

Towards an Open Data Vocabulary for Canvas Driven Innovation Ethics

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Abstract. Discussing the role of ethics in Research & Innovation is an important aspect of the technological progress we make today, and therefore contributes to the sustainable development goal on industry and innovation. In this context, the task of structuring such discussions of ethics with the business processes they relate to is difficult due to a lack of methodologies and existing use-cases. The Ethics Canvas offers a tool that uses a model based on the Business Model Canvas to structure discussions around ethical implications. We present a way to relate such ethical considerations with their business process using the semantic web. This will allow an investigation of how business models and ethics affect each other, and to structure discussions around this relation. The approach also allows discovering related ethical implications through the Ethics Canvas tool for a richer discussion surrounding ethics.

Keywords: Research&Innovation, Ethics, Canvas Model, Semantic Web

1 Introduction

The UN sustainable development goal for Industry, Innovation and Infrastructure [4] highlights the critical role of technology research and innovation (R&I) in enabling sustainable industrialisation and targets growth in R&I capacity and investment. However, as the pace of technological R&I accelerates, especially in digital technology and data-driven AI, the power of the resulting technology to negatively impact individuals and societies increasingly comes to the fore of public concern and debate. Concerns about the ethical issues that arise in the R&I process therefore are gaining more attention and must be addressed clearly and systematically if public support for R&I activities is to be maintained. Existing methods for practising ethics in technology R&I can be classified as: ex-ante, for emerging technologies at early stages of R&I; intra, during technology design and testing; and ex-post, when technology from R&I is mature and the technology

is applied. From a comprehensive literature review of R&I ethics approaches [8] Reijers et al recommend that: ethical technological design should be integrated into the day-to-day work of R&I practitioners; with guidance for discerning the ethical nature of technology design choices and how ethical principles can be balanced; different socio-technical alternatives considered; and stakeholder participation should be broadened while being guided by democratic principles.

The rapid commercialisation of digital technology R&I demonstrates how implementing such recommendations cannot be addressed solely within the confines of policies for publicly-funded research. It must instead be based on an open and honest debate with commercial R&I practitioners about appropriate methodologies and possible regulatory actions needed to enable viable ethical practice that can balance the commercial benefits of digital technology with the broader social good. The focus on ethics is also significant for the funding of R&I. While publicly funded research is already served by institutional ethics guidelines, these are not applied systematically as knowledge is transferred to the commercial sector, i.e. as a given technology transitions from a research to an innovation phase. This transition is increasingly the focus of public co-funding as governments strive to improve the economic and social impact of research through commercial innovation. In parallel, Environmental, Socials and Governance criteria are growing in importance for commercial investors concerned about the ethical impact of innovation investments.

Innovation ethics have to a large extent been subsumed into broader a discussion of ethics in R&I, often as part of policies around Responsible R&I, i.e. without differentiating the specific needs of innovation ethics in industry from those of research ethics. An early exploration of this distinction [2] proposed an analogue of academic institutional ethics review boards for industry in the form of a Consumer Subject Review Board, while acknowledging the potential complexities in managing the conflicts between ethical concerns and the maximisation of shareholder value within companies. Dreyer et al [3] highlight this conflation of research and innovation ethics as a barrier to advancing the latter in industry and calls for better alignment of proposed approaches with the tools and frameworks already used in industry both for innovation and for societal consideration such as Corporate Social Responsibility. A recent volume [5] gathered several papers addressing R&I integrity in industry, focussing on the benefits of and barriers to adoption in different sectors, the potential to treat ethics as part of a business risk assessment and the potential for a responsible R&I maturity model. While providing a rich overview of the state of the art it also highlights the urgent need of good ethical practice for commercial innovation in the form of accessible guidelines, usable tools and reliable governance structures. This paper describes how we have begun to address issues of tool support via an agile reflective tool called the Ethics Canvas. We discuss how this provides a basis for using linked open data to contribute towards advancing ex-ante, intra and ex-post practices in innovation ethics before discussing further work.

