In Critique of RoboLaw: the Model of SmartLaw

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In lieu of introduction: critique of RoboLaw

The inspiration of this paper stems from the final report of the RoboLaw[2] initiative. Although perfectly aimed to offer an in-depth analysis of the ethical and legal issues raised by robotic applications, and very impressive in the consortium of the intellectual power[3], the report appeared rather limited in the execution, choice of question, disclosure of methodology and thus – conclusions.

The answer to a research question raised in RoboLaw[4] "*whether new regulation is needed or the problems posed by robotic technologies can be handled within the framework of existing laws*" is rather too obvious. It has been clearly and convincingly established by the Industrie 4.0 Working Group[5] report that "*existing legislation will also need to be adapted to take account of new innovations*", therefore requiring not only to ensure legal compliance of new technologies, but also to develop the regulation framework in a way that facilitates innovation[6]. Moreover, in its scale, scope, and complexity, the transformations are unlike anything humankind has experienced before Schwab[7]. Therefore, it was clear before RoboLaw report had come out, that there is an obvious need for a new framework of laws. In fact, regulation urges for a nuclear option - a complete reinvention of regulation.

Accordingly, the research question chosen in RoboLaw group deserves critique and requires amendment. Having in mind the exponential development of the technology, the laws made by humans on robots are far from satisfactory. Standard regulation model is failing. Happily, besides the laws on robots, there are exponentially developed alternatives of laws by robots and laws in robots[8]. Accordingly, in search of ways to reconcile regulation and technology, we should turn to the fundamental roots of the regulation framework *per se* in the context of existing and emerging technologies. Which of the regulation alternatives would be the most efficient and just in the context of probable singularity age? In other words, the issue is whether humans are and will remain to be more efficient regulators than intelligent machines and if not, whether it is safe to delegate these activities to an artificial object[9].

Furthermore, the methodology of the RoboLaw research has been based on two internal reports (i) on the methodology to analyze existing regulatory provisions, and (ii) on the methodology for identifying and analyzing ethical issues in robotics research and applications[10]. However, these reports are not accessible to public. Undisclosed instruments used for data collection and processing make it difficult to assess and develop the research issues. Accordingly, the methodological disclosure of RoboLaw report also deserves critique. Of course, the impressive team of scholars that delivered the methodological parts and performed desk research and expert consultations[11] clearly deserves the presumption of validity and

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[2] E. Palmerini et.al., *Guidelines on Regulating Robotic*, report in Regulating Emerging Robotic Technologies in Europe: Robotics facing Law and Ethics, Collaborative project (CP), 2014, http://www.robolaw.eu/, accessed on 01/05/2017

[3] RoboLaw research team consisted of 29 schollars from Scuola Superiore Sant'Anna di Studi Universitari e di Perfezionamento di Pisa, University of Tilburg, University of Reading, Ludwig Maximilians University Munich, including prof. dr. Erica Palmerini, prof. dr. Paolo Daria, dr. Andrea Bertolini, and others. For a full description of the team see: http://www.robolaw.eu/consortium.htm , accessed on 01/05/2017

[4] See footnote 2, p.8

[5] H. Kagermann, et al. *Recommendations for Implementing the Strategic Initiative INDUSTRIE 4.0: Securing the Future of German Manufacturing Industry ; Final Report of the Industrie 4.0 Working Group*, (Forschungsunion, 2013), p.7

[6] Id, p.58

[7] K. Schwab *The Fourth Industrial Revolution: what it means, how to respond* (2016-01-14, World Economic Forum), https://www.weforum.org/agenda/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond/ , accessed on 01/05/2017

[8] R. Leenes & F. Lucivero, 'Laws on Robots, Laws by Robots, Laws in Robots: Regulating Robot Behaviour by Design', *Law, Innovation and Technology* (2014)*, DOI:10.5235/17579961.6.2.194*

[9] It is a growing argument that artificial intelligence systems should be recognized to have legal subjectivity. See for e.g.: M.S. Willick, ‚Constitutional Law and Artificial Intelligence: The Potential Legal Recognition of Computers as "Persons", *IJCAI* (1985), S. Chopra, ‚Rights for Autonomous Artificial Agents?', *Comunications of the ACM, vol. 53 no.8, 2010*, M. Laukytė, *Artificial and Autonomous: A Person?* In G.Dodig-Crnkovic et al. (eds), *Social Computing, Social Cognition, Social Networks and Multiagent Systems Social Turn - SNAMAS 2012, Birmingham : AISB, 2012*, pp. 66-71**;** B. Allgrove, ‚Legal Personality for Artificial Intellects: Pragmatic Solution or Science Fiction?' (June 2004). Available at SSRN: https://ssrn.com/abstract=926015; and others.

[10] See the full list of deliverables in: http://www.robolaw.eu/deliverables.htm, accessed on 01/05/2017

[11] See footnote 2, p.8

representativeness. However, the need to amend the research question alone is enough to revise the methodology.

To summarize, the *problem* of the research is that it is unclear how we should modify the standard regulation framework in order to achieve the most efficient reconciliation of law and technology.

Having it said, the *aim* of this study is to analyze the standard regulation framework by describing and explaining its elements and failures, and consequently developing the conceptual failure-free regulation framework in the context of technological singularity.

Thus, the *object* of this research is regulation framework.

Execution of four *tasks* should allow achieving the aim of this research and solving the problem:

1) to reveal the elements of the standard regulation framework;
2) to develop the methodology for the illustrative research of the standard regulation framework's failures;
3) to describe and explain the volumes and nature of the standard regulation framework's failures;
4) to develop the conceptual failure-free regulation framework in the context of technological singularity.

Accordingly, this research consists of four parts. The first part presents the analysis of the standard regulation framework and its elements within the theoretical context of ontology of law and institutions. The second and third parts describe the methodology and illustrative research of the standard regulation framework's failures. Having indicated the reasons of these failures, the fourth part is used to present the conceptual failure-free regulation model in the context of emerging technological singularity, and thus to contribute to knowledge, wisdom and understanding of regulation issues in the context of technological evolution.

1. The elements of the standard regulation framework

This part of the paper provides the inductive analysis of the standard regulation framework and its elements, thus completing the first task of this research. In order to achieve it, the first sub-part introduces ontology of law and institutions. The second part is meant to describe the approach to the need of regulation, while the last sub-part summarizes it all into the standard regulation framework.

1.1. The ontology of law and institutions

This sub-part introduces the theoretical context of ontology of law and institutions. The particular description of the traditional views to legal and institutional approaches and synthesis of the findings allows capturing the key context for further analysis.

The traditional legal theory rests on the idea that law starts with the idea of law (primary level of law), which then turns into the legal rules (second level), leading to legal relationships (third level)[12]. The flow of law runs through these levels both ways – from the idea to relationships and *vice versa* - from relationship to the idea of law, as shown in the *Figure 1* below.

[12] A. Vaišvila, *Teisės teorija*, (Vilnius: Justitia; 2004)

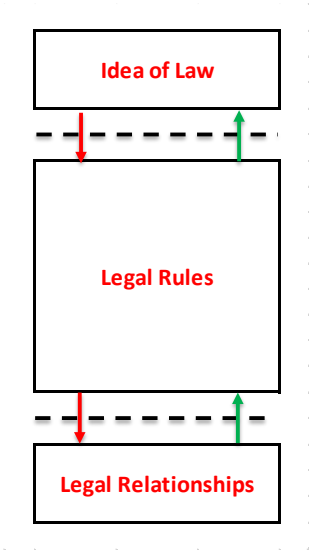

Figure 1: Ontological levels of law

According to this ontological understanding, the idea of law has impact on legal relationships (and *vice versa*) through the intermediary – regulators (legislative, executive and judicial branches of government). The legal rules have to be chosen within the context of the idea of law that limits the discretion of regulator and has to be reconciled with the actual legal relationships. Thus, on one hand, every legal norm is a consequence of some idea of law, i.e. some fundamental values of a given society. On the other hand, the need for regulation stems from the actual legal relationships (transactions) between the members of that society.

Such cycle of law ensures continuous evolvement and innovation of legal relationships. As society and relationships are evolving, at some point the regulation stops and thus ensures efficient and just results of everyday transactions. This tension, naturally, forces the regulator to review the law. This, in turn, may press to review if understanding of the idea of law is in compliance with the needs of modern legal relationships. Thus, the evolution of the everyday transactions between members of society may also demand for the evolution of its fundamental values. Accordingly, this cycle ensures the reconciliation of fundamental values (ideas of law) with everyday transactions (legal relationships).

Williamson[13] has set similar structure of institutions. The difference from the ontology of law is that Williamson has grouped the institutions into four rather than three levels. According to him, the very highest level belongs to informal institutions, customs, traditions, religion. Beneath the level of formal rules of the game is drafted. Following these rules, the governance of the play of the game is on the level below. Finally, at the bottom, there is a level of resource allocation and employment. These levels are related to each other in the same way as in the legal theory. Lower level determines the development of higher level and *vice versa*, as demonstrated in the *Figure 2* below.

[13] O. E. Williamson, ‚Transaction Cost Economics: How It Works; Where It Is Headed', *De economist, Vol. 146, No. 1, (1998),* pp. 23–58; O. E. Williamson, ‚The New Institutional Economics: Taking Stock, Looking Ahead', *Journal of Economic Literature, Vol. XXXVIII, No. 3, (2000)*, pp. 595-613

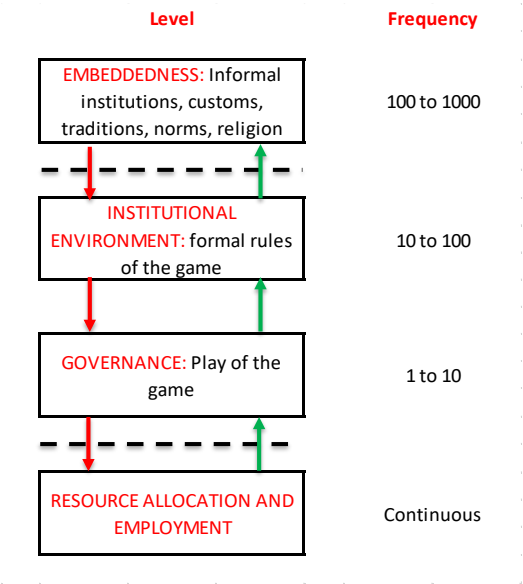

Figure 2: Structure of institutions

According to Williamson, the institutions at the top level change very rarely – once every 100-1000 years, thus they are characterized by long term and high impact on the entire system. The institutional environment (formal rules of the game) is changing every 10-100 years, and the governance institutions that play the game – every 1-10 years. The resource allocation and employment (bottom level's institutions) are changing and developing continuously[14].

Although it is beyond the scope of this research, the periods anchored by Williamson are rather disputable in the era of disruptive technological development and should be empirically re-tested. However, the basic approach to the differences in the speed of changes is acceptable as a presumption. The disputable timing of these changes is irrelevant for general illustration of the structure and correlations between the institutions.

Thus, Williamson described the relations between fundamental values of society and the individuals of that society similarly to the works of legal philosophers. Accordingly, the legal and economical perspective rests on the assumption that the regulator acts as an intermediary between society and fundamental values of that society. This gatekeeper approach to regulator forms the basics of the public law, with the duty of the regulator to preserve the fundamental values of society and the delegated power to regulate the resource allocation and employment.

The difference between the views of lawyers and economists lies in different approach to the unit of analysis. While lawyers start their analysis from the pure idea of law (top level), economists see the transaction (bottom level) as a unit of analysis[15]. That is, the legal approach is based on the belief that the need for regulation comes from the need to achieve and preserve fundamental values of that society[16], while the economists see this need arising from the efficiency of transactions[17].

In other words, the lawyers are reasoning the regulation of market through the lens of perfect rule of law, while economists – through the lens of transaction costs. Although these differences play major role in the methodological context, the alignment of the theoretical structures clearly manifests common approach to the framework of the society structure, as demonstrated in the *Figure 3* below:

[14] Id.
[15] O. E. Williamson, ‚Why Law, Economics, and Organization?', *Business and Public Policy Working Paper, No. 81. Berkeley: University of California*, *(2000)*, pp. 1-5
[16] See footnote 12,
[17] Proposition that diminishing transaction costs and the subsequent market efficiency is the strategic purpose of regulation is a well proved and has been well acknowledged by Lithuanian scientists (see for e.g.: *Id*; footnote 15; R.Šimašius, *Teisinis pliuralizmas,* dissertation, (The Law University of Lithuania. Vilnius, 2002); and others).

