



The International Treaty
ON PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE



Background Study 1

**ESTIMATING INCOME TO BE EXPECTED FROM POSSIBLE CHANGES IN THE
PROVISIONS GOVERNING
THE FUNCTIONING OF THE MULTILATERAL SYSTEM**

Nina Isabella Moeller and Clive Stannard

Authors:

Nina Isabella Möeller, Centre for Agroecology and Food Security, Coventry University, United Kingdom

Clive Stannard, School of Archaeology and Ancient History, University of Leicester, United Kingdom.

The designations employed and the presentation of material in this information product do not imply the expression of any opinion whatsoever on the part of the Food and Agriculture Organization of the United Nations (FAO) concerning the legal or development status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. The mention of specific companies or products of manufacturers, whether or not these have been patented, does not imply that these have been endorsed or recommended by FAO in preference to others of a similar nature that are not mentioned.

This study reflects the technical opinion of its authors, which is not necessarily those of the FAO, or the Secretariat of the International Treaty on Plant Genetic Resources for Food and Agriculture.

© FAO, 2014

FAO encourages the use, reproduction and dissemination of material in this information product. Except where otherwise indicated, material may be copied, downloaded and printed for private study, research and teaching purposes, or for use in non-commercial products or services, provided that appropriate acknowledgement of FAO as the source and copyright holder is given and that FAO's endorsement of users' views, products or services is not implied in any way.

All requests for translation and adaptation rights, and for resale and other commercial use rights should be made via www.fao.org/contact-us/licence-request or addressed to copyright@fao.org.

NOTE FROM THE SECRETARIAT

This study draws upon an extensive programme of research by a team of experts, conducted in connection with the *Research Project to support the deliberations of the Working Group to enhance the functioning of the Multilateral System of the International Treaty on Plant Genetic Resources for Food and Agriculture*, carried out with the support of the Government of Australia. As part of this project, the following interlinked studies were prepared between May and October 2014.

Dynamic analysis of possible changes in the provisions governing the functioning of the Multilateral System, and possible income

Clive Stannard, Francesco Caracciolo, Peter Hillery

Innovative approaches for enhancing the flow of funds into the Benefit-sharing Fund of the International Treaty on Plant Genetic Resources for Food and Agriculture: An evaluation of options

C.S. Srinivasan

Analysis of the transaction costs occurring for the user, under the SMTA of the International Treaty on Plant Genetic Resources for Food and Agriculture, and the EU Regulation on Implementation of the Nagoya Protocol

Petra Engel

Investigation of the preferences and behaviour of users of the SMTA, when making decisions to use the alternative payment options of Articles 6.7 and 6.11 of the SMTA

Klaus Möller, Felix Isbruch Tobias Flinspach

Summary of user opinions, following interviews with members of the seed industry

Nina Isabella Moeller

These research papers are available on line at:

<http://www.planttreaty.org/content/background-study-paper-1>.

The team also further developed the computer system used in the preparation of the previous study, *Assessing the potential for monetary payments from the exchange of plant genetic resources under the Multilateral System of the International Treaty on Plant Genetic Resources for Food and Agriculture*, published as Chapter 3 of the 2013 Treaty publication *Identifying Benefit Flows*, which can be accessed at <http://www.planttreaty.org/content/identifying-benefit-flows> and programmed a “*New Interface*”, in the context of investigating the relationship between revisited Articles 6.11 and 6.7. The *New Interface* is also available at <http://www.planttreaty.org/content/background-study-paper-1>.

TABLE OF CONTENTS

1. INTRODUCTION	1
2. AIMS AND OBJECTIVES	2
3. METHODOLOGY: A NUMBER OF APPROACHES	3
4. FINDINGS	4
4.1. SMTA-BASED APPROACHES: REVISITING ARTICLES 6.7 AND 6.11 OF THE SMTA, AND EXPANDING THE COVERAGE OF THE MULTILATERAL SYSTEM	4
4.1.1. ASSUMPTIONS	4
4.1.2. THE PARITY POINT: DESCRIBING THE DYNAMIC INTER-RELATION OF ARTICLES 6.7 AND 6.11	6
Preliminary Caveats	6
Adapting the reference model	6
The Parity point methodology	9
Analysis of the dynamic relationship between Articles 6.7 and 6.11	11
Conclusions regarding the dynamic relationship between Articles 6.7 and 6.11	16
Policy modifications of the Parity Point.....	17
Using the “New Interface” to the Computer Model	19
Projections of possible income from the revisited Articles 6.7 and 6.11	21
4.1.3 EVALUATION OF INNOVATIVE OPTIONS : ASSESSING POTENTIAL INCOME FLOWS IN THE CURRENT GLOBAL SEED MARKET.....	27
Static Analysis Methodology.....	27
<i>Size of Commercial Seed Market</i>	27
<i>Value of Commercial Seed Market</i>	29
<i>Share of Varieties Incorporating Materials Under SMTA Conditions in the Commercial Seed Market</i>	30
<i>Potential Payment flows into the Benefit-Sharing Fund</i>	31
Static Analysis Results	33
<i>Potential of benefit Flows from Patents</i>	33
<i>Potential of benefit Flows from Plant Varieties under PVP</i>	34
<i>Potential of Benefit Flows from Regulated Materials</i>	36
<i>Potential of Payments under a Revised Article 6.11</i>	38
<i>Potential Value of Annex 1 Expansion</i>	40
Comparing the maximum potentials of the static analysis with those of the dynamic analysis	43
Actual Payment flows into the Benefit-Sharing Fund.....	45
4.2. OTHER INNOVATIVE APPROACHES: UPFRONT PAYMENTS ON ACCESS, TO BE DISCOUNTED AGAINST PAYMENTS DUE ON THE COMMERCIALIZATION OF A PRODUCT	48
4.3. NON-SMTA-BASED APPROACHES	49

4.3.1. PROMOTING REGULAR SEED SALES-BASED CONTRIBUTIONS BY CONTRACTING PARTIES	49
4.3.2. NOVEL WAYS TO ATTRACT USE-BASED VOLUNTARY FUNDING	51
4.4. MANAGING REGULATORY INTERACTIONS BETWEEN THE TREATY, AND THE CONVENTION ON BIOLOGICAL DIVERSITY AND ITS NAGOYA PROTOCOL.....	52
5. CONCLUSION.....	56
5.1. THE THEORETICAL ANALYSIS OF POTENTIAL INCOME, AND LIMITING FACTORS, IN THE REAL WORLD.....	56
5.2. TRANSACTION COSTS AND REGULATORY INTERACTIONS	57
5.3. THE ATTRACTIVENESS OF THE INNOVATIVE APPROACHES	59

