Value Activity Monitoring

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Abstract. Value constellations are business ecosystems, where multiple actors communicate in economic, legal, information and social affairs. How to monitor such a system demands viewpoint and view-dependent strategies. The problem treated and reported here is how to monitor a value activity. The mechanism proposed to address this problem, so-called Value Activity Monitoring, is based on an ontology of same name, which is the core contribution of this paper. The artifact is designed and validated from a Design Science perspective. More specifically, the artifact evaluation has been conducted via application in real-world business cases. Previous evaluations include applications in the sectors of Renewable Energy and Intellectual Property Rights. Now, new problems are provided by a case from the Customs Control (Business-to-Government) sector. From that, the challenge is to reconcile monitoring costs and reliability. In return, it is demonstrated how the proposed artifact can be used to derive potentially effective and efficiency monitoring strategies for value activities, which comprises the main results of this research.

Keywords: Communication Action Perspective, Customs Control, Ontology, Value Activity, Value Constellations.

1 Introduction

Value constellations are usually referred to as a system of actors exchanging objects of economic value so as to satisfy a consumer's need [1]. Although necessary, the economic aspect is not sufficient to capture real-world business problems. These often come up as crossover of economic, legal, organizational and information systems aspects, altogether glued and blurred by communication action ones. Such a cloud of aspects would constitute an evolving definition of value constellation, which is much closer to practice than its predecessor, and therefore, adopted here as a starting point of discussion.

The umbrella research problem considered here is the one of *how to monitor a value constellation*. Such a problem has been treated by levels, both from a constellation viewpoint [2] and from a transactional one [3]. This time, the problem shifts to *how to monitor a value activity*. More specifically, the viewpoint considered is the one of a critical value activity nourishing an entire value constellation. Truly, it makes sense to realize that, if the monitoring of such an activity is not scrutinized, the

monitoring of its corresponding nourished constellation may become inefficient, if not ineffective.

In order to solve such a problem, a Design Science perspective is adopted [4]. Related research has been carried out on the value constellation problem [5]. Nonetheless, the focus there is on the controlling mechanisms for value constellations, which places monitoring as a mere delegation pattern. Such a treatment is not sufficient to cope with demands from essentially monitoring business cases. Moreover, the monitoring of a value constellation, as well as its encompassed transactions and activities, gives rise to a plethora of new research questions. Among them, the one of how to monitor a value activity figures out as one of practical relevance [6] for at least three reasons. Firstly, it represents an attempt *to achieve* or *explore* new requirements on monitoring as a business in its own. Second, it also represents an attempt *to optimize* how this type of business is currently done. An other important consideration is, that it represents an attempt *to furnish* business analysts with a proper viewpoint on service monitoring, which is often relegated as a process-level or IT-level concern, instead of strategic one, on a first instance analysis.

The mechanism proposed to solve the corresponding problem, so-called Value Activity Monitoring, is based on an aspect Ontology of same name, which blends Economic, Legal, Organization and Information Systems requirements with elements from the Communication Action Perspective. The artifact has been previously evaluated through cases in Renewable Energy [3] and Intellectual Property Rights [2], for the sake of refinement and evolution of its own conceptual fitness. This time, it is applied to a case in Customs Control, which brings new requirements on the monitoring of value constellations. Here, the specific problem is *how to reconcile cost and reliability on monitoring a value constellation*. As a return, it is demonstrated how the artifact proposed can be used so as to derive potentially effective and efficient monitoring strategies. This is achieved by slightly shifting the monitoring focus from the global perspective of the entire constellation to the point of its corresponding nourishing (critical) value activity.

The rest of this paper is organized as follows. Section 2 provides a theoretical background that provides reasons for monitoring value constellations from an activity viewpoint and which and how monitoring aspects were blended on the building of the proposed artifact. In Section 3, the candidate ontology is presented in detail, along with its proper internal views. In Section 4, the utility of the artifact is evaluated on the Customs Control business case. Finally, Section 5 provides some discussion and immediate research outlook.

2 Theoretical Background

As the problem of how to monitor a value constellation can be very open and complex, it is worth to set some assumptions and rationale on system viewpoints and views, for the sake of simplification and tractability.

2.1 Monitoring *Viewpoints* in Value Constellations

Monitoring is part of a bigger picture on managing value constellations [7]. According to this perspective, the modeling and configuration of a value constellation, on the business strategy viewpoint, consists of a prelude for configuring value-adding business processes and underlying IT services. The original concept proposed monitoring as an essentially process-oriented to IT services-oriented problem. However, as part this research, further guidelines have been provided in terms of treating monitoring also as a business strategy problem [8]. From that point and on, the challenge has been on injecting monitoring information in the value models, so as to align monitoring requirements from the business strategy viewpoint to the corresponding back-end business processes and IT services.

