

INVITED TALKS - ABSTRACTS

(RE)SHAPING OR ESCAPING THE FUTURE? ATRANSDISCIPLINARY PERSPECTIVE ON SUSTAINABLE DEVELOPMENT AND THE ROLE OF BUSINESS	I
Adriana Budeanu, Copenhagen Business School, Denmark	
DESIGN THINKING APPROACH TO ETHICAL (RESPONSIBLE) TECHNOLOGICAL INNOVATION	III
Nathan Ganesh, University of Applied Sciences and Arts Northwestern Switzerland, Switzerland	
A NEW ENVIRONMENT FOR ENTREPRENEURSHIP AS A LEVER OF SUSTAINABLE BUSINESS DEVELOPMENT	VI
Joaquim Ramos Silva, University of Lisbon, Portugal	
RSLINGO4PRIVACY: AN INTEGRATED APPROACH TO IMPROVE THE SPECIFICATION AND ANALYSIS OF PRIVACY POLICIES	VIII
Alberto Rodrigues Da Silva, University of Lisbon, Portugal	

(RE)SHAPING OR ESCAPING THE FUTURE? A TRANSDISCIPLINARY PERSPECTIVE ON SUSTAINABLE DEVELOPMENT AND THE ROLE OF BUSINESS

Adriana Budeanu
Department of International Economics and Management (INT)
Center for Leisure and Culture Studies (CLCS)
Copenhagen Business School, Denmark

Abstract: *Examining and discussing the role of business and entrepreneurship in the context of sustainable development is an ambitious task. This expose takes a starting point in acknowledging that business development is essential to any goal associated to the future of humanity, while at the same time, sustainable development has given way to a veritable market transition. In fact, it is suggested that sustainable consumption and social equity are becoming key goals for business strategy (Porter & Kramer, 2011) next to profitability and competitiveness. The emergence of social entrepreneurship, socially responsible investments and philanthro-capitalism are illustrative examples of an acclaimed paradigm shift in business philosophy, where profitability is embedded and aligned with society's well-being.*

In his book "From heresy to Dogma", Andrew Hoffmann makes a historical analysis of corporate reactions and positions towards sustainability-relevant matters, such as environmental goals, to conclude that businesses have become an equal partner in the negotiations that aim to define such goals (Hoffman, 2001). So much so, that businesses involvement is often comparable with the role of states in shaping society's path towards the future (Halme, Park, & Chiu, 2002). This is also illustrated by the constant preoccupation of political, cultural and (recently) spiritual leaders who speak of the role, interest and responsibility of businesses for the well-being of humanity. The subject of business involvement in sustainable development enters other spheres of everyday life also. As individuals, we are now citizen-consumers and have the option of 'voting with our wallets' to encourage businesses that make significant and genuine efforts to offer sustainable products and services, such as organic food or renewable energy. To make our choice easier, specialized organizations develop ranking systems that inform and educate while convincing us that businesses have – to different degrees – a genuine interest in encouraging sustainable consumption. At the same time, the trustworthiness of sustainable business actions is a frequent subject in mass media, albeit mostly when is highly controversial, as for example in the recent case of Volkswagen (Milne, 2015). But while a few (mostly the same) companies make headlines, the majority remains silent and only occasionally engages in the field of sustainable development. In Hoffman's perspective, businesses' active (sometimes aggressive) interest in shaping political and social debates about sustainable development is a natural way for preserving their future relevance. Then it is reasonable to ask – and rightly so - why is progress so slow, and insufficient in practice?

In his argument, (Hoffman, 2001) brings up a key paradox embedded in the definition given by the World Commission of Economic and Development to sustainable development as "the development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (UNWCED, 1987). This definition is extremely important for introducing a new moral obligation for social responsiveness to nations and individuals alike (Solow, 1991). But at the same time, this definition posits the assessment of success into the future, a time and space for which we lack unbiased evaluations. The absence of objective proof enables the emergence of multiple representations of a future for humanity, of which many gravitate around utopian or dystopian views. Utopian descriptions of the future assume that humanity will prevail in achieving sustainability, primarily by eliminating unsustainable practices known today (e.g. distributional inequity, intensive resource consumption, etc). The focus in such views is primarily on integrating desirable objectives from all groups involved, with little concern of their (sometimes) contradictory goals. The resulting integrated models are accompanied by intricate sets of conditions that often inhibit

chances for implementation. In contrast, dystopian views describe a doomed hellish future, with an apocalyptic environment (severe climate, insufficient resources, horrifying natural disasters and profound social turbulence) adverse to human survival. Faced with an apparent choice, actors can, and seem entitled to, act to avoid apocalyptic futures at all costs, under a high sense of urgency enhanced sometimes by scientifically calculated 'deadlines'. Obedient in many respects, we aim to tame the unknown future by defining, measuring and designing measures to avoid it. But as long as estimations of future needs remain uncertain, visions for a sustainable humanity result in actions that reduce un-sustainability aspects but lead only to occasional true progress (Ehrenfeld, 2004).