Figures

Figure 1 Structural elements of the reference model.....	7
Figure 2 Revised crops/crop groups, Intellectual Property status, and payment rates	8
Figure 3 Illustration of the Parity Point methodology.....	10
Figure 4 Trade-offs: Parity Point year and projected benefits.....	11
Figure 5 Trade-offs: Fixed parity year and total potential income	12
Figure 6 Trade-offs between the Article 6.7 rate, T/P and the Parity Point year.....	12
Figure 7 Trade-offs between the Articles 6.7/6.11 ratio and the Parity Point year.....	13
Figure 8 Varying R - changing Article 6.11 payment rates, with fixed 6.7 rates.....	14
Figure 9 Varying R - changing Article 6.7 rates with fixed 6.11 rates	15
Figure 10 Benefit flows at 10 and 20 years, with a changing Article 6.7 rate	16
Figure 11 Parity Point, Article 6.11/6.7, patent and PVP rates, and income to the Treaty.....	18
Figure 12 Fixing an income target.....	19
Figure 13 The “New Interface”	20
Figure 14 The influence of U on income	21
Figure 15 Influence of the rate of PVP in U on benefits	22
Figure 16 Benefit flows at Parity Point in 2038.....	23
Figure 17 Additional Potential in Expanding Annex 1 to all vegetable crops	23
Figure 18 Maximum potential of Regulated Products at Parity Point.....	24
Figure 19 Projected income at Parity Point at different rates of migration of Regulated products to PVP	24
Figure 20 Article 6.11 rates: maximum potential at Parity Point	25
Figure 21 Projections of potential income at 2081	26
Figure 22. Seed Replacement Rates Used.....	28
Figure 23. Intellectual Property Status (ratio).....	28
Figure 24. Seed Price Factor.....	29
Figure 25. Seed Price Factors for Annex 1 Vegetable Crops.....	29
Figure 26. Value of Commercial Seed of Annex 1 and Major Non-Annex 1 Crops (US\$ million).....	30
Figure 27. Share of SMTA derived PGR in different Seed Market Product Categories	31
Figure 28. Value of Commercial Seed of Annex 1 and Major Non-Annex 1 Crops.....	31
Figure 29. Value of Commercial Seed Market by Product Category (US\$ million).....	32
Figure 30. Potential annual payments under Article 6.7 (from patented varieties) (US \$ million)	33
Figure 31. Potential of PVP varieties under Article 6.8 or under a revised Article 6.7 at different rates	34
Figure 32. Potential Benefit Flows under a Revised Art. 6.7 (US\$ million).....	35
Figure 33. Potential of non-protected, regulated varieties under Article 6.7 at different rates (US\$ million)	36
Figure 34. Potential Benefit Flows under a Revised Art. 6.7, with regulated materials effecting payments	38

<i>Figure 35. Payment potential under a revised Article 6.11 (US \$ million)</i>	39
<i>Figure 36. Potential Benefit Flows under a Revised Art. 6.11, with regulated materials effecting payments</i>	40
<i>Figure 37. Potential of Key Non-Annex 1 Crops</i>	41
<i>Figure 38. Potential Benefit Flows of Annex 1 and Non-Annex 1 crops, under SMTA Art. 6.7,</i>	42
<i>Figure 39. Maximum Potential Annual Benefit Flows (Annex 1), per product category, according to the dynamic and static analyses</i>	43
<i>Figure 40. Maximum Potential Annual Benefit Flows from non-Annex 1 crops, per product category, in the dynamic and static analyses</i>	44
<i>Figure 41. Potential and realisable annual payment flows, per product category,</i>	46
<i>Figure 42. Performance factors</i>	47
<i>Figure 43. Burden-sharing between Contracting Parties and the seed industry</i>	49
<i>Figure 44. Importance of risk, expressed during the simulation exercise</i>	53
<i>Figure 45. The possible reduction of transaction costs under Articles 6.7/6.8 and 6.11</i>	54
<i>Figure 46. Games theory and voluntary payment — a lose-lose scenario</i>	57
<i>Figure 47. Preferred source of genetic material, relative weighting</i>	60

1. INTRODUCTION

1. The Governing Body, in its Fifth Session, established an *Ad Hoc* Open-ended Working Group to Enhance the Functioning of the Multilateral System of Access and Benefit-sharing, with the task of developing a range of measures for consideration and decision by the Governing Body at its Sixth Session that will:
 - (a) Increase user-based payments and contributions to the Benefit-sharing Fund in a sustainable and predictable long-term manner, and
 - (b) Enhance the functioning of the Multilateral System by additional measures.
2. In this context, the Governing Body decided that the:

“the Secretariat should prepare a number of short, strategic preliminary studies, taking into account all available information, including the recent study, *Assessing the potential for monetary payments from the exchange of plant genetic resources under the Multilateral System of the International Treaty on Plant Genetic Resources for Food and Agriculture*,”¹ including:

“A study estimating income to be expected from possible changes, consistent with the objectives of the Treaty, in the provisions governing the functioning of the Multilateral System, taking into account reports of the *Ad Hoc* Advisory Committee on the Funding Strategy and the *Ad Hoc* Technical Advisory Committee on the Multilateral System and SMTA”.
3. The present document is a technical input to the Secretariat’s Synoptic Study 1, *Estimating income to be expected from possible changes in the provisions governing the Multilateral System*.² It is not intended to be prescriptive, or to make recommendations on the decisions that the Governing Body will need to take, but to provide data and technical analysis that may help identify both problems and opportunities, and so support the Working Group in its task.

¹ This study is available on line as Chapter 3 of the 2013 publication *Identifying Benefit Flows*, at <http://www.planttreaty.org/content/identifying-benefit-flows>, and is cited in the present study as “Potential”.

² The Synoptic Study can be accessed at <http://www.planttreaty.org/content/second-meeting-ad-hoc-open-ended-working-group-enhance-functioning-multilateral-system-acces>

2. AIMS AND OBJECTIVES

4. Six “innovative approaches” to increasing user-based payments, and contributions to the Treaty’s Benefit-sharing Fund were identified by *Ad Hoc* Committee on the Funding Strategy, during the 2012/2013 biennium, following a review of the factors leading to the shortfall in user-based income. The outcomes of this work, and an analysis of the implications, was considered by the Working Group in its first meeting, in May 2014, on the basis of the document, *Background on the work undertaken by the Ad Hoc Advisory Committee on the Funding Strategy, and its further development*.³ The present study seeks to build upon, and further develop the analysis presented there, and has been used to establish a number of the parameters of research used here.
5. These innovative approaches are the following:
 - SMTA-based approaches**
 - Revisiting Article 6.11 of the SMTA.
 - Revisiting Article 6.7 of the SMTA.
 - Upfront payments on access, to be discounted against payments due on the commercialization of a product
 - Non-SMTA-based approaches**
 - Promoting regular seed sales-based contributions by Contracting Parties
 - Novel ways to attract use-based voluntary funding.
 - Expanding the coverage of the Multilateral System.
6. The Governing Body tasked the Working Group to address these approaches in two phases: it should first consider innovative ways to increase user-based payments and contributions to the Benefit-sharing Fund in a sustainable and predictable long-term manner, and then additional measures to enhance the functioning of the Multilateral System, which includes possible expansion of the Treaty’s crop coverage.
7. The primary focus of this study is on evaluating the potential to ensure a sustainable and predictable income, of possible revisions to SMTA Articles 6.7 and 6.11. Although the expansion of the Treaty’s crop coverage will be addressed by the Working Group in a second phase, it is important to understand the financial implications in the context of benefit-sharing. The present paper hence considers both questions.

³ IT/OWG-EFMLS-1/14/3, available on line at http://www.planttreaty.org/sites/default/files/OEWG-EFMLS_1-14-w3_en.pdf, which is cited in the present study as “*Background*”.

3. METHODOLOGY: A NUMBER OF APPROACHES

8. A number of a number of separate methodological approaches were brought together in preparing the present study:
 - a. A computer application was developed in the preparation of *Potential*, and this was updated and adapted, with new data on materials available under SMTAs,⁴ and to take into account the possible changes to Articles 6.7 and 6.11 of the SMTA.
 - b. A *New Interface* was programmed to support a *dynamic analysis* of the relationship between Articles 6.7 and 6.11, in order to test and validate a variety of scenarios and hypotheses, and support policy development.
 - c. A *static analysis* was undertaken of the values of the current seed market, and the possible income to the Benefit-sharing Fund, as a result of proposed changes to the Treaty's benefit-sharing mechanisms.
 - d. A *simulation exercise* was developed, based on a *strategic game* to test the likely reaction of the seed industry to possible changes to the Treaty's benefit-sharing mechanisms. In preparation for this:
 - ii. *Structured interviews* were held with a wide range of representatives of the seed industry.
 - iii. A *Transaction Cost Analysis* was undertaken of using the SMTA in its present form, of using a modified version of the SMTA, and of the costs imposed by implementation at national level of the *Nagoya Protocol to the Convention on Biological Diversity, on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization*.
9. The documents resulting from these modules are available online.⁵ The New Interface can also be accessed online or downloaded and be used freely for testing and validation of different scenarios.

