2020.

[9] Richard E Susskind. *The end of lawyers?: rethinking the nature of legal services*. Oxford University Press Oxford, 2008.

[10] Mustafa Hashmi, Guido Governatori, and Moe Thandar Wynn. Normative requirements for regulatory compliance: An abstract formal framework. *Information Systems Frontiers*, 18(3):429–455, 2016.

[11] Samer Hassan and Primavera De Filippi. The Expansion of Algorithmic Governance: From Code is Law to Law is Code . *Field Actions Science Reports*, December 2017.

[12] Guido Governatori, John Zeleznikow, Louis de Koker, Marta Poblet, Mustafa Hashmi, and Pompeu Casanovas Romeu. Rules as code will let computers apply laws and regulations. but over-rigid interpretations would undermine our freedoms. https://theconversation.com/rules-as-code-will-let-computers-apply-laws-and-regulations-but-over-rigid-interpretations-would-undermine-our-freedoms-149992, november 2020. The Conversation Trust (UK) Limited.

[13] James Mohun and Alex Roberts. Cracking the code: Rulemaking for humans and machines, 2020.

[14] Robert Muthuri, Guido Boella, Joris Hulstijn, Sara Capecchi, and Llio Humphreys. Compliance patterns: Harnessing value modeling and legal interpretation to manage regulatory conversations. In *Proceedings of the 16th Edition of the International Conference on Articial Intelligence and Law*, ICAIL '17, pages 139–148, New York, NY, USA, 2017. ACM.

[15] V. Kartseva, J. Hulstijn, J. Gordijn, and Y. Tan. Control patterns in a health-care network. *European Journal of Information Systems*, 19:320–343, 2010.

[16] Amal Elgammal, Oktay Türetken, Willem-Jan van den Heuvel, and Mike Papazoglou. Formalizing and applying compliance patterns for business process compliance. *Software and Systems Modeling, 15(1), 119-146.*, 15(1):119–146., 2016.

[17] OMG. Value Delivery Modeling Language (VDML). OMG Document Number: dtc/2014-04-05, 2014. http://www.omg.org/spec/VDML/1.0.

[18] Geert Poels, Ben Roelens, Henk de Man, and Theodoor van Donge. Continuous business model planning with the value management platform. In *Proceedings of the 12th International Workshop on Value Modeling and Business Ontologies*, page 18, 2018.

[19] OMG. Business process modeling and notation bpmn. Object Management Group (OMG) Specification, 2011. http://www.omg.org/spec/BPMN/2.0/PDF.

[20] Jan Recker. Opportunities and constraints: the current struggle with bpmn. *Business Process Management Journal*, 2010.

[21] Ilaria Angela Amantea, Antonio Di Leva, and Emilio Sulis. A simulation-driven approach to decision support in process reorganization: A case study in healthcare. In *Exploring Digital Ecosystems*, pages 223–235. Springer, 2020.

[22] Ruopeng Lu, Shazia Sadiq, and Guido Governatori. Measurement of compliance distance in business processes. *Information Systems Management*, 25(4):344–355, 2008.

[23] Paul L Bowen, May-Yin Decca Cheung, and Fiona H Rohde. Enhancing it governance practices: A model and case study of an organization's efforts. *International Journal of Accounting Information Systems*, 8(3):191–221, 2007.

[24] Jörg Becker, Patrick Delfmann, Mathias Eggert, and Sebastian Schwittay. Generalizability and applicability of model-based business process compliance-checking approaches – a state-of-the-art analysis and research roadmap. *BuR - Business Research*, 5, 11 2012.

[25] Mathias Weske. *Business Process Management Architectures*, pages 333–371. Springer Berlin Heidelberg, Berlin, Heidelberg, 2012.

[26] Sangkyun Kim. Auditing methodology on legal compliance of enterprise information systems. *International Journal of Technology Management*, 54(2/3):270–287, 2011.

[27] Steffen Höhenberger, Dennis M. Riehle, and Patrick Delfmann. From legislation to potential compliance violations in business processes - simplicity matters. In *24th European Conference on Information Systems, ECIS 2016, Istanbul, Turkey, June 12-15, 2016*, page Research Paper 188, 2016.

[28] Ruopeng Lu, Shazia Sadiq, and Guido Governatori. Compliance aware business process design. In Arthur ter Hofstede, Boualem Benatallah, and Hye-Young Paik, editors, *Business Process Management Workshops*, pages 120–131, Berlin, Heidelberg, 2008. Springer Berlin Heidelberg.

[29] R. K. Muthuri Kiriinya. *Designing compliance patterns: integrating value modeling, legal interpretation and argument schemes for legal risk management*. PhD thesis, Universita degli studi di Bologna, 2017.