Referencing visions of humanity's future, in all its complex and dynamic socio-technical, cultural and economical dimensions, gives way to multiple interpretations of meanings, symbols and imaginaries that shape social reality (Baptista, 2012) and arguments for prioritization often end with no prospects for progress. At the same time, uncertainties embedded in operating (or trying to) the notion of 'the future' open up possibilities for opportunistic behavior by individual actors. And many concepts emerging from the definition of sustainable development seem to converge towards institutional and group prerogatives at the expense of traditional beliefs and practices (Mebratu, 1998). Perhaps, instead of taking a starting point in defining 'what' is sustainable development, we could start by asking 'how' to make progress by ensuring that all social groups concerned with the future are involved in negotiations and the decisions that construct it. In this scenario, focus on delineating the parameters of the future is replaced by the intent to create possibilities for humans and all forms of life on Earth to 'flourish' (Ehrenfeld, 2004). This alternative allows for the creation of a new intellectual space where new questions about 'what' sustainable development could be, and 'who' would be the actors building it, can emerge and be addressed. Using examples of urban sustainability projects (involving but not restricted to tourism initiatives), this presentation aims to formulate such questions and start discussing the conditions under which sustainable futures may be (re)shaped or maybe escaped? By inquiring 'who' can participate in imagining a sustainable development, the presentation will also reflect on the role for business and entrepreneurship in designing our future.

REFERENCES

- Baptista, J. A. (2012). The ideology of sustainability and the globalization of a future. *Time & Society*, 23(3), 358–379.
- Ehrenfeld, J. R. (2004). Searching for sustainability: No quick fix. *Reflections*, 5(8), 1–13.
- Halme, M., Park, J., & Chiu, A. (2002). Managing Globalization for Sustainability in the 21st Century. *Business Strategy and the Environment*, 11(2), 81–89.
- Hoffman, A. J. (2001). *From Heresy to Dogma: An Institutional History of Corporate Environmentalism*. Stanford University Press. Retrieved from <https://books.google.com/books?hl=en&lr=&id=xFq-uHIGhtwC&pgis=1>
- Mebratu, D. (1998). Sustainability and sustainable development. *Environmental Impact Assessment Review*, 18(6), 493–520.
- Milne, R. (2015). Volkswagen: System failure. *Financial Times*. Retrieved from <http://www.ft.com/cms/s/0/47f233f0-816b-11e5-a01c-8650859a4767.html>
- Porter, M. E., & Kramer, M. R. (2011). Creating shared value. *Harvard Business Review*, 89(1/2), 62–77.
- Solow, R. M. (1991). Sustainability: An Economist's Perspective. *Economics of the Environment Selected Readings*. Retrieved from http://www.isites.harvard.edu/fs/docs/icb.topic203569.files/Solow.Sustainability_An_Economists_Perspective._1993.pdf
- UNWCED. (1987). *Our Common Future*. Oxford paperbacks.

DESIGN THINKING APPROACH TO ETHICAL (RESPONSIBLE) TECHNOLOGICAL INNOVATION

Ganesh Nathan

University of Applied Sciences and Arts Northwestern Switzerland, Business School Lausanne (BSL),
Switzerland

Abstract: *There is growing interest and importance for responsible research and innovation (RRI) among academic scholars and policy makers, especially, in relation to emerging technologies such as nanotechnology. It is also to be noted, although design thinking approach has been around since 1960s, there is renewed interest in this approach to innovation with increasing number of related publications over the last couple of decades. It is also currently introduced in a number of schools and community projects. This paper attempts to show that design thinking approach is potentially conducive to ethical (responsible) innovation due to its emphasis on human centred design.*

This paper first introduces why we should be concerned about ethical aspects of technological innovation. Then it shows why these problems pose challenges and constraints to address them. Following this section, it discusses about the shortcomings of linear innovation process models and introduces an improved circular innovation process model to embed ethical decision-making taking into consideration both internal and external stakeholders and networks at organizational level. However, many emerging technologies may introduce ethical issues at machine level; for example: autonomous vehicles, drones and next generation robotics. These concerns have been increasingly addressed by the emerging new field of machine ethics. However, it is important to integrate both ethical-decision making at organizational level on innovation process and machine ethics. From this perspective, this paper introduces design thinking approach to innovation and attempts to demonstrate that it is potentially conducive to ethical (responsible) technological innovation. It concludes with potential benefits and challenges with some directions for further research.