In [3], the first version of the artifact presented here has been proposed. The so-called Enterprise Monitoring Ontology had the problem of how to monitor a value constellation from a global perspective. The dominant aspect of the monitoring was still the economic one. Some elements of the Communication Action Perspective were borrowed from a companion theory, the Enterprise Ontology [9]. The resulting candidate ontology had received significant input in terms of elements of practice of a case in Renewable Energy. The challenge provided by that was the one of how to monitor a value constellation in Renewable Energy. More specifically, it was focused on how to reconcile the cost of monitoring with availability issues related to the intermittent production of the renewable energy. Moreover, assumptions on data privacy and security were also considered. As a macro-context, the corresponding business market is highly liberalized, with decentralized management. The resulting ontology had a peer-to-peer accent on deriving monitoring strategies from and to the value constellation. The main logic was to build up a monitoring constellation as a tourniquet to support critical value transactions.

In [2], the second version of the artifact has included explicit Communication Action guidelines which were provided no more from the companion theory [9], but from literature on Language and Communication Action [21]. Past limitations encountered on the case application reported in [3] have been considered. Moreover, a case on Intellectual Property Rights provided new elements of practice and challenges for monitoring value constellations in that type of market. More specifically, the case problem was the one of how to monitor a value constellation in the Digital Music Industry. The main challenge comprised to reconcile the cost of monitoring with the trust assumptions on the behavior of the partners involved in collaboration. As a macro-context, the corresponding business market is also liberalized, but the main monitoring stakeholders – the Intellectual Property Rights Societies – are government-appointed authorities, with limited monitoring resources but strong controlling capabilities over the context they operate. The resulting ontology had an applicability focus on monitoring value transactions, leaving the global aspect on a second plane, for the sake of economic fitness. The idea of building a monitoring constellation to support a critical value transaction (e.g. an untrusted one) remained intact.

Finally, new challenges have been identified for evolving the ontology presented in [2] and [3]. These come from a new real-world business case in Customs Control. The specific monitoring problem now is how to reconcile monitoring costs with monitoring reliability. This type of market comprises typically Business-to-

Government transactions, which pose new demands in terms of coordination and organization requirements. The core challenge here seems to be no more the one of building monitoring constellations as tourniquets for critical value transactions, but the one of monitoring an entire value constellation from a monitoring chokepoint, i.e. the final consumer's activity – the one played by the Government, as a final consumer of monitoring information.

2.2 Monitoring *Views* in Value Constellations

As stated before, a value constellation encompasses many collaborative aspects other than purely economic ones. These include Legal, Information Systems and Organizational Aspects. It is worth to highlight which specific aspects of each of these disciplines are considered here, as well as how and why they are blended on producing the artifact proposed here.

Economic Aspects: the *e3value* framework [1], which provides the value constellation modeling support considered here, is essentially an economically-driven one. There, the implicit (but shared) value modeling rationale is the one maximizing individual profitability. However, some other aspects ought to be considered to complement such a perspective. For instance, for the sake of sustainability, a value constellation should be specified in such a way so as to minimize future adaptation. This is called Robust Mechanism Design [10]. Another aspect comprises the premise that value cannot be transferred, but only co-created. Besides, the valuation activity, if any, is private, idiosyncratic and experimental. These aspects comprise fundamental principles of the Service-Dominant Logic [11].

Legal Aspects: although value constellations can be self-regulated, i.e. with actors applying regulating actions towards one another, certain markets have their own regulative bodies, performing a proper set of value creation activities. These in turn also produce corresponding proper value objects, e.g. accreditations and regulations as value objects [12]. Actually, such regulative elements can also constitute a market apart. Moreover, regulative bodies often work as controllers of public information access and disclosure, in collaborative assets [13].

Information Systems Aspects: the Robust Mechanism Design also finds a parallel in the Information Systems field – the Computational Mechanism Design [16]. Such a paradigm provides different types of upper-level goals, which can be translated into business value needs (in *e3value* terms). These needs comprise possible rationales of value actors, for instance: (1) maximized individual utility; (2) maximized social welfare; and (3) budget balance. Another relevant paradigm, source of Information Systems-related monitoring aspects is the Complex Event Processing (CEP) [14]. This can provide monitoring stereotypes for value activities, such as production, consumption and transformation monitoring activities (e.g. aggregation, filtering, selection, publication). Yet, the Role-Based Access Control model (RBAC) [15] also provides guidance that can be adapted so as to describe a semantics for value transactions, in terms of which value actor plays which role according to a subset of operations (e.g. value activities) that changes objects (e.g. value objects).

Organizational Aspects: on top the previous aspects, some governance guidelines can also be employed on organizing a value web and its monitoring. A typology of

theories on organization and management is provided in [17]. Among them, the Agency Theory [18] appears as the one appropriate to be used in scenarios where the monitoring information can be modeled as a purchasable commodity. Such a premise gives rise to the idea of exploring and modeling monitoring as an economy of scale, i.e. as a value constellation in its own domain, amenable to sustainability analysis.

Communication Action Aspects: finally, pervasive to all the previously mentioned aspects is the communication one. This aspect can work as a sort of "glue" to be placed among the other ones. The idea that rational actors engage on communication acts of production and coordination is not new [19-20]. Such acts can be articulated in such a way for a rational actor to achieve his individual goals. The Enterprise Ontology [9] has referred to the *production acts* as the *objective world*, whereas to the *coordination acts*, as the *social world*. These aspects are somewhat reified in the e3value framework in terms of value activities and value exchanges, respectively. However, both Enterprise Ontology and *e3value* somehow neglects treatment on the *subjective world* aspect, addressed by Allwood [21]. This world encompasses a third-level class of acts, so-called apprehension and display acts, which can be used to modify how the other types of acts are performed.

