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Parliamentary technology assessment institutions as indications of reflexive modernization

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A B S T R A C T

This article links the theory of reflexive modernization to Parliamentary Technology Assessment (PTA) by considering the latter as an indication of modern Western societies becoming more reflexive, that is, acknowledging and responding to the limitations of modern traditions by institutionalizing new processes of technology assessment to address a realm of change where uncertainty is no longer contained within modern structures. Our conceptual framework must address both the emergence and functioning of PTA in the form of institutions and the practices that are pursued within (or around, and linked to) such institutions, with due attention being paid to the multiple approaches currently being debated around the transformation of modernity and reflexivity. Reflexive modernization offers a relevant theoretical approach to analyzing hybrid entities like PTA institutions. We demonstrate this by analyzing three such institutions (Science and Technology Options Assessment [STOA, European Parliament], Institute for Society and Technology [IST, Flanders, Belgium] and Rathenau Institute [The Netherlands]), mapping their different approaches and practices in terms of features of reflexive modernization. There appears to be an overall reflexivity pathway, on which some PTAs have moved farther than others, but their progress is fractured by the resilience of modern institutions. We conclude that to ensure their role in the current institutional landscapes of evolving modern societies, the most important thing for PTA institutions is therefore to somehow develop a relevant approach while dealing with the necessary margin of maneuver for further adaptation and transformation.

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1. Introduction

Dealing with the side-effects of science and technology as well as reducing the level of controversies are big challenges for today's decision-makers. They increasingly rely on anticipatory knowledge to inform and nurture their commitments. This article will focus on one institutional locus of anticipatory knowledge production for decision-makers, Parliamentary Technology Assessment (PTA). Of

particular interest for our purpose will be to characterize the emergence and evolutions of PTA institutions as indicators of broader societal changes, namely reflexive modernization, undermining high modernity since the 1980's. The coexistence of various generations of PTA bodies in Europe, together with the current discussions (in policy circles and/or academia) for institutionalizing TA in Japan¹ or even Latin America [1] will form the backdrop of

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¹ More information can be found on the current institutionalization project of TA in Japan: <http://i2ta.org/english/english.html>. This institutionalization has also recently been discussed on a special session on "Challenges for Institutionalization of New Generations of Technology Assessment" at the Society for Social Studies of Science (4S) Annual Meeting in Tokyo (25–29 August 2010), in which one of us took part.

our analysis. However, partly because PTA today only exists in Europe and partly because influential Western sociologists like Ulrich Beck or Anthony Giddens consider modernity as first being mainly Eurocentric,² this paper will concentrate on institutional S&T developments first initiated in the US before it spread out and developed in Western Europe.

Being the first parliamentary institution of that kind, The American Office of Technology Assessment (OTA) was in its time (1972–1995) successful in finding a place within the US system and among its TA approaches. The European Parliamentary Technology Assessment institutions were established later and continue to evolve. It is striking how different most of these organizations are today in comparison with the OTA then. What is happening here? We suggest that we are seeing an adaptation to the ongoing movement of Western societies towards reflexive modernization. Conversely, the PTAs can be seen as indications of reflexive modernization, and by observing their new patterns of action, we can learn about reflexive modernization in practice.

The general point of reflexive modernization is that current institutions—which developed around and are tailored to guiding progress-oriented modernization processes—are not appropriate for dealing with new uncertainties, complexity, speculative risks and side-effects. Our choice to focus on PTAs is relevant, because these organizations are an institutional embodiment of societal response to the “Risk Society” [2] aspect of reflexive modernization, developing new forms of anticipatory knowledge to support action. Within this overall picture, the various PTAs display different rationales and approaches, even though they all have to work in the same context, being somehow formally linked to a parliament. We might therefore inquire how far one or other PTA has moved in its response to the challenges of reflexive modernization. We suggest there might be a “reflexivity pathway” and that some PTAs have moved farther along this pathway than others. In order to be able to measure (qualitatively) how far a PTA has moved in the direction of reflexive modernization, we need standards or criteria derived from relevant features of reflexive modernization. We shall identify two such criteria here, openness to plurality and blurring of boundaries, and we map the paths of three PTA institutions over time along these two dimensions. The identification of an overall reflexivity pathway allows us to highlight new trends in Parliamentary Technology Assessment as not just interesting ad-hoc novel approaches, but as indications of a new and broader generation of TA.