'Technologies can be not only contentious – overthrowing existing ways of doing things – but also morally contentious – forcing deep reflection on personal values and societal norms' (Cole & Banerjee, 2013; quoted in Nathan, 2014). Technological innovations can have undesirable consequences for society and environment. Just to give some examples: DDT as pesticide; the pharmaceutical thalidomide, prescribed as morning sickness treatment for pregnant women; chlorofluorocarbons (CFCs) used as refrigerants and propellants; etc. (Bessant, 2013; Nathan, 2014). These examples illustrate that organizational level decision-making during innovation process can have impacts on the linkages at macro level towards the market within socio-cultural-political-ecological context (see Hanekamp, 2010; Nathan, 2014). Furthermore, it is plausible to argue that many innovation decision-making processes have been blind to ethical impacts and concerns – 'innovation ethical blindness' (Nathan, 2014) and these can have economic impacts as well. For example, the Dutch government had to cancel the EPRS (Electronic Patient Record System) due to unresolved privacy issues after the investment of 300 million Euros over a 15-year period and the initiative to introduce smart electricity meters in every household within the Netherlands was also rejected by the upper house of the Dutch parliament due to privacy concerns after some years of R&D efforts (Van den Hoven, 2013; also Nathan, 2015). From social constructivism perspective, reality is socially constructed and technological innovations shapes this reality; however, this reality raises many ethical concerns and dilemmas Nathan, 2014). For example, social media raises ethical issues of cyber bullying and infringement on privacy and installation of surveillance cameras in public places introduces ethical dilemma of public safety versus privacy concerns. Technological innovations can be supportive to new constructive possibilities or can be exploitative for destructive purposes by actors within the technological field; for example, 3D printer can be used for reconstructive surgery and to make prototypes for architectural designs; however, 3D printer could also be used to print hand guns. Therefore, it is also important to consider moral contestation through exploitation that can have impacts on other intersecting fields (Cole & Banerjee, 2013; Nathan, 2014). Emerging technologies in many forms can introduce ethical concerns and dilemmas that are predictable as well as most critically less predictable ones (Matter, 2011; Nathan, 2014 & 2015). These emerging

technologies such as ICT and nanotechnology can converge into new forms of converging technologies such as nanomedicine and nanopharmacy that may introduce ethical dilemmas and concerns; these may be hard to predict at the early stages of innovation and to resolve them at later stages (Nathan, 2015). These new forms of technologies may raise some fundamental ethical questions such as how we should understand human identity and dignity. The above examples lead us to ask: what are the challenges and constraints in addressing these ethical concerns?

Some of the problems may be considered as wicked problems. These are ill-formulated or ill-structured with confusing information along with contradicting or conflicting values among those stakeholders such as decision-makers and customers or end users; moreover, requirements may be changing and dynamic and therefore ramifications can be confusing (Buchanan, 1992). Furthermore, it is also complicated with Collingridge dilemma; as already briefly mentioned, some of the ethical concerns and dilemmas may not be obvious and predictable at the early stages of innovation process and by the time they become clearer, it may be too late to remedy them due to technological lock-in (Collingridge, 1980; Nathan, 2015). Another challenge that one may face is moral overload; even if one identifies those ethical dilemmas it may be difficult to resolve those conflicting moral obligations or values or to implement them at the same time (Van den Hoven, 2013; also Nathan, 2015). So the next question is what sort of innovation process models may be suitable to address the above mentioned challenges and constraints?

There are variety of innovation process models such as traditional –stage-gate and funnel phased approach– as well as open innovation model; however, these are all linear innovation process models (Nathan, 2015). These models simplify complex innovation processes in order to emphasize critical innovation elements and stages. A simplified innovation process model consists of critical stages: searching for innovation opportunities, selecting the most suitable or viable ones and then implementing them for capturing the benefits in the market (Tidd and Bessant, 2009 & 2013). However, it is a linear progressive stage model that may not be suitable for wicked problems that require iterations with progressive and regressive processes. Furthermore, these models do not explicitly integrate ethical-decision making at each stage to identify potential ethical concerns and dilemmas among various stakeholders. Most importantly, as it is a linear open ended model, there is no explicit feedback loop to capture any unpredictable ethical concerns as early as possible following the launch of products and services in order to re-evaluate and take back these issues through the innovation process stages to rectify and to re-launch or to terminate those products or services (see Nathan, 2015). However, this simplified model could be modified as a circular innovation process model embedding ethical decision-making incorporating internal and external stakeholders at the organizational level (Nathan, 2015). A stakeholder map identifying all stakeholders, their interests along with ethical concerns and dilemmas as well as their rights and responsibilities may enable us to embed ethical decision-making within the innovation process at the organizational level; this framework could also integrate multiple perspectives and systems thinking approach (Nathan, 2015).