Altogether, these aspects were blended so as to produce the artifact proposed here. The main rationale for blending disparate theories towards producing a new one is that such an endeavor represents an opportunity for phenomenological problem exploitation (such as monitoring value constellations), as well as its potential for innovation [22].

3 Value Activity Monitoring Ontology

The artifact proposed to solve the problem of how to monitor a value constellation from a value activity point of view is the so-called Value Activity Monitoring Ontology (hereafter, VAMO). The ontology has been built according to an Ontology Engineering methodology [23], with special focus on practical application. The candidate ontology is referred here as an "Aspect Ontology", which differs from the types of ontology proposed by Guarino [24]. It is organized along three internal views and is described as follows.

3.1 Monitoring Goal View

The *monitoring goal view* is the anchor point of the ontology, and represents *what* construct elements of a value constellation are necessary in order to fulfill a certain actor's monitoring goal. The view is depicted in **Fig. 1** and is described as follows.

An agentive party is an economic rational agent. A value actor is a specialization of an agentive party. Three stereotypes are recognized to distinguish among monitoring actors: monitoring agent, monitoring principal and monitoring third-party. The focus here is on the relation that a monitoring agent has a certain basic goal. Such a goal is realized by a monitoring object. Relevant value objects for monitoring include: monitoring object, monitored object and counter-object. In order to achieve a certain goal, a value actor, as an agentive party, commits to many types of

communication acts. These acts bring about changing the state of affairs of objects, thereby transforming their state-of-affairs into one which satisfies a value actor's monitoring goal.

Three types of communication acts are recognized: production acts, coordination acts and valuation acts. A value activity is a specialization of a production act. A value exchange is a specialization of a coordination act. Last, a value indication is a specialization of a valuation act. Value activities are classified into two stereotypes: monitoring activity and monitored activity. Cardinality restrictions are defined accordingly. E3value elements are stereotypes as such. Elements market in dashed lines represents the boundaries of extension of the e3value framework towards a monitoring capabilities-enriched one.

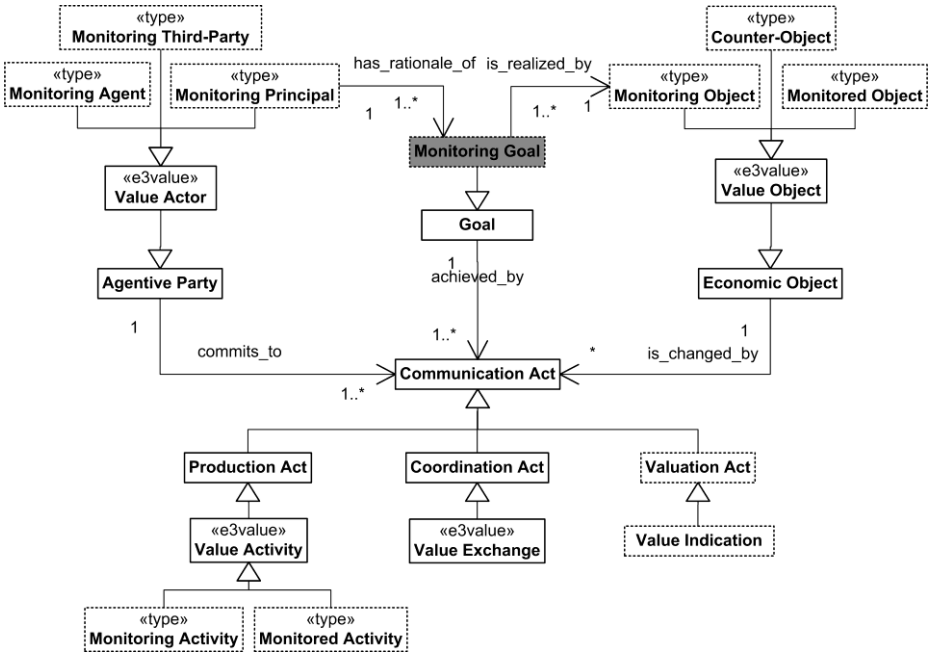

Fig. 1. Value Monitoring Goal View

This basic classification comprise the basic one that define, from a dominant principal point of view, *what* is necessary to have to realize a monitoring goal. *How* these elements communicate is described on the next view of the ontology.

3.2 Monitoring Transaction View

The monitoring transaction view represents *how* the elements of a value constellation relate to one another so as to realize a monitoring goal. It elaborates on a *coordination* (social world) perspective on the monitoring. It is depicted in **Fig. 2** and is described as follows.

A monitoring transaction is a specialization of a value transaction. Adopting RBAC [15] guidelines, a more precise semantics is given to the concept of value transaction. The semantics consists on modeling a monitoring transaction as a triple assignment involving value actors, value activities and value objects. The rationale here is to define who provides what to whom. The different actor types are assigned to activities by commitments of competence. Monitoring principal and monitoring third-party are assigned to monitoring activity, whereas monitoring agent is assigned to monitored activity. The behavior of the activity types is defined by what they produce and consume in terms of objects. Therefore, a monitored activity is the one which produces a monitored object. This object is used by the monitoring activity to produce a monitoring object. Monitoring activity also consumes monitoring object (to realize a monitoring goal). Finally, counter-objects are offered in economic reciprocity for all the other types of objects. Notice that the concept of a monitoring transaction is in dashed line, meaning that it is itself a boundary exploration concept enriching the e3value framework.