2 Ethics Canvas

We have developed the Ethics Canvas as a novel method to address some of the challenges identified in bringing innovation ethics into practice. We chose to align the affordance of our ethical analysis tool with the popular canvas format that has gained widespread acceptance for business modelling in the digital technology and startup community. Though variations exist, we aligned with the most mature, the Business Model Canvas (BMC) [6]. The BMC is a carefully designed layout of 9 blocks in which the key business considerations of technology innovation can be easily captured and iterated. It is designed to be highly iterative, with each block used to capture hypotheses which the innovation team then needs to validate through engaging with potential customers and partners, conducting market research and testing ideas through minimal viable product prototypes. The BMC can be used by technology innovation teams without recourse to external business or marketing expertise, especially in the exploratory stage of establishing that a technological innovation represents a viable commercial application. The blocks address: customer segments whose pain or potential gains are addressed by the innovation; the value proposition of the innovation in addressing such pains or gain; the channels via which the value proposition is delivered to customer; how the relationship with a customer is established and maintained; the revenue stream(s) that would result; the key resources, activities and partnerships needed to deliver the value proposition and the cost structure involved in doing so. The Ethics Canvas, depicted in Figure. 1, takes this familiar 9-block structure and the affordance of lightweight reflection and frequent iterative revision, but refactored to help structure discussions on ethical considerations.

The Ethics Canvas consists of nine thematic blocks that are grouped together in four stages of completion. The first stage (blocks 1, 2) requires identifying the stakeholders involved based on the technology under consideration. These are respectively the classes of individuals affected and the types of groups affected, where groups would have some form of advocate or representation that could potentially engage on ethical issues. The emphasis here is on identifying stakeholders who are not necessarily users and partners in the innovation, but are nevertheless impacted by it. These are then used to identify potential ethical impacts for the identified stakeholders in stage two (blocks 3-6). The impact includes changes in the behavior of the classes of individuals, changes in the relationships between classes of individuals or between individuals and groups, or conflicts that might arise between affected groups. Non-stakeholder specific ethical impacts are also analysed in stage three (blocks 7, 8), addressing the impact of service/system failure of and resource use by the innovative technology. Stage four (block 9) consists of discussions structured around overcoming ethical impacts identified in the previous stages.

The ethics canvas can be printed or used as a web application⁵ that can be used with or without an account. Analyses can be downloaded as either a

⁵ <https://www.ethicscanvas.org>

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Ethics Canvas Project Title: _____ Date: _____ Ethics Canvas v1.8 - ethicscanvas.org © ADAPT Centre & Trinity College Dublin & Dublin City University, 2017.

<p>Individuals affected</p> <p>Identify the types or categories of individuals affected by the product or service, such as men/women, user/non-user, age-category, etc.</p> <p>1</p>	<p>Behaviour</p> <p>Discuss problematic changes to individual behaviour that may be prompted by the application e.g. differences in habits, time-schedules, choice of activities, people behaving more individualistic or collectivist, people behaving more or less materialistic.</p> <p>3</p>	<p>What can we do?</p> <p>Select the four most important ethical impacts you discussed. Identify ways of solving these impacts by changing your project's product/service design, organisation. Or by providing recommendations for its use or spelling out more clearly to users the values driving the design.</p> <p>4</p>	<p>Worldviews</p> <p>Discuss how the general perception of somebody's role in society can be affected by the project.</p> <p>5</p>	<p>Groups affected</p> <p>Identify the collectives or communities, e.g. groups or organisations, that can be affected by your product or service, such as environmental and religious groups, unions, professional bodies, competing companies and government agencies, considering any interest they might have in the effects of the product or service.</p> <p>2</p>
<p>Product or Service Failure</p> <p>Discuss the potential negative impact of your product or service failing to operate as intended, e.g. technical or human error, financial failure/ receivership/acquisition, security breach, data loss, etc.</p> <p>7</p>	<p>Relations</p> <p>Discuss problematic differences in individual behaviour such as differences in habits, time-schedules, choice of activities, etc.</p> <p>4</p>	<p>Group Conflicts</p> <p>Discuss the impact on the relationships between the groups identified, e.g. employers and unions.</p> <p>6</p>	<p>Problematic Use of Resources</p> <p>Discuss possible negative impacts of the consumption of resources of your project, e.g. climate impacts, privacy impacts, employment impacts etc.</p> <p>8</p>	