2. Reflexive modernization and parliamentary technology assessment

The strong claim of reflexive modernization is that certain phenomena have weakened the traditional social

structures and brought modern society closer to a time of structural dissolution [2,3], undercutting the foundations of modern Western societies. The phenomena of globalization, the ecological crisis, the intensification of individualization, the transformation of gender roles and the decline of a full-employment society have been emphasized [4]. When the key institutions of the previous modernity (nation-state, political parties, national borders, trade-unions, nuclear family,...) lose their foundations and historical legitimacy, another modernity may emerge, which is said to be reflexive. Reflexivity acknowledges the limitations of modern traditions to address a realm of change where uncertainty is no longer contained within modern structures. One component of reflexivity is reflexive action, which always has an anticipatory component. This requires intelligence about what might happen and structured knowledge about patterns and dynamics. One can link this with the emergence of a range of institutions and processes addressing the future (still in a variety of ways). Parliamentary Technology Assessment institutions (PTAs) are one example.

For the new generation PTA, further features of reflexive modernization are important. The public attitude towards science and technology is ambivalent. This is fueled not only by accidents and other impacts of technology that became visible, but also by a critique of centralized large-scale technologies, which is revealing a shift to other social and moral preferences and values [5,6].

Nowadays, controversies surrounding scientific and technological issues (such as, for instance, BSE, biotechnologies, climate change, nanotechnologies, human enhancement) not only occur, but are expected to occur. Increasing attention is being paid to the unintended side-effects of S&T [7,8], and some TA scholars have defined TA as the analysis and assessment of unintended side-effects [9]. But nowadays there is more than anticipatory knowledge production on unintended side-effects. Looking at the evolution of PTA as a scientific and policy practice of anticipation over the last few decades, we argue that one might actually see an open-ended “reflexivity pathway” along which these institutions are moving, some faster than (or just differently from) others. Their link with socio-political realms deserves attention to explain the more or less easy progression of PTA institutions along the pathway as well as the type of outputs/outcomes they (came to) deliver.

Parliamentary Technology Assessment was originally conceived of as an analytic activity, aimed at providing decision-makers with an objective analysis of the effects of technology on political agenda, decision-making processes and society as a whole. Early in the history of PTA, it became clear that assessment projects must involve multiple perspectives. In the United States, this led to stakeholder involvement in the analysis [10]. In a number of European countries, however, various forms of Technology Assessment developed in which the analytic product became of relatively minor importance compared to the interactive process: participatory methods (such as, for instance, consensus conferences) and Constructive Technology Assessment developed as alternative forms [11–15]. Today the increasing interest of some PTAs (in particular IST and Rathenau Institute) in

² We strongly disagree with these statements. Recognising the coexistence of a variety of modernities and the impact of the “coloniality of power” (cf. the works of Anibal Quijano) remain important issues to be acknowledged and taken up by Western social scientists. Problematizing modernity is outside the scope of the present article, however. Our attempt here is to look at one type of S&T institution to map empirically complex processes that have been theorized as “reflexive modernization”.

technology festivals and “infotainment”³ events are a further step towards bridging science and society. In doing so, those PTAs are sometimes getting closer to a mode of “social assessment of technologies”.

Along the diversification of PTAs’ missions and outputs, there are some common features too, like the institutional link to parliament. In that respect, PTAs occupy a hybrid position, in a sense stuck inside or constrained by the parliamentary institutions they serve while trying to create their own breathing space and dynamics. They thus have to face tensions and struggles (e.g. when adapting to changing circumstances) that are entangled with political and institutional vicissitudes. In order to deal with these vicissitudes, a PTA has to be ready for a reflexive self-learning process of adaptation to changing circumstances (e.g. change in a political majority, the departure of an entrepreneur, budgetary cutting, fluctuation of visibility, emerging controversies, a shift in participatory culture) and opportunities (external contracting, diversification of aims, organizational change, reorientation of the TA scope, integration of networks). As fragile institutions competing for legitimacy, visibility and accuracy in producing knowledge and policy services, Parliamentary Technology Assessment organizations usually need to empirically evolve and adapt to multiple external and institutional structuring factors. Beforehand, this empirical move requires humility and the acceptance of failure and repair work, both from the outside (e.g. the parliamentary institution) and from the inside (the TA body).

A first step towards mapping the different PTAs’ approaches and practices in terms of features of reflexive modernization is to develop a framework with which we can explore the question of what it means for an institution and corresponding practices to constitute an indication of reflexive modernization. To do so, we need criteria that are, on the one hand, key to reflexive modernization while, on the other, being applicable to PTA organizations.