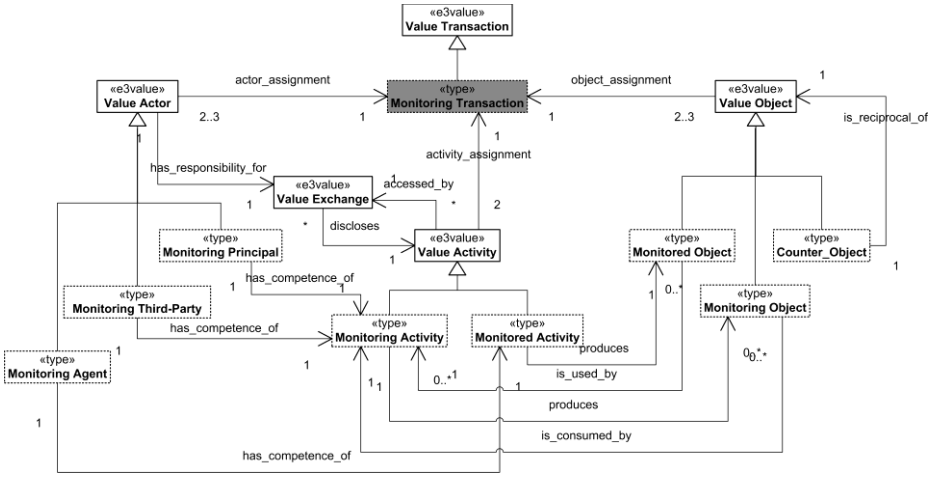

Fig. 2. Value Monitoring Transaction View

It is also worth noting that the monitoring transaction view supports only the organizational aspect of the monitoring interaction. The "how" to monitor aspect considered here refers to the coordination of the monitoring. The ultimate "how" to monitor a value activity resides in subjective world, which is covered by the following ontology view.

3.3 Monitoring Indicator View

The monitoring indicator view still represents how to monitor a value constellation, but from an individual valuating perspective (i.e. the subjective world). It is depicted in **Fig. 3** and is described as follows.

A monitoring principal has a certain goal as rationale, and this in turn is achieved by a certain monitoring activity. Again, a monitoring activity appears as a specialization of a value activity. Although not explicit in the model, in practical affairs this activity refers to the final consumer's activity, which nourishes the value constellation. Therefore such an activity is critical for the system, as without it, the constellation is not nourished anymore, and therefore, not sustainable.

The monitoring principal is connected to a value indication activity, but commitment of authority. This conforms to the tenth fundamental premise of the Service Dominant Logic [11], that value is idiosyncratic, experimental, individual and private on the value consumption's side. A value indication uses two resources to produce its output. From one side, it uses a set of predefined indicators, each of them representing their own universe of analysis and discourse. Four generic types of indicators are classified: Time Indicators, Spatio Indicators, Quantity Indicators, and Quality Indicators. Each of these indicators can be described in corresponding ontologies. From the related literature, some options were catalogued. These include, for instance, the OWL Time Ontology [25], the Ontology of Spatial Diversity [26], the Mathematical Ontology of Quantity Dimensions [27] and the SERVQUAL model, which although not yet represented as a formal ontology, constitute a pragmatic source of relevant quality indicators in Supply Management [28].

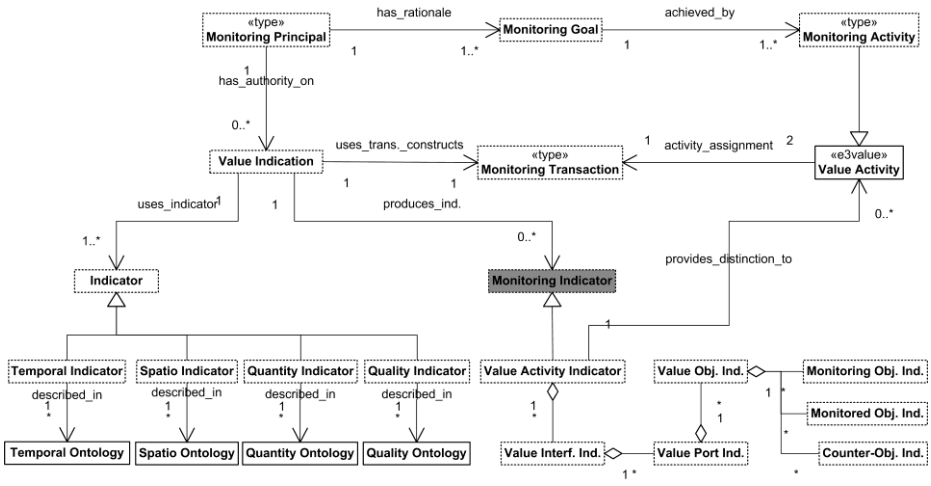

Fig. 3. Value Monitoring Indicator View

A value indicator uses also, as a resource, a monitoring transaction. From that construct it is possible to retrieve the activity of relevance: the monitoring activity. Finally, the value indication produces a set of specific indicators, by crossing value activity-related elements with the generic indicators. Indicators can be combined and assigned to basically anything, in different levels, but here, the focus is on defining what would be a value activity indicator. According to the *e3value* ontology [1], the elements that closest relates to the nourishing of a value activity comprise: (1) value objects; which are provided through (2) value ports; and these in turn are grouped into

(3) value interfaces; and these can be attached to (4) value activities. Therefore, the construction of a value activity indicator is modeled as a composition of indicators generated for valuation of all these nested elements.