However, new forms of emerging and converging technologies may be problematic to embed moral code into intelligent autonomous machines such as drones, next generation robots and autonomous transport vehicles. These problems have fostered growing interest in the emerging field of machine ethics over the last decade (Anderson & Anderson, 2006). Building ethical robots is a challenge; embedding rule based ethical decision-making in predictable situations may not be effective in unpredictable situations and enabling machine-learning to make ethical decisions in new situations may create a problem of trust (Deng, 2015).

Against the above background, this paper attempts to explore the potential application of design thinking approach. Design thinking has been around since 1960s. However, design movement evolution can be traced back to 1980s with cognitive reflections towards user centred design to service design towards human centred design in 2000; from 2010 onwards, the movement has evolved to design thinking with approaches to experience design and creative class (Curedale, 2013). Design thinking may be understood in many different ways with some core attributes; there is no single definition for design thinking and in fact defining design thinking may defeat the very essence of it. The core elements of design thinking approach to innovation are technology, business and most importantly human. It is not about consumer or customer centred; rather it is about human centred and from this perspective it is not about existing or target customers. Therefore, it can also take into consideration potential new customers. However, I would add that

these need to be contextualized within the social and ecological environment as these elements invariably interact with the environment and ethical concerns may arise due to these interactions. IDEO has popularized design thinking to innovation with a simplified model consisting of six critical elements: understand, observe, point of view, ideate, prototype and test with iterative feedback processes. The core attributes of design thinking approach are: ambiguity, collaborative, constructive, curiosity, empathy, holistic, iterative, non-judgemental and open mindset (Curedale, 2013). It appears that some of these core attributes may be conducive to address the ethical problematic context. These core attributes are integrated with certain design thinking principles such as: action oriented, comfortable with change, human centric, integrates foresight, a dynamic constructive process, promotes empathy, reduces risks and creates meaning (Mootee, 2013). Again, we can see that these principles appear to be conducive to address ethical challenges to technological innovation.

Design thinking approach could be integrated with multiple perspectives and system thinking approach to embed ethical decision-making. This paper attempts to show that this path could potentially address ethical challenges in technological innovation and provides some directions for further research.

Keywords: *design thinking approach, machine ethics, emerging and converging technologies, ethical decision-making, innovation process, technological innovation, ethical (responsible) innovation*

REFERENCES

- Bessant, J. (2013). Innovation in the Twenty-First Century, Responsible Innovation, eds. R. Owen, J. Bessant & M. Heintz, UK: John Wiley & Sons, Ltd.
- Cole, M. B. & Banerjee, M. P. (2013). Morally Contentious Technology-Field Intersections: The Case of Biotechnology in the United States, *Journal of Business Ethics*, 115:555-574.
- Collingridge, D. (1980). *The social control of technology*. Francis Pinter Ltd, London, UK.
- Curedale, R. (2013). *Design Thinking: Process and Methods Manual*, CA: Design Community College Inc.
- Deng, B. (2015). Machine ethics: The robot's dilemma, *Nature*; accessed: <http://www.nature.com/news/machine-ethics-the-robot-s-dilemma-1.17881>
- Hanekamp, G. (2010). *Business Ethics of Innovation. An Introduction*, Business Ethics of Innovation, ed. G. Hanekamp. Germany: Springer.
- Matter (2011), *A Report on responsible Research & Innovation*, Brussels.
- Mootee, I. (2013). *Design Thinking for Strategic Innovation*, NJ: Wiley.
- Nathan, G. (2014). Technological innovation and ethics. In: Bastos, J.-C. and C. Stuekelberger (eds.) *Innovation ethics: African and global perspectives*. Globethics.net series 'Global', pp. 37-44.
- Nathan, G. (2015). Innovation Process and Ethics in Technology: An approach to ethical (responsible) innovation governance, SPECIAL ISSUE: Responsible innovation in the private sector, *Journal on Chain and Network Sciences*, Wageningen Academic Publishers, Vol. 15(2): 119-134.
- Tidd, J. & Bessant, J. (2009). *Managing Innovation*, England: John Wiley & Sons, Ltd.
- Van den Hoven, M.J. (2013). Value sensitive design and responsible innovation. In: Owen, R., J. Bessant and M. Heintz (eds.) *Responsible innovation*. John Wiley and Sons Ltd., London, UK, pp. 75-83.