3. Tracing indications of reflexive modernization

From the literature and the experiences with changing interactions between science, technology and society, two criteria can be derived of reflexive modernization: “openness to plurality” and “blurring of boundaries”. While the criteria need not be exhaustive, they definitely capture key features of reflexive modernization and they are applicable to Parliamentary Technology Assessment.⁴

The criteria can be further operationalized so that they can be applied to each of the PTA cases that we will present. We will do this by example, when discussing the cases, rather than develop a set of indications. Given the diffuse and evolving nature of reflexive modernization, doing that would actually be counterproductive.

³ “Infotainment” relies on the idea that technology is fun and can (should) be further opened up to the public through manifestations combining information and entertainment.

⁴ Since PTA is not the only possible indication of reflexive modernization to be studied, it would also be interesting to apply this conceptual framework to other institutions or practices. This remains outside the scope of the present article, however.

3.1. Openness to plurality

The level of openness to plurality of a PTA ranges from substantive procedural qualities to the acknowledgment of a plurality of values and the nature of the outputs of the PTA.

A starting point, continuing on from the modern institution and definitely obvious to a research project team is the need for robust results by insuring independence (the results have to be elaborated during the process and unbiased by external interests), lack of prejudice (freedom from bias and a sufficiently broad research approach), and impartiality (no preference given to certain value standpoints) [16]. But this is only half of the story. Not only must PTAs deal with values to deliver an assessment, the values to be dealt with are plural. Indeed, there is no single set of values, be they environmental, ethical or political, which can be taken for granted. The requirement of robustness has to become broader, as Nowotny et al. [17] argue when they call for “social robustness”. Social robustness requires opening up to society. Therefore, a continuous and delicate endeavor is necessary to seek to anticipate societal expectations and to change decision-making procedures so as to make the incorporation of outside demands easier and to avoid conflict with other groups in society [18], p. 88).

There is more to social robustness: it is no longer relevant for scientific and non-scientific knowledges (e.g. the knowledge of stakeholders, patient organizations or lay people) to be mutually exclusive in a Technology Assessment process. Or rather, their complementarity is increasingly underlined and encouraged through various participatory practices that enhance open interaction and structure, thereby contributing to a reduction in the level of controversies.⁵

Such openness encourages participatory methods (including reaching out to the general public)⁶ but public participation is not a panacea. And it should not be framed as being set against expert analysis. This creates an unnecessary dichotomy. Expert analysis and participation hold a lot in common: they are both subjects to framing conditions [19,20], pervaded by power relations [21,22], vulnerable to strategic behaviors, aiming at the reduction of the diversity or being to often consensus-oriented. The real issues are about “opening up” and “closing down”, as Andrew Stirling called it in his analysis of appraisal processes and wider policy discourses on science and technology [23,24]. He signals a contrast with the traditional focus on unitary (and often expert-based) prescriptive recommendations, and describes how open appraisal poses alternative questions, focuses on neglected issues, includes marginalised perspective, triangulates contending knowledges, tests sensitivities to different methods, considers ignored uncertainties, examines different possibilities and highlights new options [24], p.279–280]. At some moment, however, some closing down is necessary,

⁵ The mode of discourse and dispute resolution in public controversy is different from that of scientific controversy, the latter being unsuitable for dealing with public controversy (Joss 1998: 166–167).

⁶ On public participation in science and technology, see for instance the special issue of *Science and Public Policy* 1999 (26-5), edited by Simon Joss.

in full realization of the reduction of complexity that is involved in creating closure. If closure is reflexive in this way, it will be a further indication of progress along the dimension of openness to plurality.

Given the earlier emphasis on modernist closing down, the current challenge for PTAs is to best accommodate to the uncertainty and dynamics of pattern, and to openly be based on a diversity of sources. That will offer the decision-making process “a context-determined and temporally limited orientation for action that makes learning through experience possible” [25], p. 18].

3.2. *Blurring of boundaries*

In reflexive modernization, boundaries (for instance between society and nature, between knowledge and superstition, between scientific facts and social values, between life and death and between “Us” and “the Others”) cease to be given and instead become choices [25]. At the same time, Beck et al. also claim that we witness a pressure to draw contextually defined boundaries. Reflexive modernization posits that every institutional decision presupposes that boundaries have somehow been drawn on a practical basis. Things have been included or excluded and a line drawn between them. However, there is no limited array of already available options. Consequently, boundaries become fictive boundaries that are understood as such but which are handled as if they were true under the circumstances at hand and institutionalized into systematic procedures that affect everyday life.