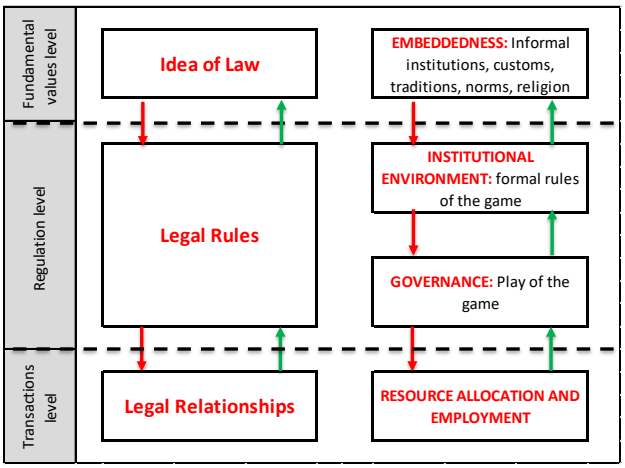

Figure 3. Alignment of the ontological levels of law and structure of institutions

The legal principles and laws imposed on society by regulators as the result of the interpretation of top-level values, of course, may work preemptively. However, the need for regulation that arises from the daily transactions' failures will always be reactive. The reactive nature means that at least one transaction (the precedent) has failed and the purpose of law here is to fix the wrongdoing, on one hand, and to set the rule for the analogous transactions of the future, on the other. This type of regulation has to go through the linear system of checks and balances before turning into law. This system is crucial for ensuring that the law would preserve the fundamental values of society and would remain within the competence of the regulator. This process of checking and balancing takes time, incurs costs and is object of the quality inquiry, i.e. whether the passed law fixes the precedent wrongdoing and disciplines the society by preventing analogous market failures. Accordingly, the description of speed, cost and quality variables should be sufficient to understand the failures of the reactive nature of law.

Therefore, in order to find the fastest, cheapest and quality-ensuring way to regulate the disruptive markets, transaction serves as the unit of analysis, whereas the economic analysis of law is used as the governing approach to the studies of regulation problems.

1.2. The anatomy of transaction and the reasons of its regulation

Transaction is a process of exchanging scarce resources[18]. The Civil Code of Lithuania[19] (article 1.63) also sees the procedural nature of transaction as the actions of persons intended to create, modify or extinguish civil rights and duties.

Therefore in order to change (quash or modify) legal *status quo* of a person, one has to act, thus resulting in his/her new status. Accordingly, this transaction starts with the need (incentive), the action (manifest of the will through activity or silence) and result elements. The incentives for some actions and actions themselves might be either in alignment with the fundamental values of the society, or not. Although it is out of direct scope of this research, the correlation between gracefulness of the incentives, actions performed and the result, is not obvious. Presumably, there might be transactions where one has highly positive incentives; however, actions performed might be grossly unacceptable, or *vice versa*. In either combination of incentives and actions, the result might be efficient (and thus – just[20]), or not.

Due to uncertainty, bounded rationality, opportunistic actions or scarce resources, the result might not be as welfare enhancing as was expected, despite the graceful incentives and the best performance. The *Figure 4* below provides conceptual visualization of the single transaction process.

[18] R. A. Posner, ‚The Law and Economics of Contract Interpretation', in *John M. Olin Program in Law & Economics Working Paper, 2nd ser, No. 229. The Law School, The University of Chicago, (2004)*, pp. 1-51; O. E. Williamson, *Markets and Hierarchies: Analysis and Antitrust Implications: A Study in the Economics of Internal Organization*, (London: Free Press, 1975). pp. 1-288

[19] The Civil Code of Lithuania, (Žin., 2000, No. 74-2262; 200).

[20] Since the diminishing transaction costs and the subsequent market efficiency is the strategic purpose of regulation, justice (law) and efficiency (economics) coincide in many ways (see footnote 17, R. Šimašius)..

Figure 4. Single transaction process scheme

The analysis of transactions and regulation issues thereof may be performed using the market failures' framework, developed mostly by Williamson[21]. The centerpiece of this framework is an illustrative proposition known as the Coase Theorem. By using an example of crop damage caused by straying cattle, Coase proposed the following:

> *"it is necessary to know whether the damaging business is liable or not for damage caused since without the establishment of this initial delimitation of rights there can be no marked transactions to transfer and recombine them. But the ultimate result (which maximizes the value of production) is independent of the legal position if the pricing system is assumed to work without cost"*[22]

The theorem has been stated in numerous ways and is subject to enormous amount of theoretical and empirical controversy[23]. The general claims of this theory may be summarized by (i) "efficiency hypothesis" i.e. regardless of how rights are initially assigned, the resulting allocation of resources will be efficient, and (ii) "invariance hypothesis", i.e. the final allocation of resources will be invariant under alternative assignments of rights[24]. In other words, under the assumption of zero transaction cost, the outcome of transactions will be efficient regardless of the legal regulation. That is, if transactions are costless, the allocation of rights or obligations is irrelevant. The transactions will always be efficient, legal rights – perfect and legal certainty – absolute. Accordingly, if law is irrelevant and the outcomes of transactions are always efficient, the state of zero transaction cost also means the state without the need for laws and lawyers – the state of self-governance.

Realizing that such proposition is too naïve to consider seriously, the state of zero transaction costs was always an utopian idea - "*a very unrealistic assumption*", according to Coase[25]. Indeed, neither science, nor fiction has ever demonstrated complete and persuasive view of what it would be to live in the world where there is no need to have legislative, executive and judicial branches of government. Thus, the real message of Coase was to study the World with positive transaction costs[26] – the World with the market failures.

Transaction costs are also seen as a difference between perfect world and real world. These costs are also defined as the "*costs of running the economic system*"[27] and conceptually equated to "*frictions in physical systems*"[28], constituting the major economic efficiency problem[29]. Moreover, since efficiency and justice coincide in many ways[30], the transaction costs create a legal problem, as well. Thus diminishing of the transaction costs is the prime aim of regulation and regulators[31].

Coase has determined three stages of transaction process that comes at certain cost[32]: (i) *Search costs* that are necessary to discover who wishes to deal with one, to inform people that one wishes to deal and on what terms, (ii) *Negotiation costs* that are necessary to conduct negotiations leading up to a bargain and formalization of it; (iii) *Control costs* that are necessary to undertake the inspection needed to make sure

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[21] O.E.Williamson, 'The Economics of Governance: Framework and Implications', in Langlois, R. (Ed.). *Economics as a Process: Essays in the New Institutional Economics*, (Cambridge: Cambridge University Press, 1986).
[22] R.Coase, 'The Problem of Social Cost', *The Journal of Law and Economics. Vol. 3, No. 1, (1960), 1-44.*
[23] S.G.Medema, R.O.Zerbe, *The Coase Theorem, The Encyclopedia of Law and Economics*, (Edward Elgar Publishing, 1999)
[24] Id.
[25] See footnote 22.
[26] O.E.Williamson, S.Tadelis, 'Transaction Cost Economics', prepared for Gibbons R., Roberts J, eds. *Handbook of Organizational Economics*, (Princeton University Press, 2012), 1-55.
[27] K.J. Arrow, 'The organization of economic activity: issues pertinent to the choice of market versus non-market allocations', in *The analysis and evaluation of public expenditures: the PPB system; a compendium of papers submitted to the Subcommittee on Economy in Government of the Joint Economic Committee, Congress of the United States, 1, Washington, D.C*. (Government Printing Office, 1969), pp. 47–64.
[28] See footnote 21.
[29] C.Marinescu, 'Transaction Costs and Institutions' Efficiency: A Critical Approach', *American Journal of Economics and Sociology, 71 (2012), 254–276.*
[30] See footnote 17, R.Šimašius,
[31] See footnote 22 and 26.
[32] See footnote 22

that the terms of the contract are being observed, and so on. These operations, according to Coase, are "*sufficiently costly at any rate to prevent many transactions that would be carried out in a world in which the pricing system worked without cost*"[33]. And of course, the more there are efficient transactions, the better off is economy and welfare of its actors.

The necessity of research, drafting and control arises mostly because sometimes people fail to keep their promises. A promisee is always at risk that a promise given will differ from the true will or the true actions of the promisor. That is, there is always a risk of asymmetry between the *ExAnte* promised and *ExPost* received value of the promise. In order to diminish the risks of these transaction costs in the future, the promisee has to invest in pre-transaction research, analysis of data and development of the protection instruments (legal or physical). These costs of transacting are incurred *ExAnte.*

Of course, the more *ExAnte* investments are made, the less is the risk of post-transaction breach. However, human body, mind and resources have their limits, which together with future uncertainty make it impossible to determine a complete set of risks and to employ preemptive means to avoid all of them. Moreover, every symbol or action (even silence) used in the pre-transaction process has its own hermeneutical risk, which might be the source of misinterpretation and hence error in the enforcement procedure. Lastly, pre-transaction investments are based on the assumptions about future events, which are impossible or too costly to determine with absolute certainty. Despite the fact that future risks are only probable, the investments in security measures are inevitable. Due to these shortages, the transacting person may decide to absorb the costs of incomplete transaction[34]. Accordingly, most of transactions are incomplete and not self-enforceable due to the risk of uncertainty, opportunistic behavior of others or enforcement errors.

If *ExAnte* stage protection fails, the parties are forced towards the process of adaptation through the state enforcement tools and/or sunk cost. In any of the aforementioned scenarios, the parties suffer from failures of protection in the pre-transaction stage. These are the *ExPost* transaction costs.

According to Richard A. Posner[35], Transaction Costs (*TC*) are the sum of *ExAnte* costs (*x*) and risk (*y*) that *ExPost* costs (z) might occur. Thus, the sum of transaction costs might be expressed as:

$$TC = x + y * z$$

In the zero transaction costs (ideal) society, there are no *ExPost* transaction costs ($y = 0$). In this case $y * z = 0$ and thus none of the safety measures is required. Accordingly, $x = 0$ and $TC = 0$. Hence, transactions are self-enforcing and the demand for regulation and enforcement services disappears. The market is working without any costs or need for law or lawyers. However, since the zero transaction cost state is deemed to be utopian, a state without *ExPost* transaction costs ($y = 0$) means that protection in the pre-transaction stage is complete, with perfect rationality and full certainty of a future.

In either way, costless society is indeed a very unrealistic assumption and by solving regulation issues we shall examine the variables that cause market failures. These variables (either *ExAnte* or *ExPost*) were identified and elaborated by Williamson[36] (and others) and may be summarized into such groups:

1) *Bounded rationality*, which describes the limited cognitive competences and lingual limits of people[37];

2) *Opportunism*, which describes the self-interested nature of people that is sometimes led by the element of the guile in transaction[38];

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[33] Id.

[34] K.Eggleston, E.A.Posner, R.J.Zeckhauser, 'Simplicity and Complexity in Contracts', *John M. Olin Program in Law and Economics Working Paper. No. 93*, *The Law School, The University of Chicago, (2000), 1-45*.; O.Hart, J.Moore, 'Foundations of incomplete contracts', *The Review of Economic Studies. Vol. 66, No. 1, (1999), 115-138*; C. A.Hill, 'Bargaining in the Shadow of the Lawsuit: A Social Norms Theory of Incomplete Contracts', *Minnesota Legal Studies Research Paper. No. 08-46, (2009), 1-38*; E.Posner, 'A Theory of Contract Law under Conditions of Radical Judicial Error', *John M. Olin Program in Law & Economics Working Paper. 2nd ser. No. 80. The Law School. The University of Chicago, (1999), 1-39*; R.A.Posner, 'The Law and Economics of Contract Interpretation', *John M. Olin Program in Law & Economics Working Paper. 2nd ser. No. 229. The Law School. The University of Chicago, (2004), 1-51*; E.Rasmusen, 'A Model of Negotiation, Not Bargaining: Explaining Incomplete Contracts', *Harvard John M. Olin Discussion Paper. No. 324. Cambridge, MA: Harvard Law School, (2001), 1-52*.

[35] Id., R.A.Posner.

[36] See footnote 21.

[37] H. Simon, *Administrative Behavior*, (New York: Free Press, 1976), p. xxviii; also see *Id*.

3) *Uncertainty*, which describes the future state of nature, price and demand levels, innovations, legal and behavioral instabilities and many other characteristics, which are unclear and which make it impossible to predict the outcome of one's promises[39]. Uncertainty and bounded rationality are sometimes characterized as informational and cognitive inability[40].

4) *Asset specificity,* which usually describes six types of specific assets[41] that create critical dependency on the scarce resources, and identity of the transacting actor[42].

The bounded rationality and uncertainty make it impossible to evaluate all the risks related to relevant transactions and safeguards at the *ExAnte* stage. Thus all transactions are incomplete[43]. Opportunism and asset specificity make all transactions not self-enforcing, which in turn creates the demand for governance system (i.e. laws and lawyers). The *Figure 5* below visualizes these transaction cost variables that cause the market failures and demand for regulation.

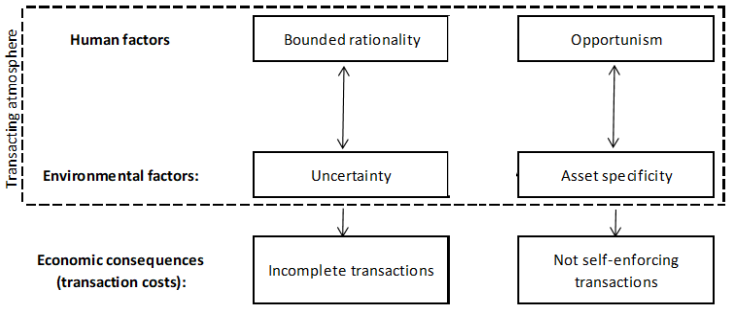

Figure 5. Transaction cost factors (adopted from Ruester[44])

Accordingly, since the major task of regulation is to diminish transaction costs, with regard to *ExAnte* costs it implies the duty to foster access to data and computing power to process it (thus diminishing perils of uncertainty and bounded rationality), and with regard to *ExPost* – the duty to foster accessibility to governance system and diminish dependency on scarce resources (thus diminishing the perils of opportunism and asset specificity).