A NEW ENVIRONMENT FOR ENTREPRENEURSHIP AS A LEVER OF SUSTAINABLE BUSINESS DEVELOPMENT

Joaquim Ramos Silva
University of Lisbon, CSG/Socius, Lisbon School of Economics and Management, Portugal

Abstract: *When more than a century ago (Schumpeter, 1908), the entrepreneur emerged, in a context of increasing influence of neoclassical approaches, as a key player in the economic development process and the vehicle of innovation, the concept had a long and winding road to affirm itself on a theoretical ground. For a long period, has had happened before with precursors like Cantillon and Say during the classical age, the mainstream economic thinking of the first decades of the 20th century succeeded in putting aside this disturbing element to equilibrium explanations (Kirzner, 1973), and only in recent decades it gained enough scope by its own right, not necessarily through the best ways (for example, as it is something that can be easily learned or created ab nihilo). Anyway, the shift of emphasis towards a more assertive view of entrepreneurship as a pillar of economic theory is a very promising turn, insofar the economists' views became more realist and operational filling a gap that lasted to long time (Casson, 2003). As stated for example by Foss and Klein (2012), the theory of entrepreneurship is closely connected with the theory of firm what turns economists' concerns more oriented to the study "of the ordinary business of life". Therefore, in the search for solutions to economic problems, such as sustainable growth, productivity improvement, competitiveness, the introduction and spread of innovations, unemployment, among others, the entrepreneurship function also began to be compared with other instruments of the economists' toolkit, particularly at the macro level. The analysis of these different perceptions of the concept and its potential is our main objective insofar they are highly influential and must be closely followed.*

Regarding this new context for entrepreneurship, there are two perspectives that must be taken into account. On the one hand, the knowledge economy and the increasing key role of innovation in the modern economic process, where it became a routine according to Baumol (2002), reinforce more the relevance of the entrepreneur's contribution to the extent he has a higher capacity to use knowledge and to introduce into market activities in a competitive manner. On the other hand, many factors have contributed to the creation of a new economic rationale that emphasizes the contexts of uncertainty and risk (not only caused by the acceleration of change in the transformation of economic structures but also as a result of more recent events such as the financial crisis that erupted in 2007-2008 and its aftermath that weakened the belief that economists know well how to deal with these situations). All this led to a stronger valuation of the role of the entrepreneur, considered particularly apt to manage its businesses within such contexts. Indeed, it is in his behavior, in the sense of interacting with economic opportunities (arising from globalization or from the new technologies of information and communication and through other ways, novel or not), where lies the overtaking of the deadlock in which we are living. Hence, there are fundamental dimensions of the modern economy, clearly demanding more entrepreneurial commitment in the management of the economy, such as in synthesis: knowledge/innovation, and uncertainty/risk.

Despite the relevance of the historical background, the newly accepted role of the entrepreneur, and that of entrepreneurship in economic theory with its diverse linkages, must be put in the frame of reference of the 21st century. It must be recalled that in these circumstances, if we look at historical patterns, the state and its public policies are very much influential in economic life. This trend was perhaps slowed down in some respects in the last decades of the 20th century, but undoubtedly remains, either in advanced or in developing economies. Simultaneously, due to innovation and globalization there is a vast array of entrepreneurship initiatives as showed in the case of emergent economies, particularly when not depending on natural resources. So, beyond its recognition as a very important domain in economic theory, one point should be underlined: entrepreneurship must also have much more attention in the field of economic policy, at all levels of government, as a way of overcoming critical situations, and likely much less through traditional measures of public spending such as subsidies and others. However, it must be fairly recognized that much of the outcome of entrepreneurship is not easily discernible in the short term. From this point of view, it is relevant to compare, for example, with the new financial theories ("modern finance") that were promoted, particularly since the 1980s (Dowd and Hutchinson, 2010). Indeed, much of them showed their inability to bring sustained and sound solutions to economic and business problems, and created a bloated financial system that caused new and huge difficulties that were at the basis of the 2007-2008 crisis and the Great Recession that followed.

Now we will focus in more detail the new trends that characterize the entrepreneurial process. Rules and policy environment became often more friendly of entrepreneurial activities in large areas across the world. It became easier to create firms, but the burden of regulations and taxation remain important, and if they have been reduced in some domains, they rose in others, not always well founded. At a broader scale, the strong increase of foreign direct investment since the middle of the 1980s, with the correlated creation of global value chains, is a good sign of this process, particularly if we take into account that the entry of a firm in a new and foreign market, implies a higher degree of risk due to a lack of local knowledge. It is clear however that appropriate policies may improve the entrepreneur's capability in this field.