The Ethics Canvas is adapted from Alex Osterwalder's Business Model Canvas. The Business Model Canvas is designed by Business Model Foundry AG. This work is licensed under the Creative Commons Attribution-Share Alike 3.0 Unported license. To view a copy of this license, visit <https://creativecommons.org/licenses/by-sa/3.0/>. To view the original Business Model Canvas, visit <https://strategyzer.com/canvas>.

Fig. 1. Ethics Canvas Design

PDF or as a structured JSON representation of the text entered into each block. The online version allows for collaborative editing of an Ethics Canvas, shared comment threads on individual block entries and tagging of strings within a block entry (see Figure. 2). Users can opt to publish a canvas, in which case any tags used are indexed. This enables the published canvas to be flagged to any users entering a similar tag in their own canvas design, thereby offering the opportunity to cross reference between canvases and establish a shared folksonomy of Ethic Canvas entry tags. The source of the application is hosted online⁶ and is available under the CC-by-SA 3.0 license.

The design of the Ethics Canvas has itself followed an iterative process over the last three years. The canvas was observed in use with different cohorts of university students at undergraduate, Masters and PhD levels, across computer science, engineering and business disciplines. To date nearly 500 students have used the canvas. This has been in a combination of: ex-ante practice exercises, where students analyse emerging technologies; intra practice exercises, where students apply the ethics canvas to an active technology development or business analysis project they are working on; or ex-post practice where they analysed the ethics of existing technology products. In the most recent evaluation of intra practice, use of the Ethics Canvas was integrated into the iterative development

⁶ <https://opengogs.adaptcentre.ie/ADAPT/ethics-canvas>

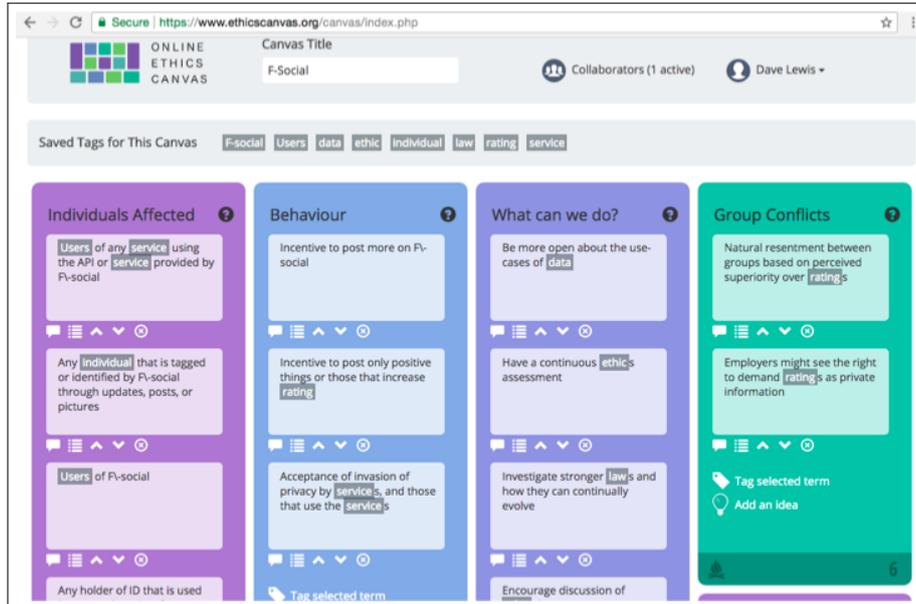


Fig. 2. Online Ethics Canvas example with use of Tags

of a BMC for different digital technology innovation projects with positive usability results and some observed design pivots arising from the ethical assessment [7]. We are working on the next iteration of the canvas and intend to exploit web technologies to provide a cohesive experience around discussing ethics. We welcome ideas, suggestions, and collaboration regarding the same.