Finally, the value activity indicator can provide distinction to a certain value activity. The logic here is to distinguish among multiple instances of monitoring activities that could potentially realize a same monitoring goal. Further levels of aggregation would include indicators for actors, transactions and entire constellations, for instance. This view closes the ontology cycle, by reconnecting to the point of a monitoring goal realized by a monitoring activity. The "how" aspect, as specified here, is essentially qualitative.

There is a handful of ontology evaluation approaches classified in the literature [29]. Among them, one of specific interest is the application-focused evaluation [30], whereby an ontology is confronted with real contextual problems so as to have its conceptual fitness assessed and refined. Following, we take this direction on evaluating the ontology proposed here on a case in Customs Control, from the International Trade domain.

4 Case Study Evaluation

4.1 Core Value Constellation

The case reported here is a sub-extract of complex network of cases initially reported in [31]. For the sake of practical demonstration, a value model has been specified for this case and is depicted in **Fig. 4**. It is described as follows.

The macro-context is the one of International Trade, where companies and market segments from the business sub-domain of fruit juice raw materials and derived fruit composites (and associate goods) collaborate. Therefore, the main actors include: (1) a *raw material supplier*, which is competent on producing raw materials (e.g. fruit extracts); (2) a *semi-manufacturer*, which is competent on transforming raw materials in semi-manufactured goods (e.g. fruit composites); (3) a semi-finished material consumer, which relatively consumes the semi-manufactured goods; (4) a shipper market segment, which can support the previous actors with transport services; and (5) a Customs Control Authority, which wants to control all the goods that flow in this constellation. This actor provides legitimation documents in exchange of excise taxes. To close the economic reciprocity of the network, money is offered in exchange in all the other transactions. Therefore, this is a typical Business-to-Government value constellation.

Taking the government authority as the dominant monitoring perspective, the monitoring problem to be addressed here is *how to monitor a value constellation in customs control from the point of view of the critical activity of controlling goods*. Henceforth, one critical assumption must be drawn. It refers to the requirement that the monitoring should be performed under cost reduction, while increasing overall monitoring reliability.

One possible approach to solve such a problem is to create some sort of monitoring chokepoint in the constellation, so as to allow the critical monitoring information to pass over that. Notice that, in **Fig. 4**, there is already a chokepoint actor, highlighted in the core of the constellation. Therefore, solution logic could comprise the reuse of available actors, activities, exchanges and objects that already exist in the constellation, so as to minimize extra supporting monitoring costs. Such logic is grounded on the idea that, in order to be monitored, a value constellation could have its organizational roles reconfigured.

It is in this context that the Value Activity Monitoring Ontology is applied and evaluated.