⁴ The updated table of such materials is contained in the Appendix to IT/OWG-EFMLS-2/14/inf.3, *The current status of the Multilateral System of Access and Benefit-sharing*, which is available on line at <http://www.planttreaty.org/content/background-study-paper-1>.

⁵ <http://www.planttreaty.org/content/background-study-paper-1>

4. FINDINGS

4.1. SMTA-BASED APPROACHES: REVISITING ARTICLES 6.7 AND 6.11 OF THE SMTA, AND EXPANDING THE COVERAGE OF THE MULTILATERAL SYSTEM

10. The dynamic analysis of the relationship between Articles 6.7 and 6.11,⁶ and the static analysis of the values of the current seed market,⁷ together provide the analytic foundations of this study. They focus on economic and other implications of possible changes to the SMTA, in particular, to Articles 6.7 and 6.11. They also assess the impact of an expansion to the Treaty's crop coverage, in terms of the potential income to the Benefit-sharing Fund this could create, in the context of these possible changes. Their respective findings are presented in this section.

4.1.1. ASSUMPTIONS

11. In order to be able to compare the current status with possible changes to the SMTA, it is necessary to make a number of assumptions regarding what these changes could be, as the basis for comparison. These assumptions have been based on paragraphs 84–96 of *Background*, which the Working Group considered at its last meeting.

12. It is assumed that:

- a. Mandatory payments⁸ will be required for products marketed under either patents or PVP, in both Articles 6.7 and 6.11. Other products will not pay, in either option. Article 6.8 might drop away entirely, or be retained for any category of products, for which the Governing Body does not make payments mandatory.
- b. Separate payments levels will be set for patents and PVP, and that the same relative levels between these levels will apply in both Articles 6.7 and 6.11. It is also assumed that the overall payment obligations under Article 6.11 will be lower than under Article 6.7.
- c. The Article 6.11 option will continue to be implemented by crop, or crop group.
- d. Under Article 6.7, payments will continue to be required on a product-by-product basis, and under Article 6.11, payment will be required for all of a breeder or seed company's products marketed under patents, or PVP, of the crop or crops in question.

13. Moreover, in order to apply differentiated possible payment rates to products, in accordance with the intellectual property protection under which they are marketed, both analyses distinguish benefit-flows in terms of (1) patented products, (2) products under PVP, and (3) "Regulated" products.

14. Regulated products characterizes a large subset of commercialized plant varieties that incorporate SMTA materials in their parentage, and which are not yet subjected to any form of intellectual

⁶ The dynamic analysis has been reproduced in its entirety here, it is available as the stand-alone study, *Dynamic analysis of possible changes in the provisions governing the functioning of the Multilateral System, and possible income*, at www.planttreaty.org/content/background-study-paper-1

⁷ The static analysis, hereinafter referred to as *Static*, is available as the stand-alone study, *Innovative approaches for enhancing the flow of funds into the Benefit-sharing Fund of the International Treaty on Plant Genetic Resources for Food and Agriculture: An evaluation of options*, at www.planttreaty.org/content/background-study-paper-1

⁸ For a discussion of mandatory and voluntary payments, see *Background*, paragraphs 40–47 (*Avoidance of SMTA material and the problem of voluntary payment*) and paragraphs 54–56 (*Addressing the problem of voluntary payment*).

property protection. The commercialization of such products is subject to seed quality control, multiplication and marketing regulations, which enable their privileged commercial exploitation, despite the lack of intellectual property protection.

15. Regulated products have been identified as a specific category, in order to be able to put a value on those materials, which, in the current SMTA, fall under Article 6.8, that is, they are encouraged to make voluntary payments, as are products under PVP. Article 27.3b of the TRIPS Agreement requires members of the World Trade Organization to “provide for the protection of plant varieties either by patents or by an effective *sui generis* system or by any combination thereof”, and it is assumed that a part of the current Regulated category will migrate to the category of PVP over time.
16. Valuing Regulated products has also been deemed useful since interviews with members of the seed industry in preparation of this study have revealed that an extension of mandatory payments to plant variety products protected by PVP might be less attractive to users than an overall extension of mandatory payments to all plant variety products, regardless of intellectual property protection.⁹

⁹ See also, e.g., pp. 70 and 74, *Investigation of the preferences and behaviour of users of the SMTA, when making decisions to use the alternative payment options of Articles 6.7 and 6.11 of the SMTA*, available at <http://www.planttreaty.org/content/background-study-paper-1>, and hereinafter referred to as *Preferences and Behaviour*.

4.1.2. THE PARITY POINT: DESCRIBING THE DYNAMIC INTER-RELATION OF ARTICLES 6.7 AND 6.11

17. As described in *Background* (paragraphs 40–50), the *Ad Hoc* Advisory Committee on the Funding Strategy identified various aspects of the current structure of the benefit-sharing mechanisms embodied in the SMTA that create mistrust, encourage free-riding, and are a strong disincentive for users, including in particular an imbalance in the payment levels of Article 6.7 and 6.11. If these structural constraints are to be overcome, and if the Article 6.11 option is to be made attractive to users, revisions to the SMTA will need to rebalance payment levels under the two payment options.
18. Users, as rational cost-minimizers, will base their choice of whether to use the Article 6.7 or the Article 6.11 option on the relative cost to them, of the two options.
19. The Parity Point is the date at which the total payments due under the Article 6.7 option equal payments due under the Article 6.11 option. Economic rationality means that the breeder will always opt for Article 6.7 *until* Parity Point is reached, and will always opt for Article 6.11 *after* it is reached.
20. The Parity Point methodology identifies the conditions under which the costs for users, in deciding for one option or another, are equal, and analyses the effects of offering the two, Article 6.7 and 6.11, options.

Preliminary Caveats

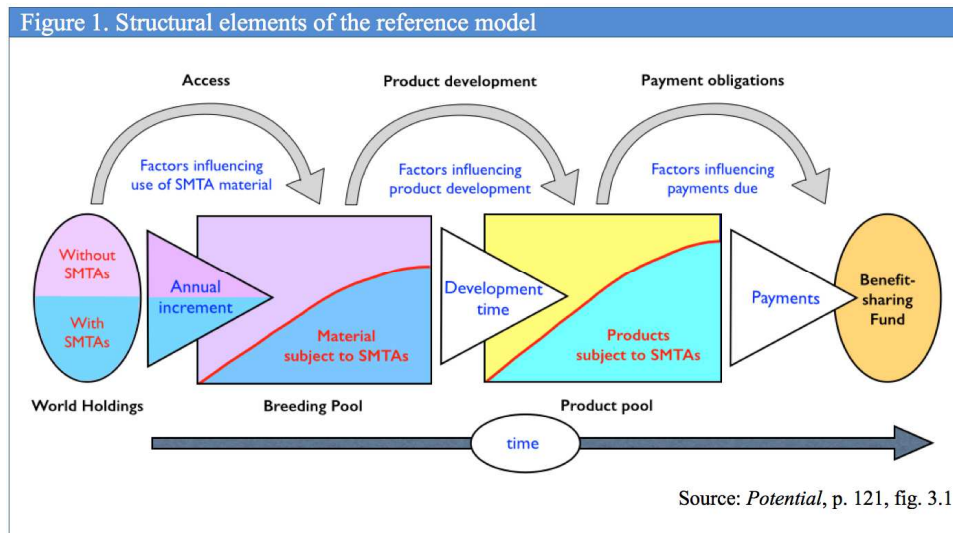
Quantification clarifies issues which qualitative analysis leaves fuzzy. It is more readily contestable and likely to be contested. It sharpens scholarly discussion, sparks off rival hypotheses, and contributes to the dynamics of the research process.