[30] Shirley Gregor and Alan R Hevner. Positioning and presenting design science research for maximum impact. *MIS quarterly*, pages 337–355, 2013.

[31] Ken Peffers, Tuure Tuunanen, Marcus A. Rothenberger, and Samir Chatterjee. A design science research methodology for information systems research. *Journal of Management Information Systems*, 24(3):45–77, 2007.

[32] Michael zur Muehlen and Michael Rosemann. Integrating risks in business process models. In *16th Australasian Conference on Information Systems, ACIS 2005*, page 50, 2005.

[33] Alan R. Hevner, Sudha Ram, and Salvatore T. March. Design science in information systems research. *Mangement Information Systems Quarterly*, 28(1):75–105, 2004.

[34] Ben Roelens and Geert Poels. The development and experimental evaluation of a focused business model representation. *Business & Information Systems Engineering*, 57(1):61–71, Feb 2015.

[35] Peter Lindgren and Ole Horn Rasmussen. The business model cube. *Journal of Multi Business Model Innovation and Technology*, 1(3):135–180, 2013.

[36] MacCormick Neil and Robert S Summers. Interpreting statutes: A comparative study, 1991.

[37] Erich Gamma, Richard Helm, Ralph Johnson, and John Vlissides. *Design patterns: elements of reusable object-oriented software*. Pearson Education, 1994.

[38] Marlon Dumas, Marcello La Rosa, Jan Mendling, and Hajo Reijers. *Fundamentals of business process management*, volume 1. Springer, 2nd edition, 2018.

[39] Wil MP Van der Aalst. Business process management: a comprehensive survey. *ISRN Software Engineering*, 2013, 2013.

[40] John Hayes. *The theory and practice of change management*. Palgrave Macmillan, 2014.

[41] Marlon Dumas, Wil M Van der Aalst, and Arthur H Ter Hofstede. *Process-aware information systems: bridging people and software through process technology*. John Wiley & Sons, 2005.

[42] W. Van der Aalst. *Process mining: discovery, conformance and enhancement of business processes*, volume 2. Springer, 2011.

[43] Thomas Allweyer. *BPMN 2.0: introduction to the standard for business process modeling*. Books on Demand, 2016.

[44] Suriadi Suriadi, Burkhard Weiß, Axel Winkelmann, Arthur HM ter Hofstede, Michael Adams, Raffaele Conforti, Colin Fidge, Marcello La Rosa, Chun Ouyang, Michael Rosemann, et al. Current research in risk-aware business process management: overview, comparison, and gap analysis. *Communications of the AIS*, 34(1):933–984, 2014.

[45] Emilio Sulis, Ilaria Angela Amantea, and Giulio Fornero. Risk-aware business process modeling: a comparison of discrete event and agent-based approaches. In *2019 Winter Simulation Conference (WSC)*, pages 3152–3159. IEEE, 2019.

[46] Emilio Sulis, Pietro Terna, Antonio Di Leva, Guido Boella, and Adriana Boccuzzi. Agent-oriented decision support system for business processes management with genetic algorithm optimization: an application in healthcare. *J. Medical Syst.*, 44(9):157, 2020.

[47] Ilaria Angela Amantea, Marzia Arnone, Antonio Di Leva, Emilio Sulis, Dario Bianca, Enrico Brunetti, and Renata Marinello. Modeling and simulation of the hospital-at-home service admission process. In *Proceedings of the 9th International Conference on Simulation and Modeling Methodologies, Technologies and Applications*, SIMULTECH 2019, page 293–300, Setubal, PRT, 2019. SCITEPRESS - Science and Technology Publications, Lda.

[48] OMG. Model driven architecture guide revision 2.0. Object Management Group (OMG), 2014. https://www.omg.org/cgi-bin/doc?ormsc/14-06-01.

[49] Steve Blank. Why the lean start-up changes everything. *Harvard Business Review*, 91(5):63–72, 2013.

[50] Alexander Osterwalder and Yves Pigneur. *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers*. John Wiley & Sons, 01 2010.

[51] Guido Boella, Alessia Calafiore, Elena Grassi, Amon Rapp, Luigi Sanasi, and Claudio Schifanella. Firstlife: Combining social networking and vgi to create an urban coordination and collaboration platform. *IEEE Access*, 7:63230–63246, 2019.

[52] Nicola Guarino, Birger Andersson, Paul Johannesson, and Livieri Barbara. Towards an ontology of value ascription. In *Formal Ontology in Information Systems: Proceedings of the 9th International Conference (FOIS 2016)*, volume 283, page 331. IOS Press, 2016.