When adopting a reflexive approach, each PTA arrangement may define and shape boundaries in a way that is appropriate according to the issue to be dealt with. The approach is dynamic, pragmatic and context-dependent: boundaries are defined and created along with the decisions. The result is an inclusion/exclusion process that is revisable, evolving and heterogeneous.

Only by admitting the features of the blurring of traditional boundaries (which may, however, foster an unintended return to the authority of strict and fixed boundaries) can the interaction with uncertainty and insecurity be incorporated into an institutional learning process. Such an institutional process acknowledges boundaries that are no longer imposed, but constructed, bargained, negotiated and appropriated by stakeholders, within a specific iterative learning process. Institutional anticipation arrangements may need to adapt to that fluidity and to somehow develop effective learning processes that allow an acceptance of ambiguity, the ability to live with uncertainty and the ability to cope with conditional, diverse and temporary options.

Finally, drawing boundaries (and in so doing, including and excluding things) results from a complex translation and engagement process through varied networks of actors, artifacts and institutions [23], p.353]. As Rip puts it, there is a variety of actors and roles, and a “distributed coherence” which is self-organized. Some actors may contribute more to the self-organization than others, but there is no general rule. Or rather, there are lots of rules, dominant positions etc., but these are contingent and cannot be taken for granted. Instead of steering, there is reflective (and reflexive) intervention:

mutual translations (which happen in any case) are now seen as the basic process [26].

As a multi-translation platform, PTA needs to be ready for change and (re)negotiation through the intervention of mutual translations. Such requirements may conflict with the current institutional settings of PTAs and of the routines and rules embedded in the political institutions they are serving and from which they cannot be completely disconnected. This will emerge from the analysis of our case studies.

4. The case studies: STOA, IST and Rathenau

As an introductory remark, some important elements need to be specified in order to clarify our approach. First, our ambition is to look at some concrete manifestations of reflexive modernization in Western societies. In order to do this, we chose PTA as an instance of reflexive modernization that reflects some or other feature of reflexive modernization. We will see that this analytical distinction is not so pure in reality and that it needs adjustments according to specific and concrete features.

Using PTA as the basis of our three case studies will allow us to highlight tensions between different, competing and complementary approaches of TA appraisal in the governance of science and technology. There will be an attempt to map these tensions, referring to these case studies as interesting data for illustrating reflexive modernization in the making.

We took the cases of the European Science and Technology Options Assessment (STOA), the Flemish Institute for Society and Technology (IST, formerly viWTA) and the Dutch Rathenau Institute. Our choice can be justified in several ways. In addition to being three of the major PTA organizations, we considered that these were diverse examples of policy instruments representing contrasted trends of reflexive modernization. STOA seems to be unreflexive, IST is in between and has already taken up a reflexive approach, while the Rathenau Institute appears to be the most advanced PTA institution on the reflexivity pathway.

Our ambition is to provide a snapshot of the working methods of some PTAs, looking at their practices over the last five years, and drawing concluding statements on reflexive modernization, for which it appears that PTA is a relevant indicator. Our analysis is based on the existing literature on these three PTAs, on formal and informal interactions with scholars and TA practitioners and on one research stay.⁷

4.1. *The science and technology options assessment unit (STOA)*

Although STOA follows consistent processual scientific rules and patterns, the TA approach adopted there is

⁷ By formal and informal interactions, we mean either discussions or interviews, as well as various presentations at international conferences or within academic circles. Pierre Delvenne completed a research stay at STOA between September 2007 and January 2008 within the framework of his completed PhD thesis entitled “Parliamentary Technology Assessment case studies: reflexive modernization and public decision-making”. See also Delvenne 2011.

definitely not open to plurality, for a range of reasons: the research approach is narrow and systematically excludes various stakeholders and the general public, societal considerations are left behind, only scientific knowledge and expert rationality are considered valuable, the products delivered are intended to close down the appraisal and to provide the best options, which are, however, sometimes disconnected from the real policy needs.