In particular, there is a possibility of using the various arguments discussed in other related canvases, including the BMC, on the Ethics Canvas platform. Such an approach would, in theory, allow the user to investigate similar ethical considerations to the ones they are currently investigating in different business contexts. This is quite similar to looking up how similar businesses operate and using their experience within the context of understanding the challenges of a new start-up. In the context of considering ethical impacts, the discussion would involve both the Ethics Canvas and the BMC to provide a comprehensive view of how innovation and ethics affect each other. Therefore, linking the BMC with its relevant Ethics Canvas is an important part of our evolving approach to tools and support for innovation ethics. This can be done based on the structure of the two canvas models. Both the business and ethics canvases are structured into blocks, and have individual ideas or segments populating each block based on context. Linking the related blocks or ideas between the two should provide a good context for how the two affect each other. Next we explore how we can implement this using semantic web technologies.

3 Canvas-driven Ethics Vocabulary

To support the broader use of the ethics canvas, we propose an open data vocabulary to formalise and interlink the structured output of the online canvas entries (already available in JSON) using Linked Open Data Vocabularies. This vocabulary (outlined in Figure. 3) provides support for the following features.

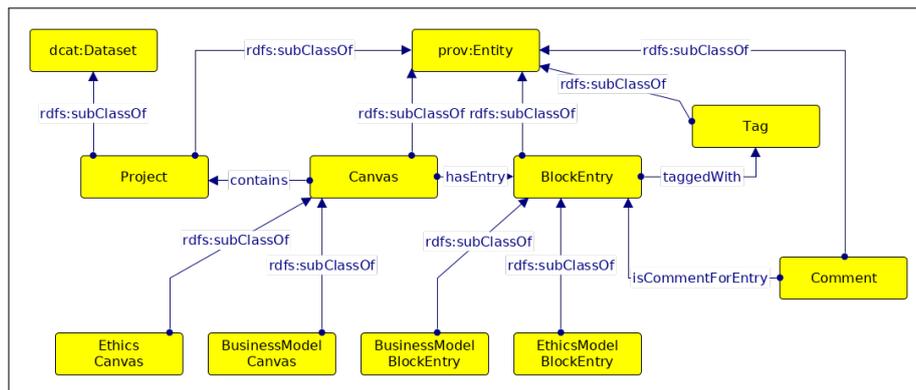


Fig. 3. Vocabulary for Innovation Ethics using Canvas analyses

Grouped Business and Ethics canvas perspectives: The vocabulary groups both business model canvases and ethics canvases under a *Project* class. This enables analyses to offer both canvas types to both i) contextualise the ethical analysis in the business context for ex-ante and ex-post practice and ii) group the ethics canvas with a business canvas during intra practice by innovation teams. By subclassing *Project* from the *Dataset* object of the W3C DCAT⁷ standard, a set of canvases can be grouped and managed as a data set using other cataloguing metadata features of DCAT. This includes the ability to create a distribution version of a dataset, which would allow for a set of canvases developed within an organisation to be differentiated from a version that was exposed more widely, including possible license terms. This would be critical in intra practice where the possibility that a data set of business and ethics canvases developed during an innovation project could be published should not impede the honest and critical development of those canvases internally. Therefore a ‘cleaning’ process to map internal canvases to ones suitable for wider consumption should be supported, e.g. removing comments, re-wording tags for indexing as part of a wider canvas repositories, including only the most recent versions of canvases and removing confidential information or trade secrets.