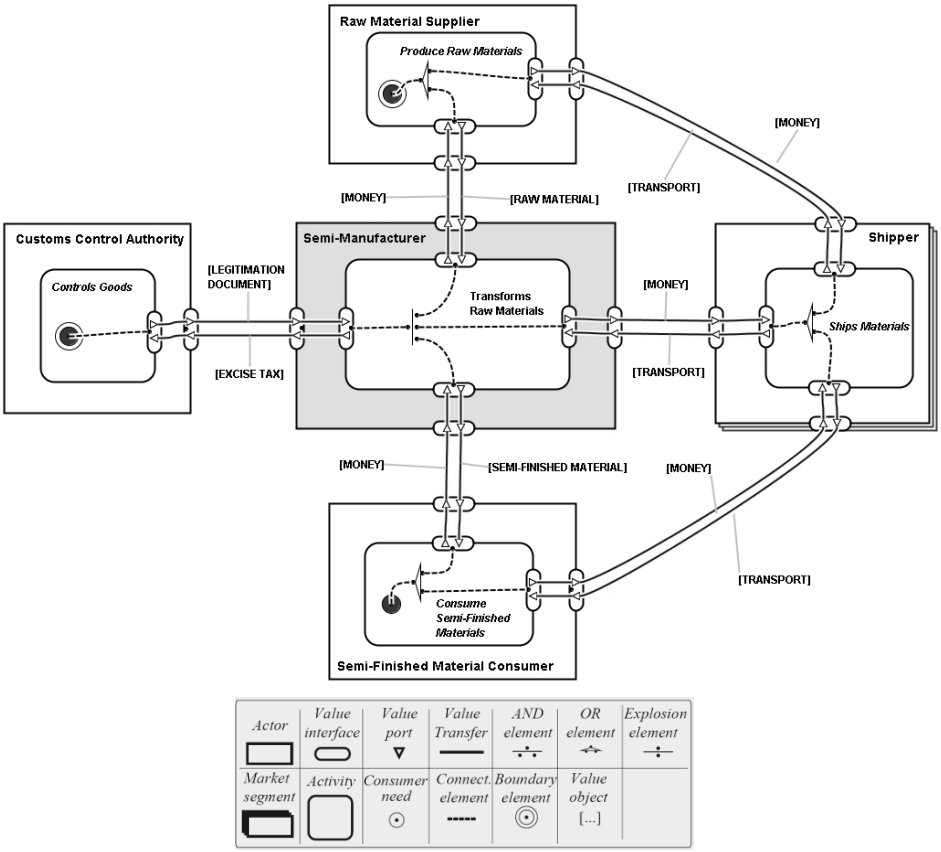

Fig. 4. Customs Control Case: Core Value Constellation

4.2 Monitoring Value Constellation

By applying the ontology proposed here, an alternative solution has been derived, which is depicted in **Fig. 5**. The solution is described as follows.

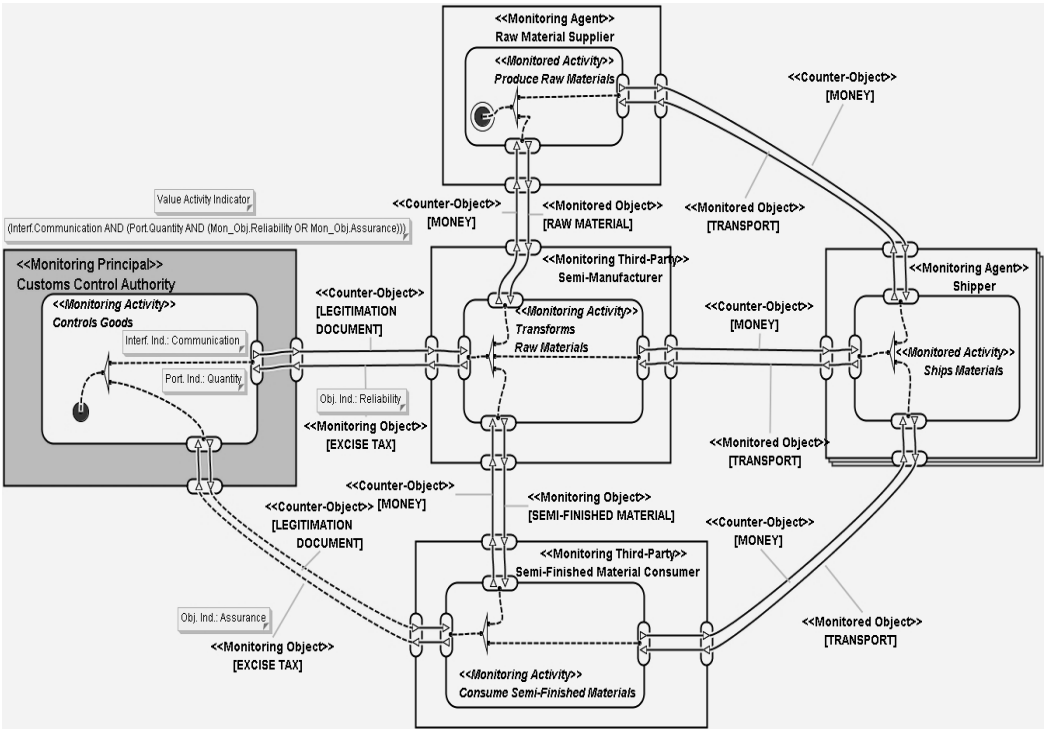

Fig. 5. Customs Control Case: Monitoring Value Constellation

Starting by the monitoring goal view, the Customs Control Authority is considered as the monitoring principal of the constellation. In order to achieve its monitoring goal (fulfilled by the ultimate monitoring object of excise taxes), the actor engages on a monitoring value activity (production), two value transactions (with semi-manufacturer and semi-finished material consumer, and a value indication, which is explained further. Notice that the actor is highlighted, indicating the dominant perspective. From such, the raw material is seen as playing the role of a monitoring agent; the semi-manufacturer plays the role of a monitoring third-party; the shipper plays also the role of a monitoring agent; and the semi-finished manufactured consumer plays the role of another third-party, so as to close the symmetry of the model in terms of monitoring versus monitored objects flow and exchange.

Some attention must be drawn to the effect of such a configuration. First, that all the actors, activities and objects from the core value constellation are reused. Second, only their respective organizational roles are reconfigured. Third, only one new value transaction is added between the Customs Control Authority and the Semi-Finished Material Consumer. Forth, that the Semi-Manufacturer is used as a monitoring chokepoint that provides indirect monitoring regarding all the other actors, i.e. the Customs Control Authority can monitor them all indirectly through this monitoring chokepoint. Finally, that the main consumption activity here (value monitoring activity) is on the Customs Control Authority's side (differently from the core value constellation, where the consumption point was on the Semi-Finished Material

Consumer's side. All the pertinent roles are represented by UML-like stereotypes on top of the e3value graphical elements.