Boundaries are authoritative, fixed, unnegotiable and non-optional. Science, politics and society remain impermeable. The very timid attempts to provide structured forums of interaction tend to fail because of a lack of involvement of certain stakeholders, the inappropriateness of the communication strategy and the organization's very low visibility inside the parliamentary institution. Scientific and non-scientific knowledges are kept as separate and non-scientific knowledge does not interfere with the PTA's arrangements. The way studies are operated renders (so far) utopian the further developments of an integrated European approach to Technology Assessment. Indeed, there is a commissioned network of scientific institutes,⁸ the European Technology Assessment Group (ETAG), which carries out TA studies on behalf of the STOA panel. But this is certainly not a laboratory for developing TA practice and social learning. Usually, one of the partner organizations will be in charge of organizing the report with little input from the other organizations [27]. Additionally, very few interactions exist between STOA and other European bodies producing anticipatory knowledge on technological innovation, such as, for instance, the European Commission's Institute for Prospective and Technological Studies (IPTS).⁹

Because a "pure" scientific approach is the only possible way for STOA to carry out TA, according to the requirements defined by the STOA panel, we witness an inflexibility in the framing of the issues and a lack of openness in the choice of a methodological approach (any interactive or participatory method such as consensus conference or citizen jury, but also the Delphi method, are underestimated and rejected). STOA can only be reactive to the STOA panel's demands and cannot tackle topics without the panel's formal acceptance. According to our observations, STOA does not adapt easily to changing circumstances and faces constraining institutional and bureaucratic restrictions. Support within the institution is not massive and there is no space left for taking up new windows of opportunity, while at the same time there is also no in-

house analytic capacity. This last point increases STOA's dependency on others for survival as an institution.

For all these reasons, we do not consider STOA to be very entrenched in a reflexive approach to Technology Assessment.

4.2. *The institute for society and technology (IST)*

IST is undoubtedly more advanced than STOA on the reflexivity pathway. It is an open multi-translation platform, which acknowledges a plurality of values and rationalities and which oscillates between an expert-based policy analysis and a social assessment role. Its flexibility is conditioned (and sometimes made difficult) by the particular emphasis on the needs of parliament.

The Flemish PTA's dual mission is key to analyzing IST's position in the socio-technical system. On the one hand, it provides the members of parliament with independent, objective and high quality scientific studies on relevant technological issues. This includes the production of relevant knowledge and policy options. On the other hand, it works to stimulate the public debate and improve social understanding and acceptability of S&T. This last point allows IST to undertake broad initiatives in order to improve societal knowledge of S&T, to reduce the level of public controversies and to combine scientific and non-scientific knowledges. To that extent, IST can contribute to an opening up of wider policy discourses and an enhancement of societal interaction.

IST consciously relies on multiple boundaries, which are acknowledged to be porous. The organization applies a pragmatic and context-dependent strategy. Indeed, when initiating participatory mechanisms on complex technological issues (e.g. a consensus conference, a 21st century town meeting or a technology festival), the PTA gathers together in the Parliament various stakeholders (scientists, citizens, politicians, artists...) to discuss a particular piece of technology, to improve social learning or to inform decision-making. Thus, in this particular case, boundaries between science, politics and society, reality and fiction, life and death, "Us" and "the Others" are blurred and any citizen may be invited to take part in the forum of interaction set up by the PTA.

Regarding flexibility, IST can adapt to changing circumstances, increase its internal and external visibility and take up new opportunities. The program is produced according to a great level of independence and transparency. On that point, it is important also to underline the managerial and scientific roles of the secretariat. However, although the Institute is independent, the strong attachment to the Flemish parliament appears somehow constraining for the development of a real dynamic of its own.

Like any other parliamentary TA office, the Flemish PTA usually works to the mid or long term. But it has progressively diversified its services in order to be able to provide policy advice for the short term too. While IST is also reactive (responding to parliamentarians' demands), it can set its own priorities too and embrace a more proactive approach. In addition, IST sometimes operates specific external contracts, like those completed while a member of the ETAG group when providing knowledge on behalf of STOA. This

⁸ There are three national PTA bodies—the Danish Board of Technology, the Rathenau Institute (the Dutch PTA), the Institute of Technology Assessment at the Austrian Academy of Sciences (ITA), two regional PTAs—the Institute for Society and Technology (IST, formerly viWTA—the Flemish PTA) and the Catalan Foundation for Research and Innovation, and three scientific institutes: the Fraunhofer Institute for Systems and Innovation Research, the Czech Technology Center AV CR and the scientific institute operating TA aims on behalf of the German parliament—the Institute for Technology Assessment and System Analysis (ITAS), which acts as coordinator.