Angus Maddison, *Contours of the World Economy 1-2030 AD: Essays in Macro-economic History* (2007, p. 1)

21. The dynamic inter-relationship of the two alternative payment options is best understood by using a model, but it is necessary to make a number of strong initial caveats. A model is not a picture of the real world, but an analytical tool to show the logic and inter-relationship of the elements. A good model allows crucial elements to be isolated, rigorously described, and mathematically manipulated. Although numbers are put on outcomes in the analysis below, these are not real world estimates, but designed to show relative values, and changes under different scenarios.
22. The real world is subject to strategic decisions by real people, and their stochastic decisions, including to avoid the Treaty and its SMTA entirely, or to segregate SMTA materials in their breeding pool, so as to avoid obligations to the Treaty that would arise from crossing these materials widely into their commercial products, are not modelled. However, decisions in the real world may be considered more fruitfully, once the basic model to which real people react has been understood.
23. Moreover, in the real world, individual breeders and seed companies make individual decisions. The model cannot replicate this diversity of individual circumstances and choices, but assumes that breeders and companies, as it were, make a single choice, based on a single portfolio.

Adapting the reference model

24. The analysis of the dynamic relationship of Articles 6.7 and 6.11 rests on the reference model which is used in *Potential*, including in order to be able to compare the results of this analysis with the earlier analysis. The structure of the reference model is shown diagrammatically in fig. 1.



25. A brief description of the main elements of the model is as follows:

- The model starts from world *ex situ* holdings of accessions of plant genetic resources for food and agriculture and identifies those that are under the Treaty, which should be available with SMTAs, and those that are not available with SMTAs.¹⁰
- These materials enter the world breeding pool at a standard rate, which causes the part of the world breeding pool subject to the terms and conditions of the SMTA to grow over time.
- The world product pool follows the same dynamic, whereby the part of the world product pool with obligations to contribute to the Treaty increases over time, at a time distance of an average development time.
- The part of the world product pool with obligations to the Treaty, at any particular time, is the basis for attributing a corresponding part of the value of world sales, according to the provisions and the payment rate of Article 6.7 of the SMTA.¹¹

26. The reference model was adapted, in order to:¹²

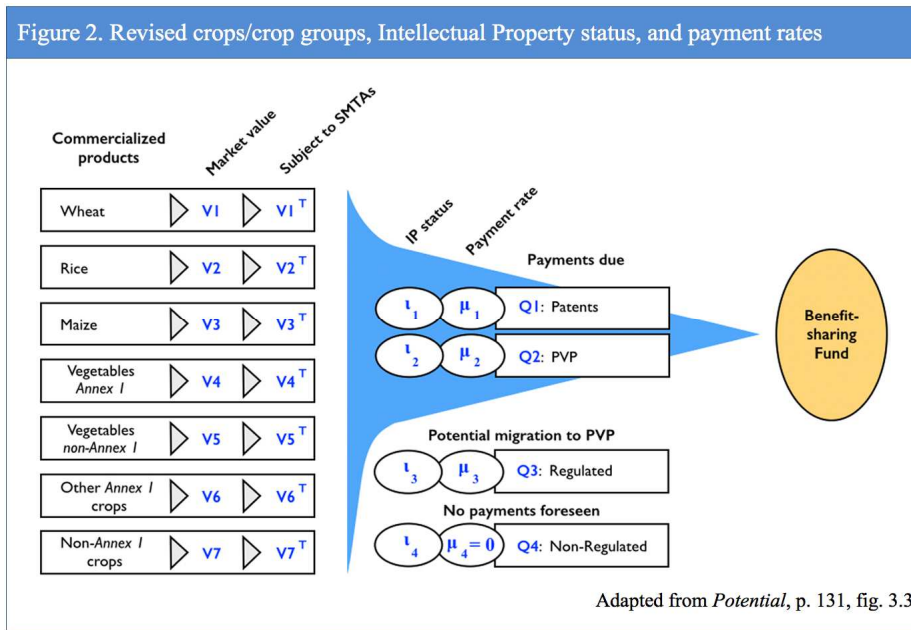
- Break-up the seed market values into (**V**) into four categories: products protected by patents (**Q1**), products protected by PVP (**Q2**), “regulated” products (**Q3**), and non-regulated products (**Q4**)”.
- Introduce vegetables as a separate, new category in the analysis (**V4** and **V5**).
- The potential of payment for each of these categories, and, where relevant, the level of payment, derives from the intellectual property regime under which they are commercialized (**u₁**– **u₄** respectively), and the payment rates (**μ₁**– **μ₄** respectively).

27. The relevant structure of the adapted reference model, as adapted, is shown diagrammatically in fig. 2.

¹⁰ Appendix to IT/OWG-EFMLS-2/14/inf.3, *The current status of the Multilateral System of Access and Benefit-sharing*, available on line at <http://www.planttreaty.org/content/background-study-paper-1>.

¹¹ In *Potential*, the model allows for *avoidance of materials under an SMTA* (**v**, see pp. 138) and for an *effective rate of payment* for payments that are voluntary (**p**, see pp. 131–132). In the current analysis, these factors are ignored: that is, avoidance is not allowed for, and it is assumed that all payments are mandatory.

¹² The formal symbols used in this section of the report are those defined in *Potential*, pp. 124–125, section 3.1.7, with the revision of the definitions of **u**, **μ**, **Q** and **V**, described here, and the introduction of the new symbols, **P**, **U**, **R** and **σ**, defined in the *Formal statement of Parity Point methodology*, below.



28. As noted above, “Regulated” products refer to varieties released under variety release procedures, within the ambit of seed quality control regulations, mainly in developing countries. They are assumed to migrate to the category of PVP over time.
29. Non-regulated products account for a small part of the commercial seed market (V), and virtual none of them will have incorporated material received under an SMTA. They attract no payments under any scenario.

The Parity point methodology

FORMAL STATEMENT OF THE PARITY POINT METHODOLOGY

1. The Parity Point is the date, t_p , when the annual payments by the user would be the same, under either Article 6.7 or Article 6.11.
2. Let U be the ratio between the payment level for products under PVP (μ_2) to patented products (μ_1); $U = \mu_2/\mu_1$.
3. U applies in both Article 6.7 and Article 6.11.
4. Let σ be total annual payment due, where $\sigma_{6.7}$ is the total annual payments due in accordance with Article 6.7, and $\sigma_{6.11}$ the total annual payments due under Article 6.11.
5. Let R be a ratio of annual payments due; $R = \sigma_{6.7}/\sigma_{6.11}$.
6. T is that part of a user's product pool, P , that is derived from material received under an SMTA, and obligated to the Treaty, and T/P is ratio of products with payment obligations to total products.
7. By the reference model, t advances by annual increments to the breeding pool, and, in a linked manner, annual increments to the part of T in T/P .
8. Under Article 6.11, *all* products are paid for, so that, for *any* t , $T/P = P$,
9. t_p is reached when, in the projections of the reference model, payment under the two options is equal:

$$[T/P \times \{(\sigma_{6.7}(\mu_1) \times u_1) + (\sigma_{6.7}(\mu_2) \times u_2)\}] = \{(\sigma_{6.11}(\mu_1) \times u_1) + (\sigma_{6.11}(\mu_2) \times u_2)\}.$$
10. On the assumption that all users opt for Article 6.11 *after* Parity Point, the maximum possible income, every year, to the Benefit-sharing Fund is:

$$\sum\{(\sigma_{6.11}(\mu_1) \times u_1) + (\sigma_{6.11}(\mu_2) \times u_2)\}_{tP}.$$
11. On the assumption that all users opt for Article 6.7 *before* Parity Point, the maximum possible income until then, in any specific year, is:

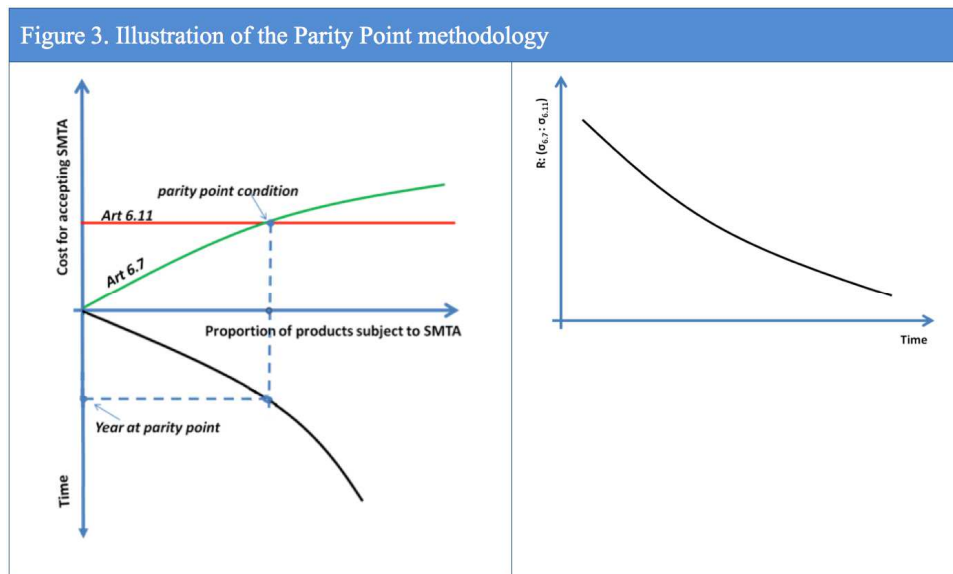
$$\sum[T/P \times \{(\sigma_{6.7}(\mu_1) \times u_1) + (\sigma_{6.7}(\mu_2) \times u_2)\}]_t.$$

30. The Parity Point methodology is based on a simple assumption, namely that recipients are rational cost-minimizers, that is, that their choice of whether to use the Article 6.7 or the Article 6.11 option will be based primarily on its economic advantage, that is the relative cost to them, of the two options.
31. They will base their decision upon two factors:
 - a. The proportion of their products for which they will be obliged, by the terms and conditions of the SMTA, to make payment to the Treaty, and
 - b. The total annual payment that will result.
32. The Parity Point methodology exploits the capacity of the reference model to make projections of income to the Benefit-sharing Fund, at any point in time. The reference model assumes that the proportion of SMTA material in a breeder's breeding pool will increase over time, at a constant rate, and that the proportion of products in the breeder's product pool, for which payments are due, will accordingly increase at a similar rate, at a date distant by the time necessary to breed a product.
33. The major structural difference between the Article 6.7 and the Article 6.11 options is that Article 6.7 payment option requires payment for *individual* commercialized products that have incorporated SMTA materials. The 6.11 payment option, however, requires payment on *all* of a breeder's commercialized products, whether or not they incorporate SMTA materials.
34. As in the current SMTA, it is assumed that, in revisiting the Articles, the Governing Body will set different overall payment levels for the Article 6.7 and 6.11 options.

35. A breeder's economic advantage is therefore governed simply by the two inter-relationship of these two factors, the percentage of his breeding pool obligated to the Treaty, and the different price levels set in the two options, that is:

(Percent of breeding pool obligated to the treaty) \times (the option's payment rates).

36. The Parity point is therefore the date at which the total payments due under the Article 6.7 option equal payments due under the Article 6.11 option. Economic rationality means that the breeder will always opt for Article 6.7 *until* Parity Point is reached, and will always opt for Article 6.11 *after* it is reached.
37. The Article 6.11 payment level, at the Parity Point, therefore defines the maximum potential income to the Benefit-sharing Fund.



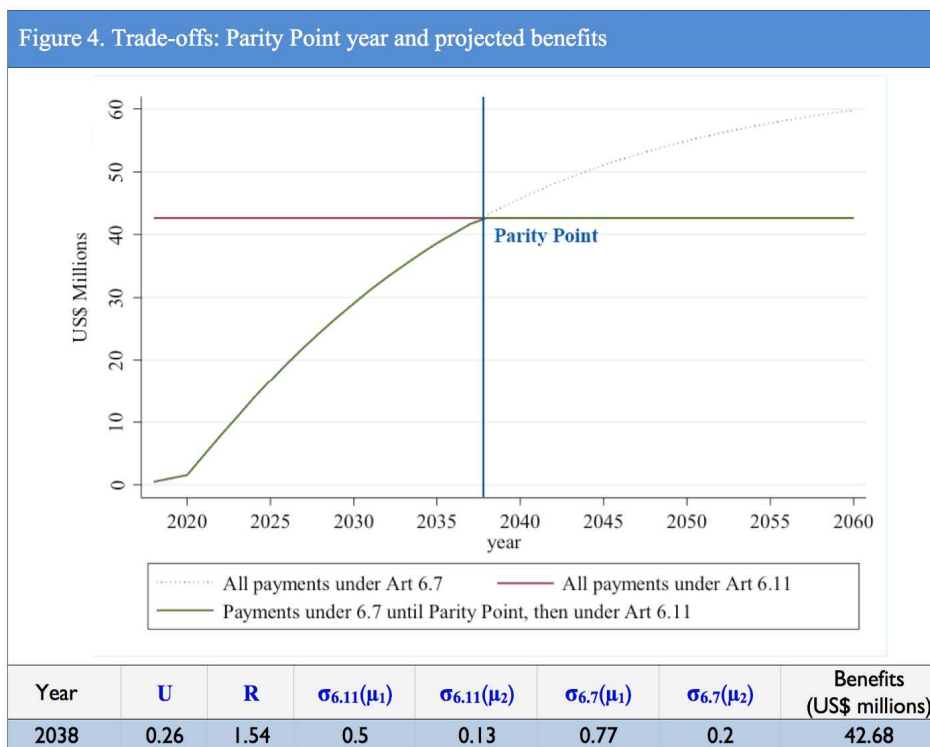
38. Fig. 3 illustrates the Parity Point methodology. The figure on the left shows that Parity Point is reached when Article 6.7 payment intersects with Article 6.11 payment, which defines the Parity Point year (t_p). The figure on the right shows how the Parity Point year responds to the ratio of Article 6.7 obligations to Article 6.11 obligations (R): the more the ratio tilts towards Article 6.7, the sooner the Parity Point year is reached; the more it tilts towards Article 6.11, the longer it takes to reach Parity.

Analysis of the dynamic relationship between Articles 6.7 and 6.11

It vexed me to understand no more from Reeve, ... he understanding the acting part but not one bit of the theory, nor can make anyone understand it.