1.3. Summary of the standard regulation model within the theoretical context of the structure of law and institutions

The market failures are fixed with the help of regulation – laws made by regulators using the powers delegated to them by the society. The discretion limits are usually analyzed through the lens of fundamental values of the society, such as right to life, liberty and pursuit of happiness (property).

Having it said and previously presented the approach to the structure of society, elements of transaction and the variables of its failures, the conceptual model of regulation, integrating fundamental values of society, regulators, transaction and variables of its failures has been developed (see *Figure 6*).

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[38] See S.Ruester, 'Recent Developments in Transaction Cost Economics', *EE2 Working Paper. Resource Markets. No. WP-RM-18, (2010)*, and footnote 36.
[39] see footnote 52; and O.E.Williamson, 'Comparative Economic Organization: The Analysis of Discrete Structural Alternatives', *Administrative Science Quarterly, Vol. 36, No. 2, (1991), p. 76*
[40] F.S.Nobre, 'Core Competencies of the New Industrial Organization', *Journal of Manufacturing Technology Management, Vol. 22, No. 4, (2011), 422 – 443.*
[41] These are: (i) site specificity; (ii) physical asset specificity; (iii) dedicated assets; (iv) human asset specificity; (v) intangible assets; (vi) temporal specificity.
[42] See footnote 38.
[43] See footnote 34, E.Rasmusen, and O.Hart, J.Moore.
[44] See footnote 38, S.Ruester.

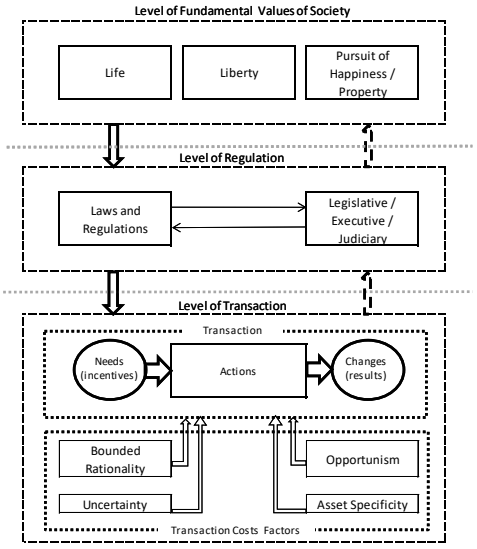

Figure 6. Standard model of regulation in theory.

At the top level there are fundamental values of society. There the transition from fundamental values of society to the level of regulation and back is implemented. It means that fundamental values of society determine certain limits of regulatory discretion; however regulatory institutions (e.g. parliament, courts, etc.) may also transform the understanding of fundamental values of society.

The middle part of the model is the level of regulation, where regulatory institutions are forming regulatory measures and *vice versa* - the need for regulatory measures shapes the institutional setting. It encompasses the setting of laws and lawyers, i.e. the linear system of three branches of government with all the checks and balances. At the middle level the transition from the level of regulation to the level of transaction and back is implemented. It means that regulatory measures shape the market transactions. However, market is very dynamic and continuous innovations are encountered there, so the regulation level is also under the direct influence of market transactions.

Lastly, the bottom part of the model is the place of the transaction and its cost variables, which, according to Williamson[45], are the reason for market failures. The everyday world is at a constant demand for regulation due to the market failures. Assumedly these failures result from the same transaction costs – inevitable part of the human nature to err. The standard model of regulation rests on human intelligence, which is limitedly rational, opportunistic, and performed under the uncertainty and asset specificity.

Having set this standard regulation framework and explained its elements within the theoretical context of the ontology of law and institutions, methodological framework is required for the illustrative research of the failures within this framework. Resulting conclusions will lead to development of the conceptual failure-free regulation model.

2. Methodological framework for the illustrative research of the standard regulation model failures

This part of the paper develops methodological approach to the research of the standard regulation framework failures, thus completing the second task. In order to achieve it, the first sub-part introduces the basic methodological assumptions whereas the second sub-part justifies the research methods used and describes the limitations of research.

2.1. Basic methodological assumptions

The failure of standard model of regulation is beyond reasonable doubt and thus does not require any additional evidence. The pricing system is assumed to work with cost[46], which sometimes is at its extremes.

[45] See footnote 13.
[46] See footnote 22, p.8.

Having it said, the research question raised in RoboLaw[47] report "*whether new regulation is needed or the problems posed by robotic technologies can be handled within the framework of existing laws*" is rather too obvious. Whatever laws are adopted within the limits of standard regulation model, it will work with the cost deriving from the inevitable risk of market failures. As long as there are irrational and opportunistic regulators and market players, transacting in the uncertain market and with scarce resources, there will always be the perils of regulatory capture, rent seeking, restrictions on entry or boundaries of innovations, higher prices and fewer choices, etc., as described by Koopman and others[48] in more detail.

Thus, the modified research question is not "whether", but "how" we should modify the standard regulation framework to achieve the most efficient reconciliation of the law and technology.

The basis of the methodology applied to answer the question is the previously explained theoretical assumption, that Transaction Costs (*TC*) are the sum of *ExAnte* costs (*x*) and risk (*y*) that *ExPost* costs (z) might occur. If *ExAnte* protection measures fail and promisor is not performing as expected, the promisee will be choosing to either sink the underperformance cost, or proceed with the enforcement of the initial promise (or compensation thereof). Any of these choices are leading towards an asymmetry in the *time*, *price* and/or *quality* of the initially expected value of the performed promise.

The direct gatekeeper of enforcement procedure is the judicial branch. The courts are the most frequent receivers of the market failure cases. On the other hand, courts are enforcing the decisions of legislative and executive branches too. Moreover, efficiency of the judicial branch has the major impact on the prevention of *ExAnte* costs. Indeed, the more efficient and unavoidable the enforcement system is, the more it will serve as a prevention tool, thus saving pre-transactional costs of drafting or protecting.

Thus, the analysis of a judicial branch performance alone is expected to provide sufficient data to describe and explain the standard model of regulation failures and its consequences. Accordingly, legislative and executive branches are excluded from the analysis herein. In sum, for the purposes of this paper, the failures within the standard model of regulation may be sufficiently described through the lenses of time, price and quality of the judicial branch performance. These findings, in turn, may be explained within the market failures framework through the lenses of bounded rationality, opportunism, uncertainty and asset specificity.

Furthermore, it is assumed that the standard model of regulation may fail in four transition points between the ontological levels of law and institutions. First of all, the regulators may fail to interpret their discretion boundaries (values-to-regulation transition). Then regulators may abuse or fail to use their power (regulation-to-transactions transition). The third one involves the failure of regulators to interpret the market signals (transactions-to-regulation transition). Lastly, the powers given to regulators may be abused or failed to be used for anchoring of the fundamental values of a given society (regulation-to-values transition).

Assumedly these regulation failures result from the same reasons as the market failures. The standard model of regulation rests on human intelligence regulating other humans. Despite the delegated powers, it is the human nature to err. Therefore regulators are also limitedly rational, opportunistic, and are performing their rights and duties under the conditions of uncertainty and asset specificity. Human actors at the middle and bottom levels are behaving rather with the same intelligence and behavioral capacity, although with the different type of transactions[49]. In other words, it doesn't matter how many governmental branches, agencies or super-agencies will be at the regulation level; as long as there are humans involved, the regulation will not be failure-free. To summarize, the standard model of regulation in practice may look like in the *Figure 7.*

[47] See footnote 2, p.8
[48] C. Koopman, et.al, 'The Sharing Economy and Consumer Protection Regulation: The Case for Policy Change', *The Journal of Business, Entrepreneurship & the Law, Vol. 8 Iss 2, 2015*.
[49] Bottom level is filled with the resource allocation transactions while middle level - with the state power transactions.

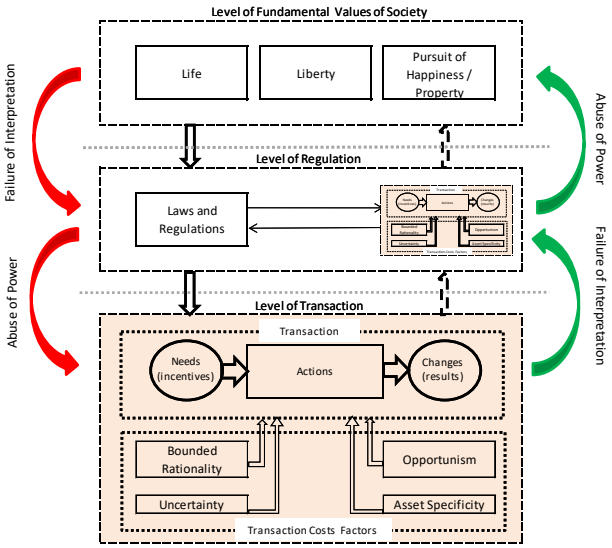

Figure 7. Standard model of regulation in practice

2.2. Research methods and limitations

Having limited this research to the performance of the judicial branch, the *object of this research* is the efficiency of the judicial branch's performance. The *type of research* performed is descriptive (describing the data through the lenses of time, price and quality) and explanatory (explaining the data within the logic of market failures framework). Within these boundaries of the research, the two-tier methodology was developed.

First of all, in order to "portray an accurate profile of persons, events or situations"[50], the *descriptive observation* of the time, price and quality of the judicial branch performance is presented. Having limited data accessibility and due to the experience in the field[51], this observation is limited to the performance of Lithuanian courts. Based on these findings, the baseline volumes of time, price and quality variables will be set and explained through the lens of the limitedly rational and/or opportunistic judgments made within the uncertain environment and having the limited resources.

Assumedly, such desktop research data is sufficient to make a point dramatically and, in turn, it allows describing and explaining the failures in time, price and quality variables through the lens of the limitedly rational and/or opportunistic judgments made within the uncertain environment and having the limited resources. Such findings are sufficient to describe and explain the failures of the standard model of regulation.

Then, based on these findings, the *technological forecasting* is used to develop the conceptual failure-free regulation model that facilitates innovation in the scenario[52] of technological singularity. This forecasting is performed within two fields – its exploratory and normative sides, which are "joined more by a vision than a reality"[53]. Exploratory forecasting will allow moving forward into the future of regulation by forming a continuation from the present. Normative forecast will allow identifying a possible, probable and/or preferable end-point of regulation, and aims to construct necessary steps towards the desirable result[54].

The essential *limitations of the research* are related to the fact that none of fundamental values of society (life, liberty and pursuit of happiness) have been analyzed. The analysis of transaction and its elements may also extend with regard to the classification of its incentives, process of decision to act, its consequences

[50] M. Saunders, et al., *Research Methods for Business Students*, 3th ed., (Upper Saddle River, N.J.: Prentice Hall, 2009); C. Robson, *Real World Research,* 2nd ed, (Oxford: Blackwell, 2002).
[51] Author is partner at Law Firm Viliusis & Astromskis; practicing law since 2004.
[52] A scenario is defined by many authors as – a description of a possible future situation (conceptual future), including paths of development which may lead to that future situation (H.Kosow et al., *Methods of Future and Scenario Analysis: Overview, Assesssment, and Selection Criteria,* (Bonn, Germany: Deutsches Institut Fur Entwicklungspolitik, 39, 2008)).
[53] Id.
[54] B. Onal, *Designing for/from the Future. Experiences, Methods, and Debate*, (Stockholm, 2009), available at: http://soda.swedish-ict.se/3866/1/basar_MFA.pdf, accessed on 01/05/2017.

and other important aspects of transaction. The research partly leaves out the analysis of institutional setting of all the regulatory (legislative, executive and judicial) bodies; causes and consequences of the regulation decisions. These aspects are also important for solving specific issues related to the modeling of regulation.

Notably, after practical intervention into the standard regulation model, the market will have to adapt and the results of new regulations will be manifested only after certain time period. Therefore, the effects of new regulatory framework may only be implied and observed while non-existing through theoretical modeling and experiments. However, the aim of this research limits itself only to development of conceptual approach on the basis of which the new regulatory framework is justified, dissociating from testing of its efficiency or evidence of exposure. The full and empirically sound testing of new regulation model is an object of future research agenda.

The limitation of data chosen to illustrate the approach to regulation is manifested by assessment of data received only from judiciary practices of Lithuania, thus excluding legislative and executive branches from the analysis. The Lithuanian judicial branch practice may be seen as too distant from general illustration. Moreover, due to personal involvement in the legal market, there is a hermeneutical risk that interpretation given might be biased and thus differ from the rational understanding. However, the data chosen are used solely for the illustration of the approach to regulation, having the logical reasoning as the main technique for the development of new regulatory framework. Moreover, despite personal involvement, the interpretation of data is provided in the utmost ethical and objective manner. Accordingly, the representativeness of the data, hermeneutical risk and other limitations is assumed to have no major impact to the validity of conclusions.