⁹ It has been pointed out that over the last 15 years (the IPTS was created in 1994), interactions have been more the exception than the rule. See for example the minutes of the STOA panel meetings: http://www.europarl.europa.eu/stoa/panel/meetings_en.htm.

raises additional financial resources as well as the organization's visibility at an international level but there is a risk of causing tensions inside the Flemish parliament. Indeed, while IST's international activities have always been strongly supported by the board, the TA institution has to be ready to face any possible future critique arising against these external contracting aims, claiming for instance that the time IST spends at the international level is time that is not being used for serving internal policy demands. Likewise, while IST's initiatives to enhance public participation in S&T are broadly encouraged, the PTA is at the same time invited to respond preferentially to their first clients' needs and to get (still) closer to the parliament.

Lastly, according to IST's leaders,¹⁰ it seems clear that the Rathenau Institute has been taken as a model for developing TA in Flanders. Therefore, these two PTAs exchange extensively at the scientific and methodological levels.

4.3. The Rathenau Institute

With reference to the two characteristics indicating reflexive modernization, as defined in Section 2, Rathenau appears to be the leading European PTA institution on the reflexivity pathway. It successfully engages with newly emerging science and technology while also organizing technology festivals and increasing the level of social knowledge. The Rathenau Institute "focuses on the influence of science and technology on society and maps its dynamics through independent research and debate".¹¹ We consider that the Institute has shifted from a role of science-based policy analysis to one of social assessment (the assessment of ELSA and the involvement of a broad array of social actors), bridging the gap between S&T and society. At the same time, the Institute continues to provide the parliament with background information and highlights the science system's responses to new scientific and social developments.

The Rathenau Institute is an independent institution and it has an administrative link with the Royal Netherlands Academy of Arts and Sciences. It used to advise the government and the parliament and progressively decided to link up with the parliament in a proactive manner. With this institutional setting, the Institute enjoys the unique position of serving a very narrow set of modern institutions (the parliament and government) while, at the same time, staying out of them. Likewise, there is some protection against a too direct power relationship with political entities.

The Dutch PTA benefits from a very good capacity for adaptation. Staff members actively network, they formulate diagnoses of what is happening and what needs to be done, and they grasp opportunities. Rathenau initially dealt with the creation of robust reports on technological issues of political relevance (including background studies of constructive Technology Assessment¹²). Then, the Institute shifted to an

approach less politically relevant but more oriented towards the stimulation of a societal agenda, public debate and interactive articulation of options. This does not mean that background studies are no longer undertaken, but they now take the form of small thematic workshops with a cross-section of stakeholders and brief reports written up afterward, available for use by all. Addressing societal issues is definitely at the forefront of the Institute's work and specific attention is paid to ethical, legal and social aspects of emerging science and technology.

Rathenau's ability to grasp new opportunities can be seen in the recent (since 2004) integration into the Institute of a science system assessment (SciSA) division, with special funding from the Ministry of Education and Sciences. The division concentrates on science policy system analysis and support and research group evaluation with a focus on new and emerging fields of research. The division's work emphasizes the relationship between the institutional systems and maps the dynamics of new innovative fields of research such as nanosciences and nanotechnologies.

5. Conclusions

Our three case studies illustrate the multiple approaches and practices that coexist under the label "Parliamentary Technology Assessment". While this multiplicity has been noted in the literature already [28,29], what is new here is that our conceptual framework reveals various trends that can be observed in reality when analyzing the process of reflexive modernization. When moving about, PTA institutions are constrained by the resilience of modern institutions but at the same time they respond to the pressure of broader changes. Their responses and the related actions reflect their ability to take some or other directions. The identification of an open-ended reflexivity pathway allows us to highlight new trends in Parliamentary Technology Assessment as not just interesting ad-hoc novel approaches, but as indications of a new and broader generation of TA.

We believe that too strong a link with modern institutions, such as the parliament or a governmental body, would prevent a TA from taking up a reflexive approach because the institutional space would not be sufficiently protected from modern interference. This may affect the credibility of the anticipatory knowledge produced by the PTA or just prevent the TA organization to adopt certain methods or tools that would not be acceptable for its political clients. Thus, a weaker, flexible but existing link with the political system should provide the PTA with sufficient space to address complex issues while contributing to the dynamism and "breath" of the decision-making process. At the same time, this would allow the PTA institution to more easily take on a social assessment function and enhance interactive learning processes within the society.