The ultimate point now shifts on to evaluate how well the highlighted monitoring activity could perform. That is, even having the monitoring objects arrived at the monitoring activity, the final consumption (and realization) of the monitoring goal behind the activity of controlling goods would also depend on evaluating (via value indication) how well such objects would arrive. This can be done by enriching the corresponding activity, as well as its immediate boundary elements (i.e. monitoring objects, value port and value interface). This is performed by applying the monitoring indicator view, from the Value Activity Monitoring Ontology. In **Fig. 5** the composing indicators are represented by annotations on top of the nested elements. For instance, for the excise tax object coming from the Semi-Manufacturer, the relevant quality indicator is the SERVQUAL indicator of reliability, whereas for the excise tax object coming from the Semi-Finished Material Consumer, the relevant SERVQUAL quality indicator is the one of assurance. For the value port, the indicator of relevance is the one of pure quantity. For the value interface, the indicator of relevance is the SERVQUAL indicator of communication. Truly, a value interface works as container for the value ports. If cooperation ceases, so it does communication. If a certain communication indicator is attached to the interface, it means that the communication allowed by that interface is somewhat regulated. Finally, a composite value indicator is built on the top of the activity. An example of critical value indicator for this activity has been formulated and placed in the picture, on the top of the monitoring value activity, as follows:

(Interf.Communication AND (Port.Quantity AND (Mon_Obj.Reliability OR Mon_Obj.Assurance)))

The indicator is built considering the logic paths (AND/OR connectors) inside the value activity. Therefore it reads that value interface communication restricts value ports quantity indicators. This in turn restricts monitoring object reliability or monitoring object assurance.

Other more complex indicators can be built upon a same monitoring activity, which depends on how many elements arrive in there. The more interfaces, ports and incoming objects it has, the more complex the value indicator for that activity can become. Value indicators can be therefore considered as a prelude for what would be further deployed on a corresponding process model as a Key Performance Indicator. Hence, it must be highlighted that the notion of value indicator here is not a process indicator. Value indicators are of economic nature, and here, essentially qualitative.

5 Conclusions and Future Work

In this paper, an attempt has been made towards solving the problem of how to monitor a value constellation from a value activity perspective. To address such a problem, a design artifact has been proposed in terms of an aspect ontology, so-called Value Activity Monitoring Ontology, which is the ultimate outcome of this research.

The main contributions of such a research outcome are at least threefold. First, that the artifact can be used as a constructor of value monitoring constellations. Such a constellation is not a constellation apart, but an ordinary value constellation enriched with monitoring capabilities. Second, it treats monitoring as an organizational reconfiguration problem. In other words, an ordinary value constellation does not need necessarily to be redeployed, or having its structure drastically modified so as to cope with its own monitoring needs. What can be done is to reallocate such monitoring capabilities and responsibilities according to the available resources. Third, that it treats the monitoring of a whole value constellation from a critical value activity point of view. This represents a self-evolution regarding previous versions of the ontology, reported in [2] and [3]. Although more specific than value constellation and value transactions monitoring viewpoint, the value activity monitoring viewpoint can be especially efficient in cases like the one reported here, where a single monitoring chokepoint has to be created to as to minimize monitoring costs.

In terms of external validity, the artifact proposed here advances in modeling efficiency against its immediate rival theory [5]. The main difference point is that, while its rival theory structures monitoring as a pattern, the artifact proposed here structures monitoring as a phenomenological/aspectual ontology. Besides essentially incomplete, patterns can be seen as alternative reasoning outcomes from the same ontology. Moreover, monitoring here is structured along a proper set of organizational roles and entities, connected by Communication Action constructs.

As an immediate future work, two research directions are identified. The first comprises to automate the process of configuring a monitoring value constellation, by employing automated configuration mechanisms developed by related companion research [32]. The second comprises translating the value monitoring viewpoint developed here into a process-level representation. This can also involve the use of value to process-level process coordination developed by other related companion research [33]

References

1. Gordijn, J., and Akkermans, H.: Value-based Requirements Engineering: Exploring Innovative e-commerce Idea. Requirements Eng. Journal 8(2), 114-134 (2003)
2. Silva, P. d-. A.,, and Weigand, H.: Monitoring Value Webs. In: A. Albani, D. Aveiro, and J. Barjis (Eds.): Proc. EEWC 2012, Springer LNBIP 110, 108-123 (2012)
3. Silva, P. d-. A., and Weigand, H.: Enterprise Monitoring Ontology. In: M. Jeusfeld, L. Delcambre, and T.W. Ling (Eds.): Proc. ER 2011, Springer LNCS 6998, 132-146 (2011)
4. Hevner, A., March, S., Park, J., Ram, S.: Design Science in Information Systems Research. MIS Quarterly 28 (1), 75-105 (2004)
5. Kartseva, V., Gordijn, J., and Tan, Y.-H.: Designing Value-based Inter-organizational Controls Using Patterns. In: Lyytinen, K., Loucopoulos, P., Mylopoulos, J. and Robinson, B., (eds.), *Design Requirements Engineering: A Ten-Year Perspective*, Springer LNBIP 14, 276-301 (2009)
6. Wieringa, R.: Relevance and Problem Choice in Design Science. In: R. Winter, J. L. Zhao, and S. Aier (Eds.): DESRIST 2010, Springer LNCS 6105, 61-76 (2010)