Canvas design evolution and variation: A general *Canvas* and *BlockEntry*

⁷ <https://www.w3.org/TR/vocab-dcat/>

class is used which is then subclassed in this case by the business model canvas and ethics canvas types and their block types as described above. There are however a variety of different innovation-focussed canvas designs available in addition to the Business Model Canvas, e.g. the Lean Model Canvas. In addition, canvas designs for other non-business concerns such as environmental or privacy issues are also emerging. This class design therefore allows different canvas designs to be used and integrated into the same project. This is key, at the very least, in supporting the anticipated continued evolution of the Ethics Canvas design.

Canvas iteration and logging: The core affordance of the canvas approach is its use to rapidly capture, test and modify ideas in an iterative and evidence-driven, pivot or proceed process [1]. To support this, *Project*, *Canvas*, *BlockEntry*, *Tag* and *Comment* classes are subclassed from the *Entity* class of the W3C Provenance Ontology⁸ (PROV-O). This allows the provenance of each of these entities to be tracked as canvas ideas are iterated across versions of the different canvas types within a project. Provenance entity relations *wasDerivedFrom*, and more specific subproperties *wasQuotedFrom* and *wasRevisedOf* can then be used to capture the revision history and the actors involved (*prov:Agent*). In ex-ante and ex-post settings, this is useful in tracking and acknowledging the contributions to ethical analyses of different users and thereby encouraging broader participation and collaboration. It may also be of use for linking different published canvas analyses as part of evidence gathering and issue generalisation for input into public policy formation. In intra practice, this can be useful for logging relationships to possible ethics governance processes and responsibilities (modelled as *prov:Activity* and *prov:Agent*) as well as offering a log of ethical analyses for future scrutiny in handling a downstream ethics issue and the effectiveness of the process in identifying and reacting to the risk of that issue.

Canvas and entry interlinking: Consistent with the current online canvas design, tags can be associated with a canvas block entry and then use to index entries to allow others users to search for similar tags within the projects available to them. This can be useful both on a public repository or a private institutional repository for sharing ethical analyses and learning across multiple innovation projects. Representing tags as first class objects allows them to be shared separately from canvases and entries, so that for instance a canvas author can declare work involving a common issue represented in a tag without having to publish the details in the canvas and its block entries. This also opens the possibility for developing more taxonomically structured folksonomies of tags managed by communities, either in the public domain or within organisations with sufficient volumes of tagged canvases to draw useful indexing and interlinking benefits. This also offers the opportunity of interlinking tags with other sources of knowledge, such as existing domain ontologies or indexes to larger general knowledge data sets such as DBPedia⁹ or other sets within the linked

⁸ <https://www.w3.org/TR/prov-o/>

⁹ <https://dbpedia.org/>

open data cloud. For instance linking to legal terms or official taxonomies may accelerate the path for such linked ethical data to inform public policy. However the accelerating nature of technology innovation means that many of the concepts useful for tags represent a moving target. To address this, tags could be combined with natural language processing techniques such as named entity recognition and text classification that could be harvested from and used to interlink to the wider corpora of written material related to technology ethics.

As a proof of concept we developed a small corpora of 102 articles annotated with a similar number of tags for each of 5 classifications, based on English language news articles gathered in January 2018. While the annotation of impacts proved unfeasible due to their multifaceted nature, 5 classifications related to the ethics canvas were found to be amenable for use in annotating the corpus. These were: ethical issues; stakeholder classes (i.e. classes of individuals); specific organisations; resources; and technologies. Experiments with term frequency and its inverse document frequency using this corpora showed potential for useful text classification of news articles if a larger annotated training corpus could be assembled. So while the annotated corpora was too small to provide accurate results in classifying articles, it offers a direction especially for conducting ex-ante and ex-post ethical analyses. Automated annotation of news articles and blog postings indexed against tags linked to published ethics canvases offers the chance to encourage much wider stakeholder involvement in the analysis of emerging or recent ethics issues. Using tags to find and filter streams of related articles for those using the ethics canvas to analyse an issue considerably lowers the bar for engaging in such analyses in comparison to academic literature surveys. It also offers a systematic way of identifying shifts in issues, technologies and actors in such textual corpora that could be used to motivate further corpora development and NLP tool training.