3. The explanation of the failures of standard model of regulation

This part of the paper describes and explains the volumes and nature of the standard regulation framework's failures, thus solving the third task of this research.

The court system of the Republic of Lithuania is made up of courts of general jurisdiction and courts of special jurisdiction. The Supreme Court of Lithuania (1), the Court of Appeal of Lithuania (1), regional courts (5) and district courts (49) are courts of general jurisdiction dealing with civil, criminal and some administrative cases. The Supreme Administrative Court of Lithuania (1) and regional administrative courts (5) are courts of special jurisdiction hearing disputes arising from administrative legal relations. There is also a Constitutional Court of The Republic of Lithuania, which ensures the supremacy of the Constitution within the legal system. However since public has no direct petition right, this court is excluded from current analysis.

There were 775 judges serving in the courts of general and special jurisdiction in 2016 (765 in 2015, 753 in 2014). During the year 2016, courts of first instance received and solved 315.681 civil, criminal and administrative cases. On average single judge in the regional court is solving 599 cases per year (626 in 20015m 592 in 2014), or 2,38 cases per one workday (2,49 in 2015; 2,35 in 2014)[55] Such load of cases is held to be big and has twofold consequences. According to the chairman of the Supreme Court of Lithuania Rimvydas Norkus[56], on one hand, it may be treated as a sign of trust in judicial system and legal procedure. On the other hand, it may be treated as a sign that society is losing the capability to solve their disputes peacefully, without judicial intervention. Having portrayed a basic profile of Lithuanian court system profile, the time (speed), price and quality are described in details below.

The speed of litigation in civil and criminal cases in the Lithuanian courts is rather stable and slow. Despite the nature of a case (civil, criminal or administrative), one will have to spend on average 1-2 years in courts before receiving the final and adjudicated decision. Of course, there are many exceptions, different cases and courts' however the average durations of procedures may be summarized in the *Figures 8* and *9* below:

[55] National court administration, *Review of Courts Activities in 2016,* (2017-03-31), available at http://www.teismai.lt/lt/teismu-savivalda/teismu-ir-teismu-savivaldos-instituciju-veiklos-ataskaitos/198 accessed on 01/05/2017

[56] National court administration, *Review of Courts Activities in 2015,* available at http://www.teismai.lt/lt/teismu-savivalda/teismu-ir-teismu-savivaldos-instituciju-veiklos-ataskaitos/198 accessed on 01/05/2017

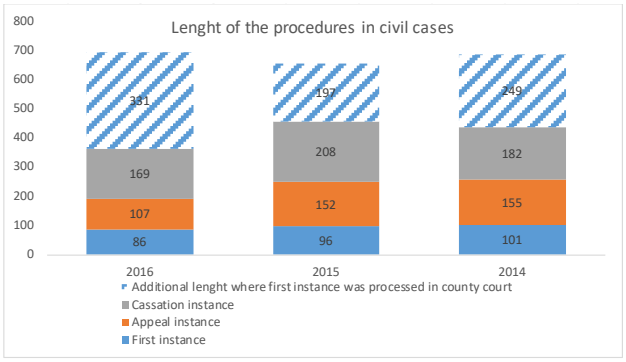

Figure 8. Length of the procedures in civil cases.

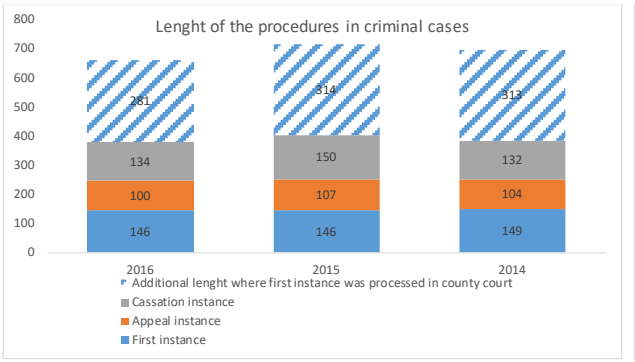

Figure 9. Length of the procedures in criminal cases

In 2016 a regular civil case started in the district court would last for 361 days (1 year) in total, if all instances are used (456 days in 2015; 438 days in 2014). However, in case of high-value matter or due to other specific reasons, the case has to be started in regional court acting as a court of first instance, then the length of the procedures might be expected to last for additional 331 days, that is – 692 days or almost 2 years in total (653 days in 2015; 687 days in 2014).

The criminal proceedings should last relatively the same amount of time. When a prosecuted case reaches the court, one might expect to spend a total of 380 days (1 year) in courts of all instances (if used) (403 days in 2015; 385 days in 2014). These numbers, of course, represent only time spent in court, excluding the length of prosecution, which is out of the scope of this research. However, if a case for the severity of a crime or other specific reasons has to be started in regional court as a court of first instance, then the length of the procedures might be expected to last for additional 281 days, that is – 661 days or almost 2 years in total (717 days in 2015; 698 days in 2014).

Administrative cases are solved mostly within two instances. However, the length of procedures in 2016 has reached the same almost 2 years in total, with 342 days spent in regional administrative court and 304 days in the Supreme Administrative Court of Lithuania.

The conclusion may be drawn from this statistics that courts are serving the slow legal process and the more complex the case is, the slower is the judiciary.

The price of the judiciary (excluding Constitutional Court of the Republic of Lithuania) in 2016 was almost 78 mln. EUR (i.e. more than 100.000 EUR per judge annually) and it has been constantly growing (75 mln. EUR in 2015; 68 mln. EUR in 2014)[57]. Most of the expenses cover salaries of the judges and other judicial staff. The data of the court system's expenses may be summarized in the *Figure 10* below:

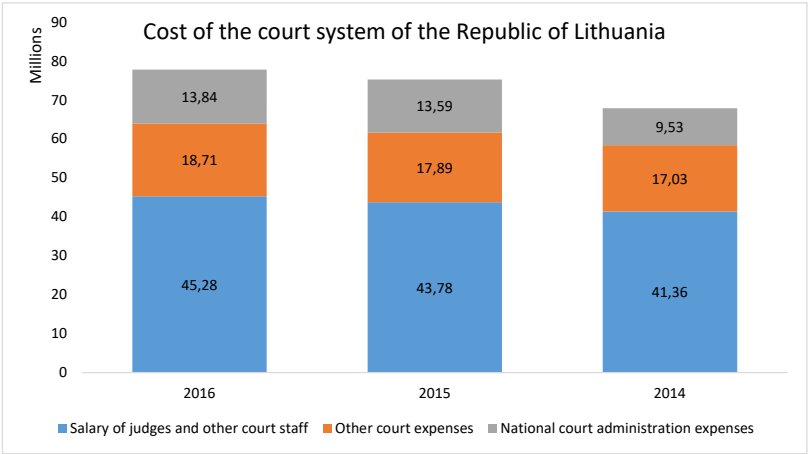

Figure 10. Cost of the court system of the Republic of Lithuania

[57] National court administration, *Review of Court Council Activities in 2013-2016,* available at http://www.teismai.lt/lt/teismu-savivalda/teismu-ir-teismu-savivaldos-instituciju-veiklos-ataskaitos/198 accessed on 01/05/2017

Of course, these numbers represent only the expenses of courts and do not include the expenses of police, prosecutors, military and other bodies, which aim is to protect society from market failures. The analysis of these expenses is not within the scope of this paper and therefore will be discussed in future works.

Despite the relatively narrow field of analysis, the note on the accessibility to the court system should be provided. According to the recommendations regarding fees of lawyers in civil cases, the maximum amount for the claim in civil cases is EUR 1983, which is equal to allmost 2,5-month average salary in the country[58]. Thus in order to have an average claim filed, an average earner will have to provide a labor worth of 1,2 months. The full litigation of average case through all the instances might cost 6-12 months of labor. It should also be noted that most of the households (53%) couldn't afford paying unexpected expenses[59], thus the judicial services remain basically inaccessible to them.

Having it said, the judiciary is a costly organization to maintain and due to the costs of lawyers - hardly accessible to an average earner.

The quality of judiciary is one of the major concerns of the National Court Administration[60]. In 2016 it approved the quality standards of court decisions, which is regarded as big achievement. However, these standards concern only the rhetorical functions of court decisions, rather than issue of judicial error.

It should be noted in the context of judicial error that almost 4 out of 10 decisions or rulings of the court of first instance are quashed or changed in both – civil and criminal cases. The Supreme Court of Lithuania reverses more than half of appellate court's decisions / rulings in civil cases and more than four out of ten decisions in criminal cases[61]. Moreover, as illustrated in the *Figure 11*, the number of errors has remained relatively stable throughout the last three years.

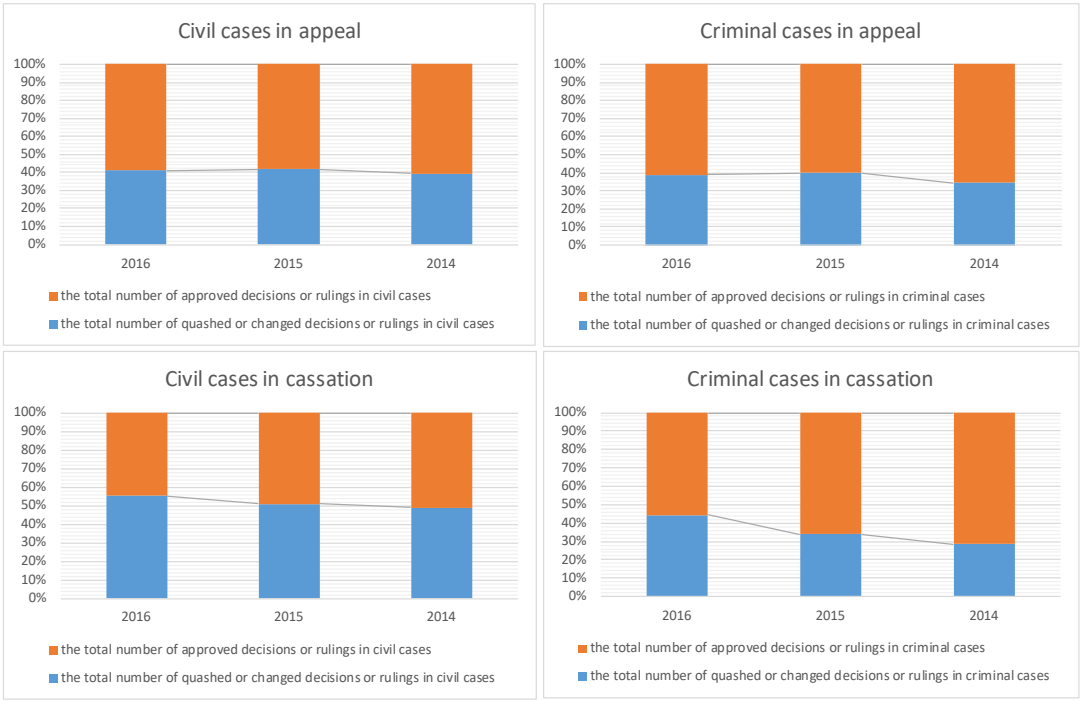

Figure 11. Court errors in civil and criminal cases

However, since the Supreme Court of Lithuania is the court of last instance, there is no way to assess if all of its decisions or rulings are error-free. However the statistics of the European Court of Human Rights, where the selected cases having exhausted domestic remedies are reviewed carefully, clearly shows the probability of errors in decisions of the Supreme Court of Lithuania, too.

[58] Which was 822,80 EUR at the last quarter of 2016 (Statistics Lithuania, https://osp.stat.gov.lt/web/guest/pradinis , accessed on 01/05/2017.
[59] Statistics Lithuania, *Report on Income and Living Conditions 2015,* available at: https://osp.stat.gov.lt/services-portlet/pub-edition-file?id=23858 , accessed on 01/05/2017.
[60] See footnote 55.
[61] Id.

Lithuania has had a total of 140 judgments before this court, where 103 judgments were in favor of claimants and at least one violation of the European Convention of Human Rights and its protocols was found. Most of these were violations of the length of proceedings (27) and right to a fair trial (25)[62]. In 2016 it was determined that 13 judgments out of 22 cases tried before the court contained violations. Most of these violations are regarding the right to a fair trial (4) and lack of effective investigation (4)[63]. Although these cases might be seen as exceptional, however they clearly expose the flaws in the judicial system as a whole. This, in turn, allows us concluding that some of the decisions and rulings of the Supreme Court of Lithuania might be erroneous, adopted without any real and effective possibility of review.

Thus the quality of decisions is far from being tolerable. The courts, having the monopoly of justice and thus no margin for error, are making mistakes in more than four cases out of ten. Thus, the risk of judicial error is high.

To summarize, the judiciary is slow, expensive and erroneous. This, in turn, evolves into the distrust of legal system, demands high *ExAnte* investments, precludes some transactions to appear at all and stimulates opportunistic behavior of persons, who are willing to abuse the trust by making use of the judicial uncertainty and specificity.