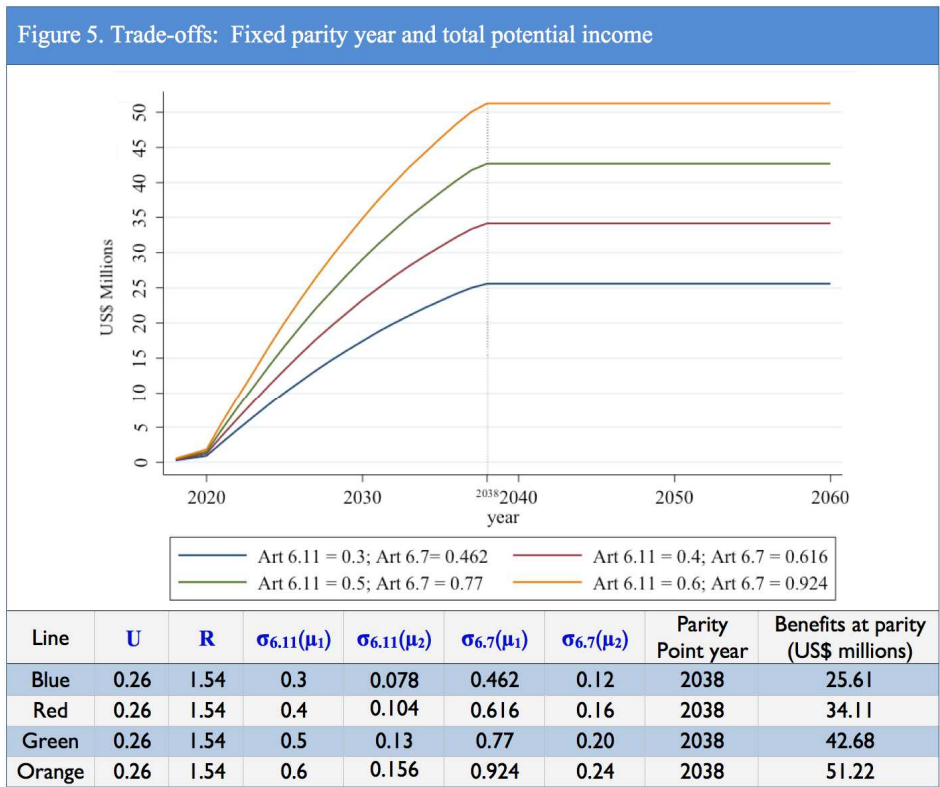
The Diary of Samuel Pepys, Sunday, 19 August, 1666.

39. The dynamics of the inter-relationships between payment rates, Parity Point year, and maximum potential, are complex. Because breeders and seed companies act as rational economic actors, they can be expected to change to Article 6.11 when Parity Point is reached. The level at which the Article 6.11 rate is set therefore defines the total potential income to the Benefit-sharing Fund.
40. Fig. 4 shows Parity Point and projected income, using the parameters shown below the figure. These should not be taken in any way to be recommendations to the Working Group, but are theoretical levels, intended to be held constant in scenarios investigating the dynamics of a dual option payment system. The rate assumed for patents are: in Article 6.7, the current rate of 0.77%, and in Article 6.11, the current rate of 0.5%. There is no precedent on which to base a rate for PVP, and this has been set arbitrarily at: in Article 6.7, 0.20%, and, in Article 6.11, 0.13%. The “projections of income” are totally dependent on the rates assumed, and not estimations of real, expected income. These payment rates correlate to a **U** (patent rate/PVP rate) of 0.26 in both Articles 6.7 and 6.11. They also correlate to an **R** (payment rates in Article 6.7/payment rates in Article 6.11) of 1.54.
41. Parity Point is reached in 2038, and the projected annual income at that year is US\$ 42.68 million. This defines the theoretical maximum, at any later date.

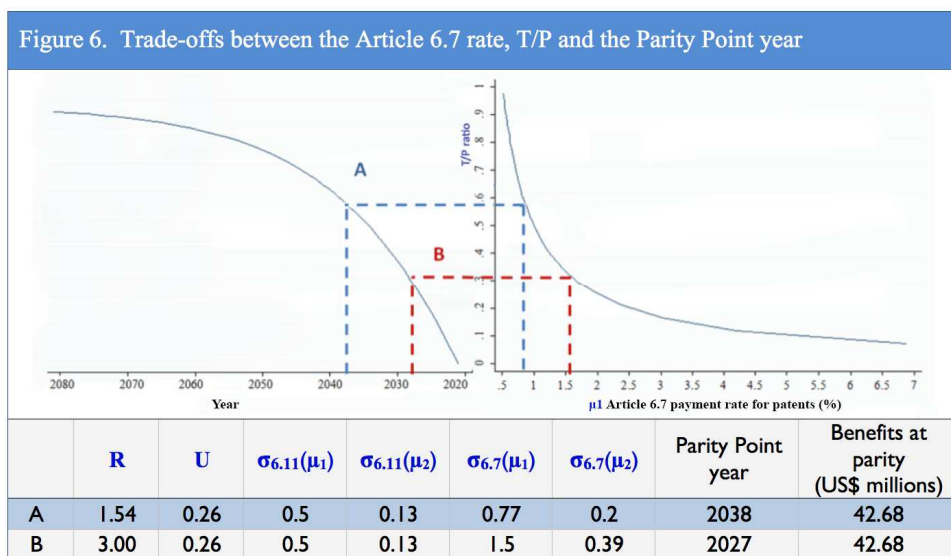


The role of the payment rates in Article 6.11 in defining the theoretical maximum is further shown in fig. 5. The values are the same as in fig. 4 for the two key parameters, **U** (PVP/patent rates) and **R** (Article 6.7/Article 6.11 rates), but the payment rate for Patents under Article 6.11 ($\sigma_{6.11}(\mu_1)$) is given at a range of rates, and, of course, the other payments rates vary accordingly. The effect is clear: the

Parity point year (2038) does not change, but the income rises substantially, in accordance with the total payment obligations.



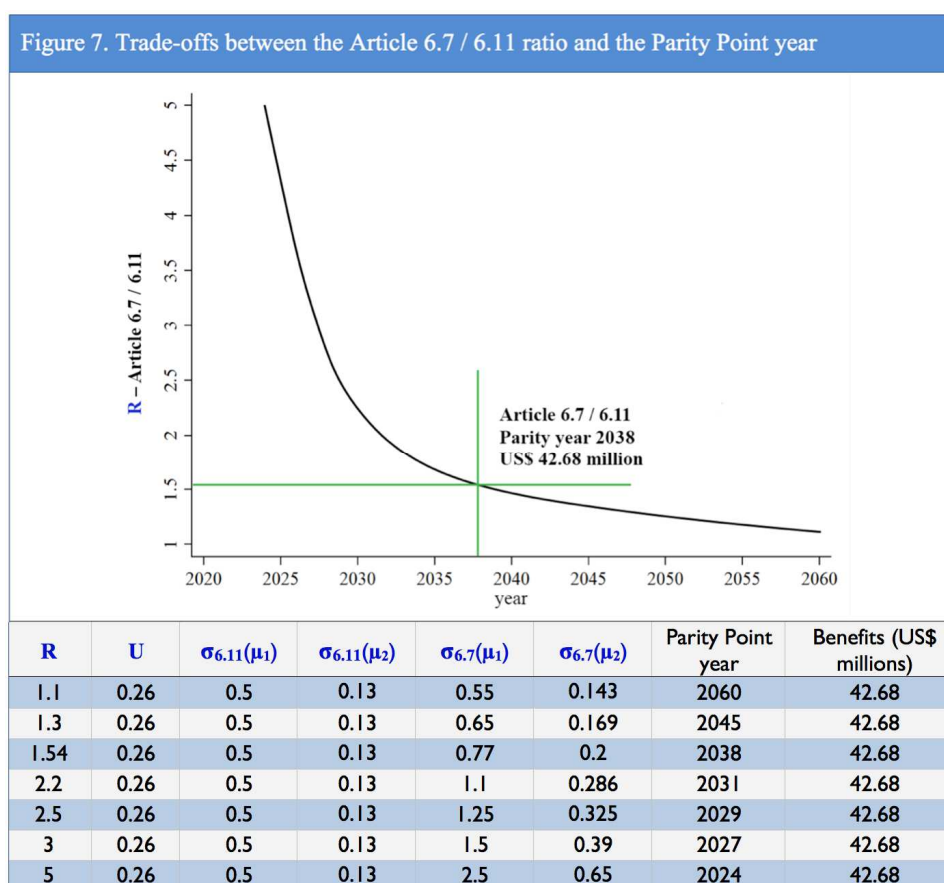
42. Figure 6 shows another set of trade-offs. The curve on the left shows the years to Parity Point for Article 6.7, against **T/P** (the ratio of products derived from SMTA material to total products). The curve on the right plots the Article 6.7 payment rate for patents (μ_1), at Parity Point Year, against **T/P**. The two readings against these curves, A and B, link the Parity Point year on the left, to the Article 6.7 rate for patents on the right. Reading A uses the same parameters as in fig. 4. In reading B, only **R** (the ratio of total payment obligations for Article 6.7 to total payment obligations for Article 6.11) is changed, and nearly doubled.