7. Gordijn, J., Weigand, H., Reichert, M., and Wieringa, R.: Towards Self-configuration and Management of e-service Provisioning in Dynamic Value Constellations. In: Proc. SAC 2008, ACM New York, NY, USA, 566-571 (2008)
8. Silva, P. d.-. A., Weigand, H.: On the Move to Business-Driven Alignment of Service Monitoring Requirements. In: M. van Sinderen and P. Johnson (Eds.): Proc. IWEI 2011, Springer LNBIP 76, 103-117 (2011)
9. Dietz, J.: Enterprise Ontology: Theory and Methodology, Springer (2006)
10. Bergemann, D. and Morris, S.: Robust Mechanism Design. Econometrica 73 (6), 1771-1813 (2005)
11. Vargo, S. L., Akaka, M. A.: Service-Dominant Logic as a Foundation for Service Science: Clarifications. Service Science 1 (1), 32-41 (2009)
12. Lando, O., Beale, H. (eds.): Principles of European Contract Law (Parts I and II) – Prepared by the Commission on European Contract Law. Kluwer Law International (2000)
13. Cormier, D., Aerts, W., Ledoux, M. J-, and Magnan, M.: Web-Based Disclosure about Value Creation Processes: A Monitoring Perspective. ABACUS 46, 320-347 (2010)
14. Luckham, D. C.: The Power of Events: An Introduction to Complex Event Processing in Distributed Enterprise Systems, Addison-Wesley (2001)
15. Sandhu, R., Ferraiolo, D.F. and Kuhn, D.R.: The NIST Model for Role-Based Access Control: Toward a Unified Standard. In Proc. of the 5th ACM Workshop on Role-Based Access Control, 47-63 (2000)
16. Dash, R. K., Jennings, N. R., Parkes, D. C.: Computational-Mechanism Design: A Call to Arms. IEEE Intelligent Systems 18 (6), 40-47 (2003)
17. Hung, H.: A Typology of the Theories of the Roles of Governing Boards. Corporate Governance: An International Review 6 (2), 101-111, April (1998)
18. Eisenhardt, K. M.: Agency Theory: An Assessment and Review. Academic of Management Review 14 (1), 57-74, Jan (1989)
19. Austin, J. L.: How to do Things with Words. Harvard University Press, Cambridge (1962)
20. Searle, J. R.: Speech Acts: An Essay in the Philosophy of Language. Cambridge University Press, Cambridge (1969)
21. Allwood, J.: Linguistic Communication as Action and Cooperation: A Study in Pragmatics. PhD Thesis, Göteborg University (1976)
22. Oswick, C., Fleming, P., Hanlon, G.: From Borrowing to Blending: Rethinking the Process of Organizational Theory Building. Academy of Management Review 36 (2), 318-337 (2011)
23. Sure, Y., Staab, S., and Studer, R.: Ontology Engineering Methodology. In: S. Staab and R. Studer (eds.), *Handbook on Ontologies*, International Handbooks of Information Systems, 135-152 (2009)
24. Guarino, N.: Formal Ontology in Information Systems. In: Proc. FOIS 1998, OS Press, 3-15 (1998)
25. Hobbs, J. R., Pan, F.: Time Ontology in OWL - W3C Working Draft 27 September 2006, available at http://www.w3.org/TR/owl-time
26. Bateman, J.; Borgo, S.; Luettich, K.; Masolo, C.; Mossakowski, T.: Ontological Modularity and Spatial Diversity. Spatial Cognition and Computation 7 (1), 97-128 (2007)
27. Gruber, T.R., Olsen, G.R.: An Ontology for Engineering Mathematics. In: Doyle, J., Torasso, P., Sandewall, E. (eds.) Proc. 4th Int. Conf. on Principles of Knowledge Representation and Reasoning. Gustav Stresemann Institut, Morgan Kaufmann, Bonn, Germany (1994)
28. Parasuraman, A., Berry, L. L., Zeithaml, V. A.: Refinement and Reassessment of the SERVQUAL Scale. Journal of Retailing 67 (4), 420-450 (1991)
29. Brank, J., Grobelnik, M., and Mladenic, D.: A Survey of Ontology Evaluation Techniques. In: Proc. SiKDD 2005, 166-170 (2005)

30. Porzel, R., Malaka, R.: A Task-Based Approach for Ontology Evaluation. In: Proc. ECAI 2004 Workshop Ont. Learning and Population (2004)
31. Bukhsh, F. A., Weigand, H.: Evaluating the Application of Service-Oriented Auditing in the B2G Domain: A Case Sudy. In: J. Grabis and M. Kirikova (Eds.): BIR 2011, Springer LNBIP 90, 281-295 (2011)
32. Razo-Zapata, I. S., De Leenheer, P., Gordijn, J., Akkermans, H.: Fuzzy Verification of Service Value Networks. In: Proc. CAISE 2012, Springer LNCS 7328, 95-110 (2012)
33. Fatemi, H., Van Sinderen, M. , Wieringa, R.: Value-Oriented Coordination Process Modeling. In: Hull, R., Mendling, J., Tai, S. (Eds.): BPM 2010, Springer LNCS 6336, 162-177 (2010)