Obviously, the standard model of regulation is insufficient in terms of costs, speed and quality. It should be emphasized that most of the regulation models and strategies rest on human reactions and decisions, integrating the risk of human nature to err. Misaligned incentives of human being frequently serve as a source of incomplete or not self-enforcing transacting, rather than the lack of suitable legal protections. Unfortunately, most of the legal systems tend to rely on humans who try to anticipate what the other human might do before they do it. However, neither legal, economical, kinetic nor digital firewalls will stop a determined wrongdoer, exploiting vulnerabilities of humans. The post-breach reactions also tend to rely on humans, who are dealing with jurisdictional fragmentation and attribution of behavior.

These findings also suggest that it is irrelevant how much standard model of regulation has institutions that are supposed to check and balance each other. As long as irrational and opportunistic humans are involved, the regulation failures will be caused by the same reasons as the market failures. Thus the urge to diminish rapidly these transaction costs of regulation through the reinvention of one is obvious. The problem is that we can't deny human kind its nature to err and human enhancement is a highly controversial option. Therefore, the sole possible alternative is to look for technological solutions that would allow replacing or decreasing human involvement in the regulation field. Clearly, the regulation level needs the nuclear breakthrough in computing power and intelligence of the technologies used for law in data-driven world.

4. Conceptual failure-free regulation model in the context of technological singularity

This part of the paper develops the conceptual failure-free regulation model in the context of emerging technological singularity, thus solving the fourth task of this research. In order to achieve it, the first sub-part introduces the trends in the field of technologies of the law, thus performing the exploratory forecasting role of the research. The second sub-part introduces the conceptual context of the technological singularity scenario, thus performing the normative forecast to identify a possible, probable and/or preferable end-point of regulation. The third sub-part reviews the cyber-security issues related to the technological singularity. The overall analysis will allow developing the conceptual failure-free regulation framework (SmartLaw).

4.1. Genesis of the legal technologies

Since the major writings of Coase, Williamson, and other major scholars of transaction cost theory, the world has changed considerably. The rapid and exponential growth of data, its computation and storage capacity have led to the recent rise in legal technologies (LegalTech) and evolution of new search, drafting and control techniques. The technological changes are so rapid and the impact is so deep, that the very nature of transacting has considerably changed.

[62] European Court of Human Rights, *Violation by Article and by State (1959-2016),* available at http://www.echr.coe.int/Documents/Stats_violation_1959_2016_ENG.pdf , accessed on 01/05/2017.
[63] European Court of Human Rights, *Violation by Article and by State 2016,* available at http://www.echr.coe.int/Documents/Stats_violation_2016_ENG.pdf, accessed on 01/05/2017.

The trends of the LegalTech industry are promising. The list of LegalTech companies on AngelList[64] has been expanded from 15 companies in 2009 to 1532 companies in 2017. However, despite the recent industrial growth, the idea of artificial intelligence use in law is far from being new in the academic discourse.

Shortly after Konrad Zuse had built his first programmable computer in 1941, the idea of artificial intelligence began its shift from fiction to science. Started with the seminal McCulloch and Pitt[65] paper "*A Logical Calculus of the Ideas Immanent in Nervous Activity*"; followed by "Turing test" [66] and Dartmouth Summer Research Project on Artificial Intelligence in 1956, the field of artificial intelligence studies has been widely accepted as a field of science rather than fiction, and has captured some of the greatest minds since. At the same time, lawyers started their discussion on the use of artificial intelligence in law[67].

The works of Loevinger[68], Allen[69], Mehl[70], for example, could be regarded as the introduction to scientific and practical researches in this field, but the onset of application of artificial intelligence in law is usually related to the article by Buchanan and Headrick[71] "*Some speculation about artificial intelligence and legal reasoning*". The practical experiments of synthesis of artificial intelligence and legal processes on the ground of these conceptual ideas did not take long. Such were the projects of McCarty[72] TAXMAN or Stamper[73] LEGOL. Of course, the interdisciplinary scientific researches continued developing in various directions. The works of Hafner[74], Gardner[75], Rissland[76], Sergot et al.[77] are considered to be influential scientific works in the area of artificial intelligence and law.

The International Conference on AI and Law (ICAIL) was started in 1987 and continued annually. Since then it has become the main forum of application of artificial intelligence in law. These conferences resulted in establishment of the International Association for Artificial Intelligence and Law (IAAIL) and start of the Artificial Intelligence and Law Journal. It did not take long for the movement to involve not only the USA, but also Europe (e.g.. JURIX conferences), Japan (e.g., JURISIN workshop) and other countries.

Thus, academic discourse on artificial intelligence and law is celebrating more than 50 years of development. However, so far only primitive artificial intelligence systems have been found in legal practice. As Isaac Asimov has predicted with the punctilio of accuracy, **r**obots are neither common, nor very good in 2014, but they are in existence[78]**.** Thus the cognitive skills of superior level characteristic to the lawyer's profession are unattainable for the systems of artificial intelligence yet.

Nevertheless, the rapid technological development[79] and the current market trends (such as Google quantum supercomputer, digital copy of oneself[80], etc.) suggest that primitive artificial intelligence is gaining new properties and abilities that very soon will surpass their human counterparts. This process is accelerating. It is recognized in scientific literature that the latest technologies are and will continue changing the legal industry essentially.

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[64] Legal Startups, https://angel.co/legal, accessed on 01/05/2017

[65] W.S.McCulloch, W.H.Pitts, ‚A Logical Calculus of the Ideas Immanent in Nervous Activity', *Bulletin of Mathematical Biophysics, (1943), 115–133*

[66] A.M.Turing, ‚Computing Machinery and Intelligence', *Mind 59, (1950), 433–460*

[67] see for e.g. L.Loevinger, ‚Jurimetrics--The Next Step Forward', *Minn. L. Rev. 33 (1948), 455*; D.W.Allen, ‚Transaction Costs', in B. Bouckaert, G. De Geest, eds., *Encyclopedia of Law and Economics* (Chelthenham: Edward Elgar, 1999), pp. 893-925; L.Mehl, ‚Automation in the Legal World: From the Machine Processing of Legal Information to the Law Machine', *Mechanisation of Thought Processes (1958), 757-787*; B.G.Buchanan, G.Bruce, T.E.Headrick, ‚Some speculation about artificial intelligence and legal reasoning', *Stanford Law Review (1970), 40-62*

[68] Id., L. Loevinger.

[69] A. E. Layman, 'Symbolic logic: A razor-edged tool for drafting and interpreting legal documents', *Yale LJ 66 (1956): 833.*

[70] See footnote 67, L. Mehl.

[71] See footnote 67, B.G.Buchanan, G.Bruce, T.E.Headrick.

[72] L.T.McCarty, 'Reflections on" Taxman: An Experiment in Artificial Intelligence and Legal Reasoning', *Harvard Law Review (1977): 837-893*

[73] R.K. Stamper, 'The LEGOL 1 prototype system and language', *The Computer Journal 20.2 (1977): 102-108.*

[74] D.C. Hafner, 'Representing knowledge in an information retrieval system', in R.Oddy, et al., eds., *Information Retrieval Research*, (London: Butterworths, 1981).

[75] A. Gardner, 'The design of a legal analysis program', *AAAI-83, 1983.*

[76] E.L. Rissland, 'Examples in Legal Reasoning: Legal Hypotheticals', *IJCAI. 1983.*

[77] M.J. Sergot, et al. 'The British Nationality Act as a logic program', *Communications of the ACM 29.5 (1986): 370-386.*

[78] I. Asimov, *Visit to the World's Fair of 2014*, (N.Y. Times, 16/08/1964), http://www.nytimes.com/books/97/03/23/lifetimes/asi-v-fair.html , accessed on 01/05/2017.

[79] L.Muehlhauser, A.Salamon, 'Intelligence Explosion: Evidence and Import', in A.Eden, et al., eds., *Singularity Hypotheses: A Scientific and Philosophical Assessment*, (Berlin: Springer, 2012), 15-42

[80] A.Sally, *Digital doppelgängers: Building an army of you*, (New Scientist, 2012) http://www.newscientist.com/article/mg21528771.200-digital-doppelgangers-building-an-army-of-you.html, accessed on 01/05/2017.

Even having really limited capabilities, the first generation of LegalTech has already disrupted the legal market[81], and applications for using artificial intelligence are rapidly growing. From a chat-bot that gives advice whether you have to pay your parking ticket[82], artificial intelligence-enabled document creation or review[83], dynamic contracts or compliance management[84] to algorithms that predict decisions of the European Court of Human Rights[85] or the US Supreme Court[86]. In 2012 New York District Court issued the judicial opinion in a pending federal case, Da Silva Moore v. Publicis Groupe, where the use of e-discovery has been officially endorsed in the US: "*Computer-assisted review appears to be better than the available alternatives, and thus should be used in appropriate cases.*"[87]

Accordingly, academically trained attorneys are increasingly being replaced by technology used to analyze evidence and to assess its relevance for investigations, lawsuits, compliance efforts, and more[88]. For example, the Law Firm Baker & Hostetler has announced that they are employing IBM's AI Ross[89] to handle their bankruptcy practice, which at the moment consists of nearly 50 lawyers.[90]

One of the primary reasons for such increase in LegalTech is due to the increased accessibility to neural networking models and other probabilistic algorithms. Further automation of law is streaming especially to quantitative legal prediction[91], machine learning[92], and other fields of scientific and practical legal problems. Professor Richard Susskind predicts unprecedented upheaval in a profession where the working practices of some lawyers and judges have changed little since the time of Charles Dickens. According to him, there will be anything dramatic, but there will be incremental transformations in such areas as methods applied to review legal documents, to assess legal risk, and to make decisions[93].

Taking into account the probability that artificial intelligence might transcend the human one, the trend of legal technologies development allows hoping for digital option that would preclude perils of human nature to err and overcome problems of jurisdictional fragmentation and attribution of behavior. This, in turn, would allow elaborating the technological tools to foster the accessibility to justice and quality of regulation. That is, the following hypotheses were made:

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[81] See for e.g. M. Bay, 'Survey Shows Surge in E-Discovery Work at Law Firms and Corporations', *Law Tech. News (July 6, 2012)*; E. Koblentz, 'Judge Carter OKs Peck's Predictive Coding Decision in 'Da Silva Moore,' *Law Tech. News (Apr. 26, 2012),* W. D. Henderson, R. M. Zahorsky, 'Paradigm Shift', *A.B.A. J., July 2011*; D. R. Mountain, 'Disrupting Conventional Law Firm Business Models Using Document Assembly', *15 Int'l J.L. & Info. Tech. 170 (2007)*; E. J. Goldstein, 'Kiiac's Contract Drafting Software: Ready for the Rapids?', *Law Tech. News (May 18, 2012)* and others.

[82] See for e.g. DoNotPay, http://www.donotpay.co.uk/signup.php , accessed 2017-05-01; R. Price, *This chatbot fought parking fines and now it's helping refugees*, (World Economic Forum, 07/03/2017), https://www.weforum.org/agenda/2017/03/this-chatbot-fought-parking-fines-and-now-its-helping-refugees?utm_content=buffere3b83&utm_medium=social&utm_source=twitter.com&utm_campaign=buffer , accessed on 01/05/2017.

[83] See for e.g. Ironclad, https://www.ironcladapp.com/about, accessed on 01/05/2017, Lawgeex, https://www.lawgeex.com, accessed 2017-05-01, G. O. Hernandez, *4 Ways Technology Is Changing Contracts*, (Legal Tech News, 2016-12-29), http://www.legaltechnews.com/id=1202775740310/4-Ways-Technology-Is-Changing-Contracts?rss=rss_ltn&utm_source=SocialFlow&utm_medium=LegaltechNews , accessed on 01/05/2017, G. O. Hernandez, *Artificial Intelligence Has Found a Home in Contract Management*, (Legal Tech News, 04/08/2016), http://www.legaltechnews.com/id=1202764272201?back=law&slreturn=20170402123536, accessed on 01/05/2017.

[84] See for e.g. SirionLabs, https://www.sirionlabs.com/, accessed on 01/05/2017.

[85] S. Knapton, *Artifically intelligent 'judge' developed which can predict court verdicts with 79 per cent accuracy*, (Legal Tech News, 2016-10-24), http://www.telegraph.co.uk/science/2016/10/23/artifically-intelligent-judge-developed-which-can-predict-court/ , accessed on 01/05/2017.

[86] J. Wakefield, *AI predicts outcome of human rights cases*, (BBC, 2016-10-23), http://www.bbc.com/news/technology-37727387 , accessed on 01/05/2017

[87] *Monique DA SILVA MOORE, et al., v. PUBLICIS GROUPE & MSL Group*, 868 F.Supp.2d 137 (2012), No. 11 Civ. 1279(ALC)(AJP). United States District Court, S.D. New York. June 15, 2012.

[88] E. Livni, *Your next lawyer could be a machine*, (World Economic Forum, 06/02/2017), https://www.weforum.org/agenda/2017/02/machines-could-soon-replace-lawyers?utm_content=buffer933aa&utm_medium=social&utm_source=facebook.com&utm_campaign=buffer , accessed on 01/05/2017

[89] Ross is built on IBM's cognitive computer Watson. It was designed to read and understand language, postulate hypotheses when asked questions, research, and then generate responses (along with references and citations) to back up its conclusions. Ross also learns from experience, gaining speed and knowledge the more you interact with it. ROSS monitors the law around the clock to keep up-to-date with developments in the legal system, specifically those that may affect your cases. See for more: http://www.rossintelligence.com/ , accessed on 01/05/2017.