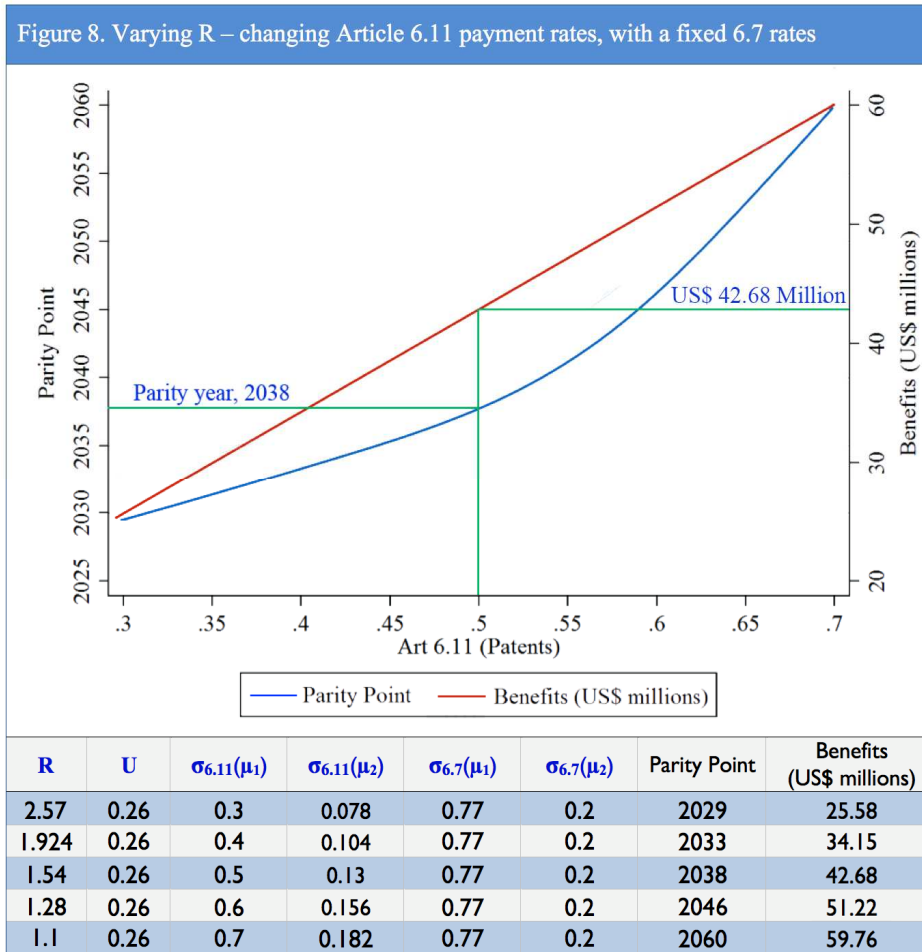
43. There is no change in the theoretical maximum, which remains at US\$ 42.68 million annually, as a consequence of the increase of the relative cost of the 6.7 option over the 6.11 option, but the Parity Point year shifts 11 years closer, from 2038 to 2027. This dynamic is because the higher the

payment differential between Article 6.7 and Article 6.11 (the higher **R**), the smaller is the part of the breeding pool required for parity, and the assumption of the reference model is that SMTA material in the breeding pool accumulates at a steady rate.

44. Fig. 7 plots changes in **R**, the Article 6.7 /6.11 ratio, against the Parity Point year. The parameters are the same as in fig. 4, except that **R** is varied, with the payment rates in Article 6.11 held constant. The figure may be used to estimate **R** at any specific year. The Parity Point indicated corresponds to fig. 4. To bring the Parity Point year much closer requires a substantially higher **R**, which would have to rise to 5, for example, to reach Parity in 2024.



45. As we have seen, the Parity Point year depend upon **R**, the ratio of Article 6.7 payment rates to Article 6.11 payment rates ($\sigma_{6.7}/\sigma_{6.11}$). It is possible also to investigate the effects of holding either $\sigma_{6.11}$ or $\sigma_{6.7}$ constant, and varying the other element of the ratio.
46. Fig. 8 holds the two Article 6.7 payment rates ($\mu_1 + \mu_2$) constant, and varies only the Article 6.11 rates. Two curves are plotted against the x-axis (which is expressed, for simplicity, in terms of the Article 6.11 rate for patents): projected annual benefits are read from the right y-axis, and the Parity Point year from the left y-axis. This is shown here for the same parameters as in fig. 4.