The emergence of entrepreneurship in the last decades significantly changed the theoretical landscape of economics and business. Although the process is far from being consolidated, we focused on some of its main aspects. Looking at the future, we hardly deny that entrepreneurship and entrepreneurs have a major role to play towards the improvement of economic structures, particularly when responsive to the true needs of the populations, and not only of particular groups. As referred to before there is a clear contrast with the relevance of what was called "modern finance". And the problem is not confined to the situation prior to 2008, as an author put it later as far as Quantitative Easing is concerned: "QE in some ways resembles the artificial seeding of clouds after a period of drought. Rain has fallen, catastrophe has been averted but much of the water lies in stagnant pools on the baked ground ..." (Taylor, 2012). Thus, entrepreneurship has a great contribution to give in breaking out of these situations but often lacks the best environment (including at the level of public policies) to display its full capacity. All the issues that have been raised, show how important and necessary is to deepen the study of this subject in order to open routes for the affirmation of entrepreneurship in all its potential.

REFERENCES

- Baumol, W.J. (2002). *The Free Market Innovation Machine: Analyzing the growth miracle of capitalism.* Princeton University Press, Princeton.
- Casson, M. (2003). *The Entrepreneur: An economic theory.* 2nd Edition. Edward Elgar, Cheltenham/UK.
- Dowd, K. and Hutchinson, M. (2010). *Alchemists of Loss: How modern finance and government intervention crashed the financial system.* John Wiley & Sons, Chichester.
- Foss, N.J. and Klein, P.J. (2012). *Organizing Entrepreneurial Judgment: A new approach to the firm.* Cambridge University Press, Cambridge/UK.
- Kirzner, I.M. (1973). *Competition & Entrepreneurship.* The University of Chicago Press, Chicago and London.
- Schumpeter, J.A. (1908). *Théorie de l'Évolution Économique.* French version of 1935. Librairie Dalloz, Paris.
- Taylor, M. (2012). *The return of animal spirits would be good for all.* Financial Times, September 21.

RSLINGO4PRIVACY: AN INTEGRATED APPROACH TO IMPROVE THE SPECIFICATION AND ANALYSIS OF PRIVACY POLICIES

Alberto Rodrigues Da Silva
University of Lisbon, INESC-ID, Instituto Superior Técnico, Portugal

Abstract: Popular web and mobile applications attract and manage a huge number of users. They collect data from their users without ensuring traceability between privacy policies and application design decisions. A particular challenge for policy authors and application developers is the need to use a common language and companion tools that supports translating important privacy policy statements into actionable requirements. For example, European Union and United States employ privacy policies as “notices” to end users and, in the U.S., these policies are often the sole means to enforce accountability. Given the pressure to post privacy policies and the pressure to keep policies honest, companies must do more to align their policies and practices. In this respect, more should be accomplished by enabling developers with new tools to better specify their data needs while policy authors, who are typically legal professionals, can work with those specifications to create more accurate policies or to enforce those policies in the context of developer data needs.

In general, a privacy policy is a technical document that states multiple privacy-related requirements that a system should satisfy. These requirements are usually defined as ad-hoc natural language (NL) statements. Natural language is an ideal medium to express these policies because it is flexible, universal, and humans are proficient at using NL to communicate. Moreover, natural language has minimal adoption resistance as a requirements documentation technique (Ferreira & Silva, 2012) (Ferreira & Silva, 2013). However, NL has intrinsic characteristics that become the root cause of quality problems, such as incorrectness, inconsistency or incompleteness (Ferreira & Silva, 2012) (Pohl, 2010).