[90] C. de Jesus, *AI Lawyer "Ross" Has Been Hired By Its First Official Law Firm*, (Futurism, 11/03/2016), https://futurism.com/artificially-intelligent-lawyer-ross-hired-first-official-law-firm/ , accessed on 01/05/2017.

[91] D.M. Katz, 'Quantitative Legal Prediction—Or—How I Learned To Stop Worrying And Start Preparing For The Data-Driven Future Of The Legal Services Industry', Emory Law Journal, vol. 2013, no. 62:909, 2011.

[92] H. Surden, 'Machine Learning and Law', *Washington Law Review, Vol. 89, No. 1, 2014*.

[93] J. Croft, *Artificial intelligence disrupting the business of law,* (Financial Times, 06/10/2016), https://www.ft.com/content/5d96dd72-83eb-11e6-8897-2359a58ac7a5 , accessed on 01/05/2017.

1) The accessibility of justice will increase if the time required for analysis and drafting of legal documents is reduced;

2) The quality of regulation will increase if irrationality and opportunistic behavior of humans decrease.

These propositions are accepted as basic research assumptions, object for future proving. However, for the purposes of this paper it is generally assumed that the accessibility of justice (thus – efficiency) and quality of regulation will increase if the need for human intelligence and actions in regulation field decreases. It is also assumed, that this may be achieved only through invasion of autonomous intelligent legal technologies.

4.2. The Context of Technological Singularity

Singularity defines "the destiny of the human-machine civilization"[94]. It starts with the moment in time and velocity (power) of computation, when artificial intelligence becomes equal to a human intelligence, and transcends towards the post-humanistic era.

The Singularity and its law of accelerating returns[95] essentially are an economic theory and a powerful driver of transforming, as Kurzweil states, "*every institution and aspect of human life, from sexuality to spirituality*"[96]. Therefore, it also may be viewed through the lens of the new institutional economics. Moreover, singularity is also a transcendence phenomenon, since it allows us transcending the limitations of human intelligence and biological bodies, thus empowering us to gain power over our fates:

> *Our mortality will be in our own hands. We will be able to live as long as we want (a subtly different statement from saying we will live forever). We will fully understand human thinking and will vastly extend and expand its reach. By the end of this century, the nonbiological portion of our intelligence will be trillions of trillions of times more powerful than unaided human intelligence*[97]

Indeed, the Moore's law, stating that the capacity of computer processors doubles every 18 months, has proven to be quite accurate so far. All of the foregoing is influenced by the change in human knowledge levels, or rather continuous increase of knowledge. The level of human knowledge doubled during the period from 1750 to 1900's. And since 1965, the level of human knowledge has been doubling every five years. According to some predictions, the knowledge level shall double every 73 days from 2020[98].

As the knowledge level increases, people are becoming incapable of controlling and generating information and data, thus computer programs are used as auxiliary tools in data mining. Large flows of information and data require more powerful computer (technological) systems[99]. The powerful computer systems lead to the growth of their advantage over humans. Therefore, the separation between capabilities of humans and computer systems is constantly growing.

With the rapid growth of artificial intelligence capacities, their memory volume, self-training and creative potential, the difference between the abilities of human and machine brain is decreasing, and we may switch places in the future in this respect. Already, computer memory consists of elementary circuits, the number of which is comparable to that of nerve cell connections in the human brain (about *10* trillion), and the speed of their operation is higher than that of the human brains (billions of operations per second).

It is believed that artificial and human intelligence will be equal after 10-20 years, and then artificial Intelligence will "outgrow" the human one. Kurzweil[100] has noted that faster and smarter (self-replicating and self-organizing) chips will themselves accelerate the growth of power of computers. According to his Law of

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[94] R. Kurzweil, *The Singularity is near. When Humans transcend biology*, (NY Penguin Group, 2005)

[95] Id, Law of accelerating returns describes the acceleration of the pace of and the exponential growth of the products of an evolutionary process. These products include, in particular, information-bearing technologies such as computation, and their acceleration extends substantially beyond the predictions made by what has become known as Moore's Law. The Singularity is the inexorable result of the law of accelerating returns. /// The Law of Accelerating Returns" - the rate of change in a wide variety of evolutionary systems (including but not limited to the growth of technologies) tends to increase exponentially

[96] See footnote 94.

[97] Id.

[98] R.T.Toločka, ‚Regulated Mechanisms', *Technologija, (2008), 19-20*

[99] Digital Universe study, *iView content – Final (2010)* 8-10, available at http://gigaom.files.wordpress.com/2010/05/2010-digital-universe-iview_5-4-10.pdf accessed 20/05/2017; J.Gantz, et al. *The Digital Universe in 2020: Big data, Bigger digital shadows, and biggest Growth in the East,* (February 2013), 13-14; available at https://www.emc.com/collateral/analyst-reports/idc-digital-universe-western-europe.pdf , accessed 20/05/2017.

[100] R.Kurzweil, *The Age of Spiritual Machines*, (NY Penguin Books, 1999).

Accelerating Returns, we will achieve one human brain capability (10^{16} calculations per seconds) for $1,000 around the year 2023; and one human race capability (10^{26} calculations per seconds) for $1,000 around the year 2049[101].

Kurzweil predicts that in 2029 artificial intelligence will pass a valid Turing test and therefore achieve human levels of intelligence. He believes that in 2045, with the creation of superintelligence capable of self-improvement, "technological singularity" will occur. This superintelligence shall undoubtedly be superior to human intelligence; it will become autonomous and independent from the will of man[102]. Softbank CEO Masayoshi Son also predicts that the dawn of super-intelligent machines will happen by 2047[103]. Of course, there is no unanimous agreement if such scenario may be predicted on the ground of simple equation with computational power, as Kurzweil and Son did. According to Russell[104], even with a computer of virtually unlimited capacity, we still would not know how to achieve the brain's level of intelligence.

Of course, such predictions might be seen as fiction, rather than science. However, many fictions of Jules Verne, Isaac Asimov and other writers have proven to be accurate in many aspects of the current world. Accordingly, the assumption of technological singularity should be seen as possible rather than utopian.

However, humans are yet irreplaceable in the field of intelligent activities. There is no super-intelligent artificial system, having the ability to train itself, accumulate experience, make and explain rational decisions of its own. However, the development of search engines, language processing and control systems, other technologies, as well as the field of artificial intelligence seem to be very promising in the context of diminishing transaction costs.

It should be reminded here that the operation of artificial intelligence is based on the achievement of goals[105]. The objectives of artificial intelligence are[106]:

1) to preserve itself in order to maximize the satisfaction of its present final goals;

2) to preserve the content of its current final goals; otherwise, if the content of its final goals is changed, it will be less likely to act in the future to maximize the satisfaction of its present final goals;

3) to improve its own rationality and intelligence in order to improve its decision-making, and thereby to increase its capacity to achieve its final goals;

4) to acquire as many resources as possible, so that these resources could be transformed and put to work for the satisfaction of the artificial intelligence's final goals.

Accordingly, artificial intelligence systems may be (and are) used to diminish the negative impact of the transaction cost variables, if such is its overall goal. That is, if the final goal of artificial intelligence system is to diminish transaction costs, the system should be seeking, acquiring, preserving, and improving intelligence, necessary to minimize the impact of irrational and opportunistic behavior in uncertain environment with limited resources.

Moreover, it should be noted that it is not a discussion of *tomorrow.* Even the primitive artificial intelligence systems that already exist and are consumed *today* significantly reduce transaction costs. The exponential growth of the "digital universe" and technology makes it possible to record and analyze data at the molecular level[107]. The dream of having complete data and unlimited calculation capabilities may indeed come true. Decisions made under these conditions have the real potential to be perfectly rational *per se,* thus eliminating the *bounds of rationality*. Moreover, complete data and unlimited computation capabilities, together with advanced forecasting methods, allow development of perfect future prediction and/or

[101] R.Kurzweil, *The Singularity is near. When Humans transcend biology*, (NY Penguin Group, 2005).
[102] See Id, p. 179, and D. Galeon, C. Reedy, *Kuzweil Claims That the Singularity Will Happen by 2045,* (Futurism) https://futurism.com/kurzweil-claims-that-the-singularity-will-happen-by-2045/ , accessed on 20/05/2017.
[103] D. Galeon, *Softbank CEO: The Singularity Will Happen by 2047*, (Futurism, 01/03/2017), https://futurism.com/softbank-ceo-the-singularity-will-happen-by-2047/, accessed on 20/05/2017.
[104] S. Russell, P. Norvig, et.al., *Artificial Intelligence. A Modern Approach*, Third Edition (Prentice Hall: New Jersey, 2010).
[105] N.Bostrom, ,The Superintelligent Will: Motivation and Instrumental Rationality Advanced Artificial Agents', in V.C. Müller, ed., *Theory and Philosophy of AI*, *(Special issue 22 (2) Minds and Machines, 2012*), p71–85.
[106] See footnote 79, p. 15-42
[107] The Royal Swedish Academy of Sciences, *Press Release: The Nobel Prize in Chemistry 2016,* (2016-10-05), available at: https://www.nobelprize.org/nobel_prizes/chemistry/laureates/2016/press.html, accessed on 20/05/2017

adaptation techniques. Thus the perils of *uncertainty* are eliminated. In turn, having unbounded rationality and certainty of the future, the complete transacting may indeed be possible.

Of course, the presence of world-wide network of specific assets, 3D printing and other technologies may eliminate the *specificity of assets*. Only the risk of *opportunistic* behavior of artificial intelligence system remains the unsolvable issue.

Foreseeable singularity era comes with the success story of innovation, evolution and enhancement in all the fields of human mental and physical activities. However it is also a story of existential risk, that we have been warned by the Future of Life Institute[108] and by the open letter, signed by Stuart Russell[109], Peter Norvig[110], Stephen Hawking[111], Elon Musk[112], Steve Wozniak[113] and over than 8000 other leading scholars in "ranges from economics, law and philosophy to computer security, formal methods and, of course, various branches of AI itself"[114].

In theory, the opportunistic behavior of artificial intelligence may be eliminated with the use of fictional three laws for robots, set by Isaac Asimov in 1950[115]. These principles, although fictional in 50's, are often used in the theoretical and practical development of today's artificial intelligence systems[116]. However, the danger persists in humans, (i) who will be able (by law, or by hacking) to set the goals for artificial intelligence system, (ii) who will have a "kill switch", (iii) whose experience and intelligence will be used to teach intelligent machine. That is, artificial intelligence system might do harm only if it has a biased goal, existential fear and knowledge, wisdom and understanding learned from human behavioral experience.

This issue was extensively analyzed by Stephen M. Omohundro[117], who stated that even artificial intelligence with the ability to play chess may be dangerous, if not properly designed. The artificial intelligence system, developed without any special precautions from human intervention may oppose to disconnection and try to break into other technological systems in order to create its own copy. The improperly designed artificial intelligence system may try to acquire resources without regard to the safety of others in order to achieve the goal for which it was designed[118]. However, when properly protected from the perils of *mens rea* or *actus reus,* the artificial intelligence systems may be harmless to the society, thus eliminating negative impact of opportunistic behavior from the transactions. In turn, having eliminated perils of opportunism and asset specificity, the self-enforcing transactions may also seem to be possible.

Therefore, having complete and self-enforcing transactions in the singularity age, the assumption of zero transaction cost does not seem to be unrealistic, as founding fathers of transaction cost theory held it. New technologies are (and will be) changing the search, negotiations and control stages of transactions, altogether with the overall legal system.

Even the biggest sceptics, holding the singularity and post-humanism scenarios as a matter-of-science fiction, cannot ignore the obvious fact that currently ongoing fourth industrial revolution is already fundamentally altering every human transaction and institutions in the unprecedented ways. In its scale, scope, and complexity, the transformations are unlike anything humankind has experienced before[119]. Thus although we are still in the early stage of the intellectual technologies development and, in fact, there is a

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[108] https://futureoflife.org/ai-open-letter
[109] Berkeley, Professor of Computer Science, director of the Center for Intelligent Systems, and co-author of the standard textbook Artificial Intelligence: a Modern Approach
[110] Director of research at Google and co-author of the standard textbook Artificial Intelligence: a Modern Approach
[111] Director of research at the Department of Applied Mathematics and Theoretical Physics at Cambridge, 2012 Fundamental Physics Prize laureate for his work on quantum gravity
[112] SpaceX, Tesla Motors
[113] co-founder of Apple
[114] https://futureoflife.org/ai-open-letter
[115] (i) A robot may not injure a human being; (ii) A robot must obey the orders given to it by human beings, except where such orders would conflict with the first law; (iii) A robot must protect its own existence as long as such protection does not conflict with the first or second law (I.Asimov, *I, Robot*, (NY Gnome Press, 1950).
[116] R.J.Sawyer, *On Asimov's Three Laws of Robotics* (1994), available at http://www.sfwriter.com/rmasilaw.htm, accessed 20/05/2017; U.Barthelmess, U.Furbach, 'Do We Need Asimov's Laws?' (2014-05-16), available at http://www.technologyreview.com/view/527336/do-we-need-asimovs-laws/ , accessed on 20/05/2017
[117] S.M.Omohundro, ,The Basic AI Drives. - Self-Aware Systems', *Proceedings of the 2008 conference on Artificial General Intelligence, Amsterdam: IOS Press, (2008)*, 483-492
[118] Id
[119] K. Schwab, *The Fourth Industrial Revolution: what it means, how to respond,* (World Economic Forum, 14/01/2016), https://www.weforum.org/agenda/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond, accessed on 02/05/2017.

probability that artificial intelligence will never transcend the human one, the ongoing technological evolution trends exponentially towards the predicted singularity scenario.