Following the reflexivity pathway is not easy and implies many challenges for PTA institutions to take up. Just as reflexive modernization is a dynamic process of evolution of modern societies, such a reflexivity pathway entails the evolution of particular instances (here, the Parliamentary TA institutions) according (and in relation) to this macro process of evolution. Reflexive modernization thus primarily concerns nature of the ongoing changes at the

¹⁰ Interview with IST's Director, Robby Berloznik, on 12th June 2008.

¹¹ See the Rathenau Institute's website: <http://www.rathenau.nl>.

¹² See Rip and Schot 1997 and Arie Rip's communication: "Une perspective hollandaise", Workshop on Governance and Technology Assessment, Université de Liège, 10th October 2008. See the website for this event: http://www.spiral.ulg.ac.be/gouvernance_et_technology_assessment_08.

societal level and the related emerging trends that can affect the system's dynamics and patterns. Although the American OTA was successful in finding a place within the US system and among its TA approaches in the socio-political environment of the 1970's onward, such a reopening today may not be conceivable in the same way without a broader openness to plurality, a greater accommodation to a blurring of evaporating boundaries. Likewise, today's European systems are evolving and the level of global interdependence has increased. Taking this seriously while providing appropriate responses to more specific contextualized needs embodies one of the greatest challenges for PTAs, which have to (re)define their niches and compete with other centers and research programs.¹³ The most important thing for PTA institutions is therefore to somehow develop a relevant approach while dealing with the necessary margin of maneuver for further adaptation and transformation.

It can happen that, to a certain extent, some particular institutional contexts or socio-political realities do not render it desirable for PTAs to embrace a reflexive approach. In other words, there is no determinism arguing that one PTA should progress as far as possible on the reflexivity pathway.

Instead, we should consider that every PTA faces a lot of challenges in ensuring its role in the current institutional landscapes of evolving modern societies. For STOA, its own role almost disappeared in 2000 (due to a lack of resources, visibility and leadership). The big challenge for STOA will be to survive after the recent departure of its entrepreneurial director and to try to decrease its dependency externally (on the ETAG consortium). At the same time, behind the apparent official consensus regarding a non-reflexive approach to TA, there are effective disagreements and struggles between the STOA panel members regarding the relevance and usefulness of taking public participation more seriously and involving broader stakeholders and the general public.¹⁴ The panel members have already clashed over two quite different visions of a TA approach: one of openness and flexibility and the other of a more specialized and controlled approach following limited strict scientific methods: this last approach has won the battle so far.

For IST, the challenge is to keep on advancing along the reflexivity pathway while further reinforcing its rapidly built¹⁵ credibility among TA practitioners and the Flemish parliament. This will be a matter of finding its place and

right equilibrium, balanced between policy advising for the parliament and the task of using parliamentary resources to stimulate the public debate on science and technology issues. At stake in the future will also be the relevance of possible external opportunities (such as participating in an international consortium like ETAG), which increase IST's visibility as a scientific institution but which are not especially directly rewarding at the political and societal levels.

For the Rathenau Institute, it is now important to consider the next step on the reflexivity pathway. There is no final objective or particular goal to reach except the one of considering constantly evolving contextual patterns and dynamics and finding one's niche accordingly. Therefore, the Rathenau Institute may in the future face the dilemma of maintaining separately two different fields of activity (Technology Assessment and Science System Assessment), giving up one of the two divisions or reinforcing the possible interactions between the two, for example, by also considering system approaches for TA and deciding to go for technology governance as a new direction. Such an extension of TA activities towards the science production side may be a step towards building a new generation of PTA by blurring further the boundaries with science institutions.

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References

- [1] Invernizzi N. Participación ciudadana en ciencia y tecnología en América Latina: una oportunidad para refundar el compromiso social de la universidad pública. *Revista CTS* 2004;1(2).
- [2] Beck U. *Risk society*. London: Sage; 1992.
- [3] Giddens A. *The consequences of modernity*. Cambridge: Polity Press; 1990.
- [4] Beck U, Giddens A, Lash S. *Reflexive modernization*. Cambridge: Polity Press; 1994.
- [5] Schot J. The contested rise of a modernist technology politics. In: Misa T, Brey P, Feenberg A, editors. *Modernity and technology*. Cambridge: MIT Press; 2003. p. 257–78.
- [6] Irwin A, Wynne B. *Misunderstanding science*. Cambridge: Cambridge University Press; 1995.
- [7] Joss S. *The Role of Participation in Institutionalised Technology Assessment. A Case Study of Consensus Conferences*. PhD Thesis. London: Imperial College; 1998.
- [8] Callon M, Lascoumes P, Barthe Y. *Agir dans un monde incertain*. Paris: Seuil; 2001.
- [9] Hennen L. Uncertainty and modernity. *Participatory technology assessment: a response to technical modernity? Science and Public Policy* 1999;26(5).
- [10] Laurent B. Un tournant participatif? Une mise en perspective historique de la participation du public dans les politiques scientifiques américaines. In: Bacqué M-H, Sintomer Y, editors. *La démocratie participative: histoires et généalogies*. Paris: La Découverte; 2011. p. 246–60.
- [11] Van Eindhoven J. Technology assessment: product or process? *Technological Forecasting and Social Change* 1997;54(2).
- [12] Rip A, Schot J. The past and future of constructive technology assessment. *Technological Forecasting and Social Change* 1997; 54(2).