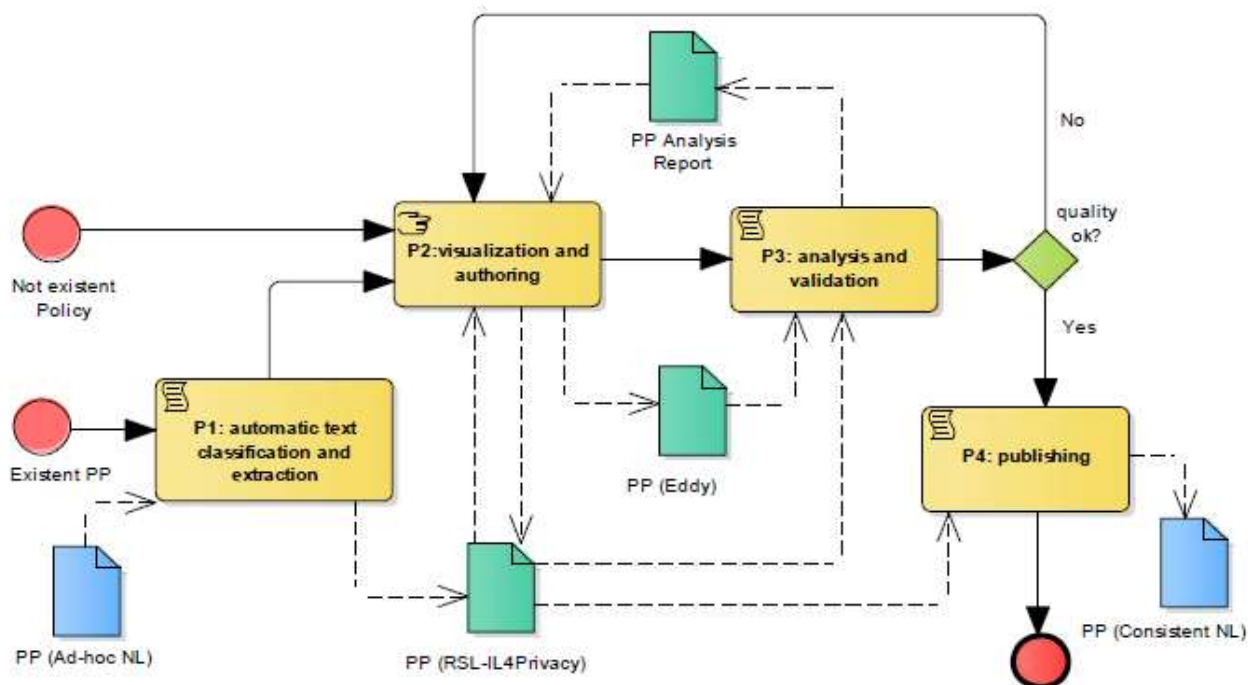


Figure 1: RSLingo4Privacy approach (defined with a BPMN business process diagram).

Recently we proposed the definition of a domain-specific language (DSL) for the specification of privacy-aware requirements, called RSL-IL4Privacy (Caramujo & Silva, 2015). The RSL-IL4Privacy allows specify privacy policies by providing several constructs, such as statements, private data, recipients and

enforcement mechanisms, which are necessary to specify and document privacy-related requirements. The goal of the proposed approach is to use the RSL-IL4Privacy formalization as the necessary mechanism for the specification of policies while providing features for better analyzing and validating the corresponding privacy requirements.

RSLingo4Privacy is a multi-language approach that uses the following privacy-aware languages: RSL-IL4Privacy and Eddy. Figure 1 overviews RSLingo4Privacy approach as a top-level BPMN business process diagram. If a given (ad-hoc natural language) policy exists, the process P1 applies complex text classification and text extraction techniques to automatically produce the equivalent specification in RSL-IL4Privacy. In addition or otherwise, if that policy does not exist, the RSLingo4Privacy approach starts directly with process P2 to allow visualizing and authoring the policy in a rigorous and consistent way based on the RSL-IL4Privacy language. Process P3 takes as input both RSL-IL4Privacy and Eddy specifications, and provides analysis and validation features, producing, for example an analysis report with errors and warnings that can be taken into consideration during these authoring and validation processes. Finally, when the quality of the policy specified in RSL-IL4Privacy is appropriated, the process P4 is responsible for producing an improved version of the policy, specified again in natural language but in a more consistent and high-quality manner.