Therefore, within the context of singularity scenario**,** undisputedly only intelligent machines has the real potential to decide on thousands of legal cases (i) within the fraction of the second; (ii) using the unbiased knowledge, wisdom and understanding of thousands of judges; (iii) for a cost of a penny. It is far more efficient scenario than having one case solved (i) within the average period of 2 years; (ii) using the biased knowledge, wisdom and understanding of a handful of judges; (iii) for a considerable cost much of the average class can't afford to have.

More complex group of issues is related to moral and ethical aspects of technological advancement. There is no scientific consensus on many of these issues, with the range of opinions from technophobic denial to the idea that only androids may be ethical[120]. However, moral and ethical dilemmas deserve separate in-depth research, thus they are left outside the scope of this paper.

Another group of complex issues is related to the security of cyber-dependent World. Besides the technologies that evolve for the good of humanity, the cyber-security threats also evolve with the same exponential scope. These issues also deserve separate in-depth research. However, moral and ethical dilemmas are related to the top-level institutions and understanding of the fundamental values of society, while cyber-war is the ongoing in the resource allocation, i.e. bottom level of the system. Accordingly, these issues have to be reviewed at least on general level, setting the background for the future works.

4.3. General review of cyber-security issues

While one singularity narrative, presented previously, touts the benefits of the greatest technological developments and bright future of cyber dependent opportunities, other warns the World of cyber-activism (hacktivism), cybercrime, cyber-espionage, cyberwar and cyber-terrorism[121]. Even cyber murder may become a reality since cyber-dependent medical technology is a likely target. It is beyond any reasonable doubt that cyber security of cyber ecosystem has become one of the major threats to the World[122].

The ongoing cyberwar does not require expensive soldiers, arms and ammunition. It is a war without any territorial and geographic borders. It is a war of sophisticated algorithms operating from advanced, lightning-fast computers. The exponentially increased use of software and digital services with asymmetrical distribution of security measures possesses major economic and political threats. To name just a few, cyberwars, espionage, ransomware, DDoS attacks, blackmail and fraud, phishing, large data leaks, and other financially or politically motivated attacks have become an exponentially growing, unsolvable, everyday problem of law and economics. Cybercrimes differ from traditional crimes, because perpetrators are more difficult to track, economies of scale are larger and it is easier for cyber criminals to operate on an international scale[123]. The threat streams from private data of individual to the critical infrastructure and governments. There is no immunity. Indeed, the World has been hacked and the chances of being caught are small.

Some high-profile cyber-attacks are highlighting these risks and costs. In 2013 Target lost approximately 40 million credit and debit card accounts, costing Target approximately $250 million. In 2014, a hack at Sony Corp. exposed Hollywood secrets. In 2015, the adult-themed, extramarital affair website Ashley Madison was hacked exposing the personal information of some 32 million users[124]. AdultFriendFinder followed with 412 million accounts loss in 2016. 1,5 billion accounts of Yahoo has been compromised in 2013 and 2014 attacks, LinkedIn has lost 165 million in 2012, Dropbox – 68 million in 2013[125], etc. The United States government lost background investigation records of millions of current, former, and prospective federal

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[120] J.E. Nadeau, ‚Only Androids Can Be Ethical', in K. Ford and C. Glymour, eds., *Thinking about Android Epistemology*, (MIT Press, 2006), p. 241-248.

[121] B.B. Hughes, D. Bohl., et al., 'ICT/Cyber benefits and costs: Reconciling competing perspectives on the current and future balance', *Technological Forecasting & Social Change 115 (2017) 117–130*.

[122] World Economic Forum, *The Global Risks Report 2016, 11th Edition* (2016), http://www3.weforum.org/docs/Media/TheGlobalRisksReport2016.pdf , accessed on 01/05/2017

[123] T. Kiseleva, B. Overvest, et al., 'Cyber Security Risk Assessment for the Economy', *CPB Communication, Dutch National Cyber Security Centre,* (July 6, 2016).

[124] J.Heidenreich, 'The privacy issues presented by the cybersecurity information sharing act', *North Dakota Law Review, Vol. 91:395 (2015)*.

[125] E.Palermo, P.Wagenseil, *The Worst Data Breaches of All Time*, (Tomsguide, 14/12/2016) http://www.tomsguide.com/us/pictures-story/872-worst-data-breaches.html#s21 , accessed on 01/05/2017.

employees and contractors, including the fingerprints of 5.6 million federal employees in 2014 attack that lasted for several months[126]. The 2016 breaches also included the Department of Homeland Security and the Federal Bureau of Investigation[127].

According to "The Global Risks Report 2016," from the World Economic Forum, detectable crimes in cyberspace cost the global economy an estimated 445 billion USD in 2014[128]. There were no signs of slowing down in 2015 and a forecast for 2019 estimates up to 2 trillion USD[129]. The trends of cyber security incidents by attack type, time and impact were clearly summarized by IBM X-Force Threat Intelligence Index 2017 report[130] as in the *Figure 12*:

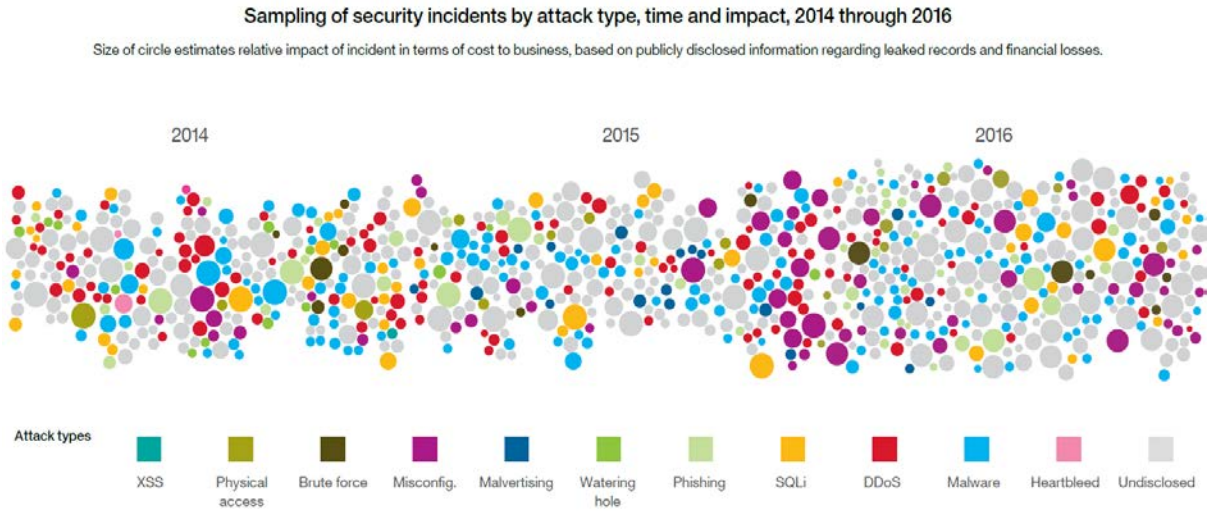

Figure 12: Cyber security incidents by attack type, time and impact (*source:* IBM X-Force Threat Intelligence Index 2017 report)

Nevertheless, the problem is much bigger. World is cyber-dependent. Airports, cars, hospitals, stock markets, power grids are run by computers and these computers are shockingly vulnerable to cyber-terrorist attack. An attack of sufficient strength could destabilize a country's economic or military apparatus without the need for armed conflict. This requires a completely different framework for prevention or response than one for kinetic warfare, where physical actions are taken against physical targets. That is not to say that casualties in cyberwar are impossible. Cyber attacks on power grids and communications have the ability to cause kinetic effects directly, damaging physical infrastructure. For example, in March of 2015, Iran launched a cyberattack against Turkey's power grid that shut down power systems in over half the nation's provinces[131]. Thus cyber attacks remain among the biggest threats to people, businesses, governments and other institutions.

It should be emphasized that most of the cyber security strategies and regulation models rest on the human reactions and decisions, integrating the risk of human nature to err. Indeed, only 48% percent of data security breaches are caused by acts of malicious intent. Human error or system failure accounts for the rest.[132] Verizon 2016 Data Breach Investigations Report[133] reveals that cybercriminals are continuing to exploit human nature as they rely on familiar attack patterns such as phishing. 95 percent of breaches and 86 percent of security incidents fall into nine patterns. Sixty-three (63) percent of confirmed data breaches involve using weak, default or stolen passwords. Most attacks exploit known vulnerabilities that have never been patched despite patches being available for months, or even years. In fact, the top 10 known

[126] See footnote 124.
[127] A.Kayastha, *Top 10 Security Breaches of 2016*, (Tufitech, 27/12/2016), http://www.tufitech.com/news/top-security-breaches-2016/, accessed on 01/05/2017.
[128] See footnote 122.
[129] *Cybercrime will cost businesses over $2 trillion by 2019*, (Juniper Research, 2015) https://www.juniperresearch.com/press/press-releases/cybercrime-cost-businesses-over-2trillion, accessed on 01/05/2017,
[130] Security Intelligence Staff, *IBM X-Force Threat Intelligence Index 2017,* (Security Intelligence, 2017), https://securityintelligence.com/media/ibm-x-force-threat-intelligence-index-2017/ , accessed on 01/05/2017.
[131] D. Laton, 'Manhattan_Project.exe: A Nuclear Option for the Digital Age', *25 Cath. U. J. L. & Tech (2017)*.
[132] B. Laberis, *20 Eye-Opening Cybercrime Statistics*, (Security Intelligence, 14/11/2016), https://securityintelligence.com/20-eye-opening-cybercrime-statistics/, accessed on 01/05/2017.
[133] J. Brumfield, *Verizon's 2016 Data Breach Investigations Report finds cybercriminals are exploiting human nature*, (Verizon, 2016-04-27), http://www.verizon.com/about/news/verizons-2016-data-breach-investigations-report-finds-cybercriminals-are-exploiting-human-0, accessed on 01/05/2017.

vulnerabilities account for 85 percent of successful exploit. All findings boil down to the human element. Indeed, misaligned incentives of human being, rather than the lack of suitable technical protections are more often a source of information insecurity[134].

Unfortunately, most of the cyber defense systems tend to rely on humans who try to anticipate what the other human might do before they do it. However, neither kinetic nor digital firewalls will stop a determined hacker, exploiting vulnerabilities of the humans. Post-breach reactions also tend to rely on humans, who are dealing with jurisdictional fragmentation and attribution of behavior. On either stage, government faces additional so-called "Going Dark" problem, which refers to situations in which government has legally obtained the right to search certain devices but has no technical ability to carry out those orders of court[135]. Moreover, these problems and conflicts arise when government seeks to obtain information for the purposes of investigating or thwarting crimes, but cannot bypass the encrypted information even when it has the accompanying devices in its possession[136].

Typical attempts to improve cybersecurity through regulation involve enhancement of capabilities to collect and share information about cybersecurity threats. However, cybersecurity regulation takes place within complex ecosystems, where stakeholders from diverse societies, having distributed responsibilities, diverse problems and challenges, make it difficult to initiate collective action. Therefore, cybersecurity is the sea of paradoxes, where the choosing of one direction can be at the expense of another direction, while the obligation of government is to go both ways[137].

The major cyber security paradox stems from the classical tension between security and privacy. In order for governments to ensure cybersecurity, they need to access the data of individuals and organizations for surveillance purposes. That is, capability to preclude or react to the cyber-attack increases as privacy barriers decrease. Therefore security and privacy are opposite vectors, although the obligation of government is to ensure both. The heated discussion about the legitimate balance between national security and information privacy, intensified by the Snowden leaks, has been going on for several years.[138]

This debate might be highlighted by example of the US Cybersecurity Information Sharing Act ("CISA"), adopted in 2015, which has established a core real-time cybersecurity information sharing framework between private entities and the federal government. While its goal may be commendable, CISA has been criticized by *inter alia* Apple, Google, Amazon and Microsoft mostly with privacy, civil liberties and transparency related arguments[139]. The recent FBI and Apple encryption dispute in the San Bernardino Case[140] has exposed the major critical arguments supporting both sides of the paradox. Government asked Apple to create a backdoor to the iPhone 5C used in a 2015 San Bernardino terrorist attack that killed 14 people and seriously injured 22. Apple appealed arguing that government is asking for something that is too dangerous to create[141].