¹³ Competing, for example, with research programs on nanotechnology in the US (e.g. the National Science Foundation funded program Nanotechnology in Society carrying out real-time TA (Guston and Sarewitz 2002); see <http://cns.asu.edu>) or in Europe (e.g. the Dutch Nanoned initiative carrying out constructive TA (Rip and Schot 1997); see <http://www.nanoned.nl/default.htm>).

¹⁴ We refer to specific observations made by Pierre Delvenne during his research stay at STOA and also to the discussions that followed a session hosted by STOA at the last European Science Open Forum (ESOF) in Barcelona (18th–22nd July 2008), entitled “The interaction between democracy and expertise: dilemmas for Parliaments” (Pierre Delvenne's personal notes).

¹⁵ IST (formerly viWTA) was created in 2000 and became operational in 2002. Within the last 7 years, IST has quickly become one of the leading PTA institutions in Europe and has proved its ability to successfully engage with a wide range of stakeholders.

- [13] Guston D, Sarewitz D. Real-Time technology assessment. *Technology in Society* 2002;24.
- [14] Joss S, Bellucci S. Participatory technology assessment. *European Perspectives*. London: Center for the Study of Democracy; 2002.
- [15] Grin J, Van de Graaf H, Hoppe R. *Technology assessment through interaction*. The Hague: Rathenau Institute; 1997.
- [16] Grunwald A. Scientific independence as a Constitutive part of parliamentary technology assessment. *Science and Public Policy* 2006;33(2).
- [17] Nowotny H, Scott P, Gibbons M. *Re-Thinking science. Knowledge and the public in an Age of uncertainty*. Cambridge: Polity Press; 2001.
- [18] Holzer B, Sorensen M. Rethinking Subpolitics: beyond the “iron cage” of modern politics? *Theory, Culture & Society*; 2003:20–79.
- [19] Blok A. Experts on public trial: on democratizing expertise through a Danish consensus conference. *Public Understanding of Science* 2007;16.
- [20] Bruun Jensen C. Citizen projects and consensus-building at the Danish Board of Technology: on experiments in democracy. *Acta Sociologica* 2005;48(3).
- [21] Mouffe C. *The return of the political*. London and New York: Verso; 1993.
- [22] Mouffe C. *The democratic paradox*. London and New York: Verso; 2000.
- [23] Smith A, Stirling A. Moving outside or inside? objectification and reflexivity in the governance of socio-technical systems. *Journal of Environmental Policy and Planning*; 2007. 8–3.
- [24] Stirling A. “Opening up” and “Closing down”. Power, participation and Pluralism in the social appraisal of technology. *Science, Technology & Human Values* 2008;33.
- [25] Beck U, Bonss W, Lau C. The theory of reflexive modernization. problematic, hypotheses and research programme. *Theory, Culture & Society*; 2003:20–1.
- [26] Rip A. A co-evolutionary approach to reflexive governance – And its Ironies. In: Voss J-P, Bauknecht D, Kemp R, editors. *Reflexive governance for sustainable development*. Cheltenham: Edward Elgar; 2006. p. 82–100.
- [27] Brunet S, Delvenne P, Fallon C, Gillon P. *Dealing with nanotechnology: do the boundaries matter? safety, reliability and risk analysis*. London: CRC Press; 2009.
- [28] Vig N, Paschen H. *Parliaments and technology*. New York: State University Press; 2000.
- [29] Delvenne P. *Science, technologie et innovation sur le chemin de la réflexivité. Mise en perspective des offices parlementaires de Technology Assessment*. Louvain-La-Neuve: Academia Bruylant (collection Thélème); (in press).

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