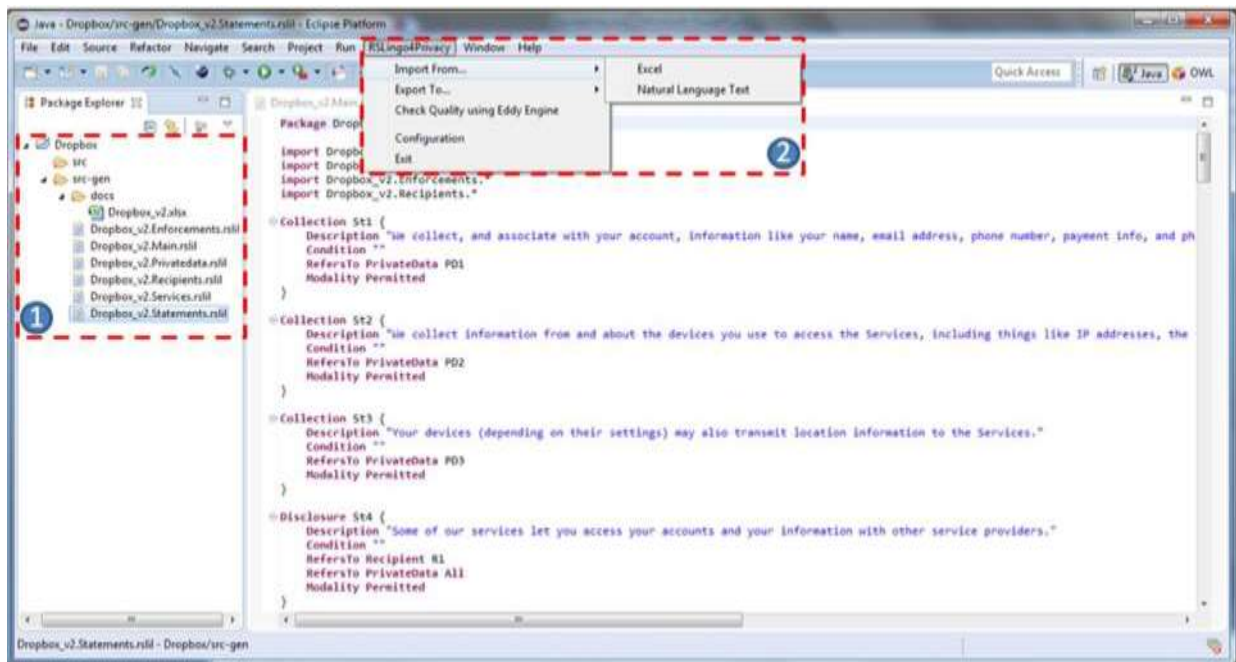


Figure 2. Structure of RSLingo project (1) and RSLingo4Privacy Main Menu bar (2).

This talk presents both the RSLingo4Privacy approach (Figure 1) and its companion tool, the RSLingo4Privacy-Studio, (Figure 2) which is particularly designed for better supporting the specification, analysis and documentation of privacy-aware requirements in the scope of privacy policies.

This work complements the current state-of-the-art by providing a versatile tool designed around the RSL-IL4Privacy domain specific language, with multiple representations while taking into account the importance of having requirements documented in a format as close to natural language as possible. This tool is built on top of the Eclipse IDE, and particularly leveraging and integrating technologies such as: Xtext, Xtend, Eclipse Modeling Framework (EMF), RapidMiner, Eddy engine and Apache POI library.

The explanation and validation with several case studies shows the potential of RSL-IL4Privacy as a rigorous language for expressing privacy requirements and, in addition, shows the relevance of the provided interoperability features. These features are classified by different classes of transformations, all of them founded on that common and intermediate format: RSL-IL4Privacy (defined with the respective Xtext grammar). First, T2M transformations intend to automatically classify NL statements and extract from them text snippets using text mining and text extraction algorithms. The implementation of such transformations is a complex task that involves the integration and tuning of tools like RapidMiner, and is still a working in progress research. Second, M2T transformations produce a consistent and easy-to-read version of a privacy policy. These versions can be produced in multiple formats, such as structured NL in Word, plain text or even HTML. Third, M2M transformations may include two variants: M2M transformations that support multiple representations of the RSL-IL4Privacy; for example, from plain text format (defined with Xtext) into tabular

format in Excel, and vice-versa; and finally, M2M transformations between RSL-IL4Privacy with other languages and formats, such as JSON or Eddy (which can be itself latter mapped in OWL or equivalent formats).

The major merit of the proposed approach is that it allows both technical and non-technical users to easily author and analyze policies using a language close to NL, but that is simultaneously readable by machines and so providing automatic validation at both syntactic and semantic levels. This fact permits RSL-IL4Privacy to act as an intermediate language and be supported by an environment that integrates multiple representations of a privacy policy addressing concerns of multiple stakeholders.

The concrete artifacts of the RSL-IL4Privacy representations for Dropbox, Facebook, LinkedIn and Twitter privacy policies, as well as the analysis of other case studies under the scope of RSLingo4Privacy are available and can be found on its GitHub repository (<https://github.com/RSLingo/RSLingo4Privacy>).

REFERENCES

- Caramujo, J. & Silva, A.R. (2015). Analyzing Privacy Policies based on a Privacy-Aware Profile: the Facebook and LinkedIn case studies. *In Proc. of the 17th CBI conference*. IEEE, 1, 77-84.
- Ferreira, D. & Silva, A.R. (2012). RSLingo: An Information Extraction Approach toward Formal Requirements Specifications. *In Proc. of the 2nd MoDRE workshop*. IEEE, 39-48.
- Ferreira, D. & Silva, A.R. (2013). RSL-IL: An Interlingua for Formally Documenting Requirements. *In Proc. of the 3rd MoDRE workshop*. IEEE, 40-49.
- Pohl, K. (2010). Requirements Engineering: Fundamentals, Principles, and Techniques. Springer.
- Silva, A.R. et al. (2016). Improving the Specification and Analysis of Privacy Policies: The RSLingo4Privacy Approach. *In Proc. of the 8th ICEIS conference*. SCITEPRESS.