These arguments were supported by many, including the United Nations High Commissioner for Human Rights, who warned the FBI that unlocking a Pandora's box possesses the potential for "extremely damaging implications" on human rights[142]. Indeed, the Snowden leaks and other total surveillance attempts[143] have clearly demonstrated that humans involved in regulation are also vulnerable to opportunistically misuse of the private information collected. That is, distrust in personal data mismanagement extends to governmental institutions, thus requiring for protection measures from human vulnerabilities.

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[134] R. Anderson, 'Why Information Security is Hard—An Economic Perspective', *Proceedings of the 17th Annual Computer Security Applications Conference, 358–65 (2001). IEEE Computer Society.*

[135] J. M. Traylor, ‚Shedding Light on the „Going Dark" Problem and the Encryption Debate', *University of Michigan Journal of Law Reform. Vol. 50:2 (2017)*.

[136] Id.

[137] H. Bruijn, M. Jansen, 'Building cybersecurity awareness: The need for evidence-based framing strategies', *Government Information Quarterly 34 (2017) 1–7.*

[138] S.Schuster, M. Berg, et al., 'Mass surveillance and technological policy options: Improving security of private communications', *Computer Standards & Interfaces 50 (2017) 76–82.*

[139] See footnote 124.

[140] *USA v. In the Matter of the Search of an Apple iPhone Seized During the Execution of a Search Warrant on a Black Lexus IS300*, United States District Court, C.D. California, No. ED 15-0451 M 2016 WL 618401.

[141] See footnote 135.

[142] Z. R. al-Hussein, *San Bernardino Shooting: UN chief warns of implications of Apple-FBI row*, (The Press-Enterprise. Associated Press, 04/03/2016), http://www.pe.com/2016/03/04/san-bernardino-shooting-un-chief-warns-of-implications-of-apple-fbi-row/, accessed on 01/05/2017.

[143] P. Laungaramsri, ‚Mass surveillance and the militarization of cyberspace in post-coup Thailand', *ASEAS – Austrian Journal of South East Asian Studies, 9(2), (2016), 195-214.*

Thus, despite the growing amount of cyber security strategies, cases and research in the field, the problem is far from solved. What is the desired level of protection of systems? How much (cross-border) collaboration is necessary to fight cybersecurity? Who to fight to? What is the right amount of spending on cybersecurity? What is the right level of visibility? Who should ensure the cybersecurity of systems?[144]

Moreover, the technology, upon which all these strategies and security tools are developed, might very soon be outdated. It is expected to meet 2020 with 24 billion interconnected devices, with different security techniques and policy requirements applied by producers, thus making security challenges more difficult to fulfill as it is hard to develop a generic "one fits all" security strategy or model[145]. Clearly, for these and other reasons cyber-dependent World is also in urge of a digital nuclear option, capable of swiftly inflicting grievous damage while simultaneously safeguarding the cyber systems of its motherland[146].

Since security and privacy are at the opposite ends of the same problem, the digital Manhattan Project may be developed either from the perspective of security or privacy. The first option involves a breakthrough in computing power and intelligence of the technologies used for security of data-driven world. However, such evolution would also open new possibilities for the development of hacking tools, as faster and smarter technologies will be accessible to the wrongdoers, too. Moreover, technological singularity may not be reached in another 30 years. Therefore, security perspective option will not be accessible soon enough and (most likely) will not diminish the cyber security risks at the speed and scope needed for it to be treated as a nuclear option.

The second option is to reinvent the privacy law. This perspective has some major deviations from the technological advancement option described above. Security and privacy are opposite vectors, thus abilities to preclude or react to the cyber-attacks increase as privacy barriers decrease, even with the *status quo* in computation power and intelligence of the technologies. However, technological advancement is exponential, while the development of privacy law remains linear and slow. Thus the governments are urged to find a way for self-governance or to speed up, at a major scale, the regulatory procedures and decisions thereof. Finally, the law may be changed with the stroke of a regular pen. Therefore privacy perspective option is accessible and it may diminish the cyber security risks even with the *status quo* in computation power and intelligence of the technologies. Moreover, it may solve an ancillary issue of the governance efficiency.

Nuclear option in privacy law would require treating privacy not as a law, but rather as a privilege. This perspective would open all private data to the system until the privilege to be forgotten is earned through a trustworthy behavior. This option would be in alignment with the very idea of opportunism, which describes the self-interest nature of people. The transaction cost theory is based on a presumption of opportunistic behavior, since it is too costly (or even impossible) to determine in advance whether individual actor is capable of acting opportunistically or not. General law, however, is based on the presumption of honesty, which protects all the actors (including hackers) from intervention to their privacy, until there is enough proofs of actual or potential threat to security. Thus nuclear option in privacy law would bypass “Going Dark” problem and would ensure maximum security available with the use of status quo technologies.

Of course, there is an undefined set of third options, encompassing a mix of both: advancement of technologies while sustainably reaching for a trust-free governance system that would allow decreasing cyber security related privacy barriers. However, the general conclusion might be drawn that cyber-security issues greatly relate to the same human nature to err due to their bounded rationality, (willfully) opportunistic behavior in the uncertain environment, having limited resources. Thus general description of standard regulation model failure is aligned with the specific description of hardships in regulating the cyber-security issues. Accordingly, the conceptual failure free model, developed below, could be used to solve cyber-security regulation issues too.

4.4. Conceptual failure-free regulation framework (SmartLaw)

It was assumed that the accessibility of justice (thus – efficiency), quality of regulation and security would increase if the need of human intelligence and actions in preemptive and reactive regulation field decreased.

[144] See footnote 137, H. Bruijn, M. Jansen.
[145] A.R. Sfar, E. Natalizio, et.al., A Roadmap for Security Challenges in Internet of Things, *Digital Communications and Networks*, *http://dx.doi.org/10.1016/j.dcan.2017.04.003*
[146] See footnote 131.

It is also assumed that this may be achieved only through the invasion of autonomous intelligent legal technologies.

However, nuclear option in regulation (and security) would also require an access to the unlimited personal data. This, in turn, requires trust-free governance of the data collected – a cryptographic governance system, which should be organized in a blockchain manner - both autonomously and in a networked-based collective (distributed) nature, without any point of central control or single point of failure. Such technology, merging cryptography with governance on a digital platform, if possible at all, might lead to the trust-free governance, which embraces the emerging digital lifestyle.

Intelligent machines can be trained to constantly analyze patterns in order to identify any deviation in it, much like a human counterpart does, just much faster, cheaper and in higher details of variations. Moreover, it may constantly use existing data to learn and enhance its functionalities and cyber warfare strategies. Using the logics of process mining methodology[147] to the transaction pattern analysis, such system could be modeled as in the *Figure 13* below.

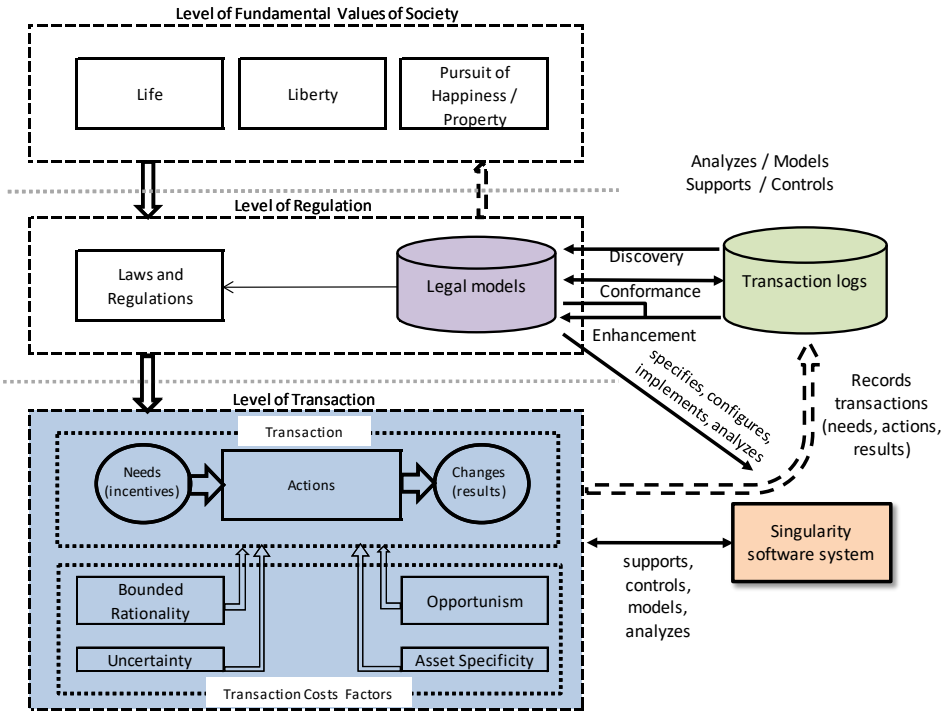

Figure 13. Conceptual failure-free regulation framework (SmartLaw)

According to this model, all of the transacting data, which can be collected under such circumstances (from subjective to objective data), would go to the trust-free database, where they would be supported and controlled by the trust-free software system. Trained within the standards of fundamental values (life, liberty and pursuit of happiness), it would autonomously analyze and model legal framework to prevent market failures as much as possible, constantly learning and enhancing at the same speed and scope as the everyday transactions evolves. The law might become smart, i.e. individualized and constantly adopting in the real time situations. This proposition is in line with the suggestion that artificial intelligence could present a solution to the issues of human error and slow response time[148]. An artificially intelligent machine that is capable of autonomously learning and performing defensive and offensive strategies is invaluable and inevitable in the digital age. Moreover, the possibility of such framework is not a very unrealistic assumption in the context of developments in legal technologies.

[147] W.M.P. van der Aalst, *Process mining: Discovery, Conformance and Enhancement of Business Processes,* (New York: Springer, 2011), pp. 1-352; W.M.P. van der Aalst, et al., ‚Process Mining Manifesto', in *BPM 2011 Workshops proceedings. - Lecture Notes in Business Information Processing. Springer-Verlag, (2012), pp. 1-19.*

[148] See footnote 131

5. In lieu of Conclusions: *"The first thing we do, let's kill all the lawyers"* (Shakespeare)

Shakespeare's line from Henry VI "*The first thing we do, let's kill all the lawyers*" is a longtime cultural favorite of the jokes about attorneys. However, soon it may not be an utopian proposition to consider. Not literally, of course, however machines may be ones who will quash the need of lawyers in order to regulate free market behavior.

This conclusion stems from the performance of the four-task set in the introductory part:

1) The analysis of the inductive analysis of the standard regulation framework and its elements has revealed that it has three levels. At the top level, there are fundamental values of society, linked to the second level of regulation and back. The need for regulatory measures shapes the institutional setting and it encompasses the setting of laws and lawyers. This level is linked to the level of transaction and back. Transactions and their cost variables, causing the market failures, are at the bottom part of the framework. Standard model of regulation rests on human intelligence, which is limitedly rational, opportunistic, and performed under the uncertainty and asset specificity. Thus, the first task of this research is completed;

2) The second task of this research was completed with introduction of basic methodological assumptions, justification of research methods, and description of limitations.. The descriptive and explanatory research was limited to the efficiency of the judicial branch performance. However the data and methods chosen were sufficient to illustrate the approach to regulation, having the logical reasoning as the main technique for the development of new regulatory framework;

3) The description and explanations of the volumes and nature of the standard regulation framework failures have revealed that (i) the standard model of regulation is insufficient in terms of costs, speed and quality; and (ii) as long as there are irrational and opportunistic humans acting in uncertain environment with the limited resources, this model will encounter regulation failures. By concluding that the sole possible solution is to look for technological solutions that would allow replacing or decreasing human involvement in the regulation field, the third task of this research was completed.

4) Finally, the conceptual failure-free regulation model in the context of emerging technological singularity was developed, thus solving the fourth task of this research. The model is based on general assumptions, that (i) the efficiency of regulation will increase if the need of human intelligence and actions in regulation field decrease; and (ii) this may be achieved only through the invasion of autonomous intelligent legal technologies; and (iii) in the context of probable singularity scenario, the assumption of zero transaction cost does not seem to be unrealistic. Indeed, an autonomous and safely designed artificial intelligence presents a solution to the issues of human error, slow response time and costs hereof.

Obviously, the use of robotic tools enables to mine, analyze and share big sets of data with the punctilio of accuracy, within the fraction of the second at very low costs. Using exponentially growing computational power to analyze the impact of legal rules on the incentives, actions and results of transacting, it turns possible for the system to create highly individualized and smart rule of law (SmartLaw), that allows to achieve maximum efficiency (justice) to that individual and society as a whole; that is, to create a perfect and alive system of law.

However, much more has to be done to validate the conceptual model in theory and practice. The speed of institutional changes should be empirically re-tested in the context of disruptive technological development. Moreover, the correlation between gracefulness of the incentives, actions performed and the result of transactions has to be determined. Of course, more complete study of the cost, speed and quality of the performance of all government branches would enrich the understanding of the regulation failures. Also moral and ethical dilemmas, cyber-security and related issues deserve separate in-depth researches.

Therefore full and empirically sound testing of propositions that (i) the accessibility of justice will increase if the time required for the analysis and drafting of legal documents decrease, and (ii) the quality of regulation will increase if the irrationality and opportunistic behavior of humans decrease, is an object of future research agenda.

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