4 Conclusion & Future Work

Responsible Innovation is becoming recognised as a topic deserving of study, support and guidance separate to the more well established area of Responsible Research. While a body of literature is starting to emerge, few practical tools for ethical analysis in active commercial innovation settings are available. Furthermore, existing methodologies often rely on embedded ethical expertise and therefore seem unlikely to scale to the pace of innovation and breadth of stakeholder involvement required to address ethics in digital technology innovation. We have previously proposed aligning ethical analyses with the lightweight, unmediated canvas affordance that has become widely adopted for business analysis in the digital technology innovation sector and have developed practical tools to implement this approach. In this paper, we argue that such an approach could be leveraged to enable broader industry and societal engagement in the ethical analysis and debate of the emergent ethical issues associated with digital technologies. To enable this ex-ante, intra and ex-post practice, we propose an open

data vocabulary to support the logging, sharing, searching and interlinking of instances of ethical analysis.

We are currently extending the existing Ethics Canvas implementation to support the capture and publication of such analyses. This will be released as an update to the current open source platform with features for publishing linked business canvases to open data repositories. Future work will also explore indexing published interlinked ethics-business canvas models to support the federated search of tags and concepts across published data sets. The use of text classification and named entity recognition to index news articles that may in future inform both ex-ante and ex-post use of the canvas tool is also a target for further exploration. Future work will also include the evaluation of this approach for intra practice in ICT (Information & Communications Technology) innovation classroom settings as well as with active ICT innovation project teams. Its future use in ex-post practice will be explored in educational setting with non-ICT students, which will require seeding it with a set of business model canvas data sets based on existing digital technology applications. Opportunities to develop further usage guidance and support materials for employing and publishing linked business and ethics canvases as linked open data will be explored to improve uptake both as an educational and research tool.

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References

1. Blank, S.: The four steps to the epiphany: successful strategies for products that win. BookBaby (2013)
2. Calo, R.: Consumer subject review boards: A thought experiment. *Stan. L. Rev. Online* **66**, 97 (2013)
3. Dreyer, M., Chefneux, L., Goldberg, A., von Heimburg, J., Patrignani, N., Schofield, M., Shilling, C.: Responsible innovation: A complementary view from industry with proposals for bridging different perspectives. *Sustainability* **9**(10), 1719 (2017)
4. Industrial Innovation and Infrastructure (Goal 9) targets - Sustainable Development Goals - United Nations Development Programme. <http://www.undp.org/content/undp/en/home/sustainable-development-goals/goal-9-industry-innovation-and-infrastructure/targets/>, accessed:2018-05-30
5. Martinuzzi, A., Blok, V., Brem, A., Stahl, B., Schönherr, N.: Responsible research and innovation in industry—challenges, insights and perspectives (2018)
6. Osterwalder, A., Pigneur, Y.: Business model generation: a handbook for visionaries, game changers, and challengers. John Wiley & Sons (2010)
7. Reijers, W., Koidl, K., Lewis, D., Pandit, H.J., Godjim, B.: Discussing ethical impacts in research and innovation: The ethics canvas. IFIP TC9 Human Choice and Computers Conference, Poznan, Poland (September 2018 (in-press))

8. Reijers, W., Wright, D., Brey, P., Weber, K., Rodrigues, R., O'Sullivan, D., Gordijn, B.: Methods for practising ethics in research and innovation: A literature review, critical analysis and recommendations. *Science and engineering ethics* pp. 1–45 (2017)