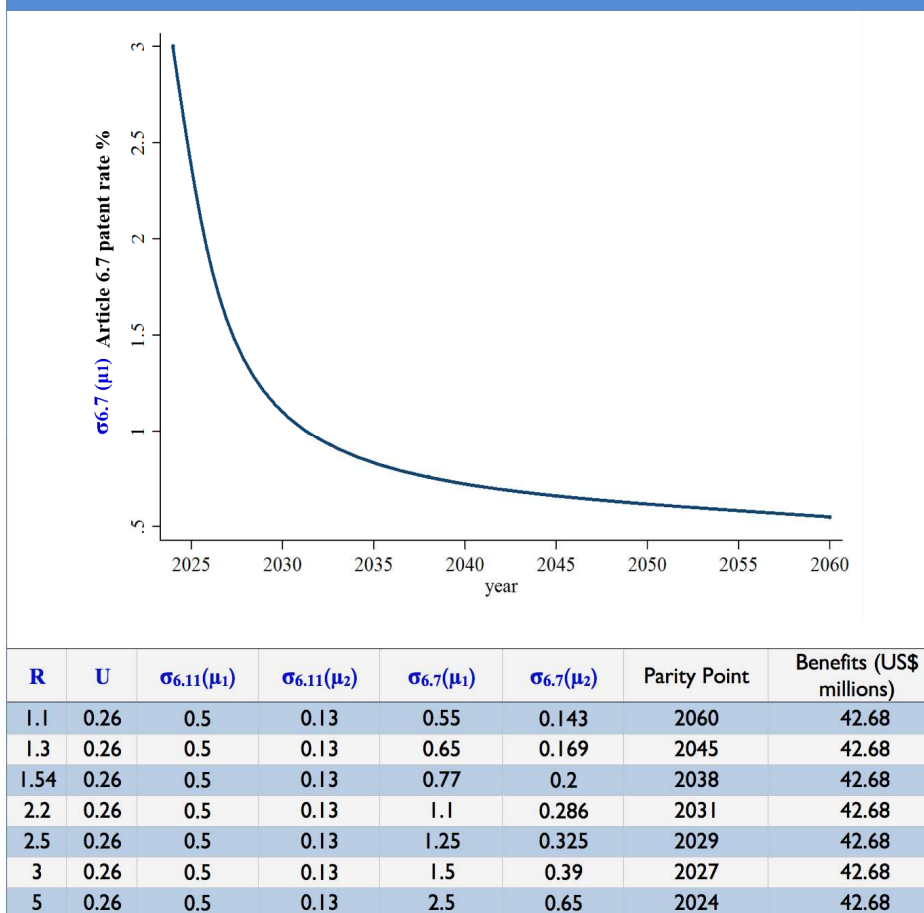


47. There are two consequences:

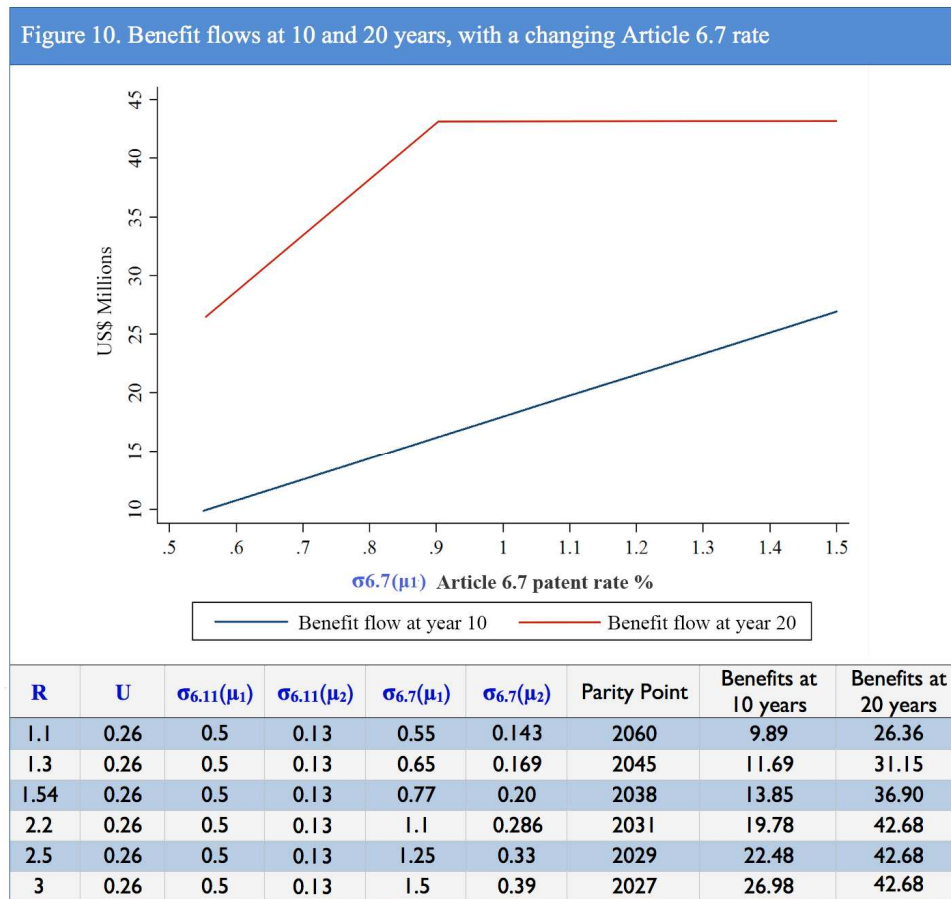
- As demonstrated, the theoretical maximum depends upon the payment rates for Article 6.11, in relation to Article 6.7. The higher this is, the higher the theoretical maximum is. With the Article 6.11 patent rate set to 0.6%, the theoretical maximum annual income is US\$ 51.22 million, while when it is set to 0.7%, this rises to US\$ 59.76 million.
- As also demonstrated, the speed with which Parity Point is reached depends upon the Article 6.7 rates, in relation to the Article 6.11 rates. With the Article 6.7 rates held constant, they become relatively smaller as the Article 6.11 rates increase. With the patent rate for Article 6.11 set to 0.3%, the Parity Point is reached in 2029, while when it is set to 0.6%, Parity Point is reached in 2046.

48. Fig. 9, on the other hand, holds Article 6.11 payment rates, $\sigma_{6.11}(\mu_1 + \mu_2)$, constant, and varies only the Article 6.7 rates, $\sigma_{6.7}(\mu_1 + \mu_2)$. As demonstrated, the rates in Article 6.11 govern the theoretical maximum, and those in Article 6.7 govern the Parity Point year, as shown in the figures below the graph. Until Parity point is reached, however, the maximum probable income is set by Article 6.7, because it is not in a breeder or seed company's interest to choose the Article 6.11 option.

Figure 9. Varying R – changing Article 6.7 rates, with fixed 6.11 rates



49. By holding the Article 6.11 rates constant, and varying the Article 6.7 rates, it is also possible to derive estimates of the rate at which income would build up. This is illustrated in fig. 10, which plots projected income at 10 and at 20 years, against the increase in the Article 6.7 payment rates, with Article 6.11 held constant. For simplicity, the x-axis is expressed in terms of the Article 6.7 rate for patents $\sigma_{6.7}(\mu_1)$. The higher the Article 6.7 rates, the sooner Parity Point is reached, but Article 6.11 rates establishes the theoretical maximum, which peaks at US\$ 42.68 million.



Conclusions regarding the dynamic relationship between Articles 6.7 and 6.11

50. From this analysis, we can draw a number of conclusions regarding the dynamics involved in the SMTA making provision for two different payment options, in Article 6.7 and 6.11.

- Users of SMTA material, as rational economic actors, will decide on which option to accept in terms of the overall cost to them.
- The first factors in their choice derive from the structure of the payment options themselves. The second reflect individual decisions they can make regarding the choice and management of individual SMTA materials. The model deals only with the former, but the latter is the more real and ultimately important.
- The key factor on which decisions will be based is simple: the overall cost to a user depends strictly on how much SMTA material is in his breeding pool, and the price of the two options. These two factors combine as follows:

(Percent of breeding pool obligated to the treaty) \times (the option's payment rates).

- Because Article 6.11 requires payment for *all* of a seed company's products, whereas Article 6.7 lays payment obligations only on products descended from SMTA materials, a rational economic actor can only accept the Article 6.11 option after the cost of payment under Article 6.7 and 6.11 become the same. The point at which this occurs is the "Parity Point". After this point, the Article 6.11 option is cheaper.
- If it is assumed that the percent of SMTA material in the breeding pool grows at a steady rate (the reference model assumes an annual rate of 4.2%)¹³, then it is possible to express the "Parity Point" in terms of time.

¹³

Potential, p. 257.

- f. The dynamic structure of using the two payment options is as follows:
- ii. The rates in Article 6.11 govern the theoretical maximum, because, once reached, this is the cheaper option.
 - iii. The rates in Article 6.7, relative to Article 6.11, govern the Parity Point date.
 - iv. The higher the Article 6.7/6.11 ratio, the sooner the Parity Point arrives. Conversely, the lower the Article 6.7/6.11 ratio, the longer it takes to reach Parity Point.
51. These conclusions relate only to the *structure* of the two-option system, and are independent of real values, which depend on the actual rates stipulated in the SMTA. They have, however, important real world implications.
- a. Breeders and seed companies have many ways to avoid reaching a high percentage of SMTA material in their breeding pool, which — at any reasonable payment rates in Article 6.7 — means they will never move to finding Article 6.11 cheaper:
 - ii. They can avoid use of material under an SMTA altogether, or, more likely, can take only a few materials under SMTAs, when they judge these to be especially valuable to their breeding programme, and when they cannot get them elsewhere.
 - iii. They can segregate materials received under SMTAs within their breeding programmes, so that only a small number of their products — where there is an real economic advantage — have ancestors received under SMTAs. Discussions with companies during this study confirm that this is already the case.
 - b. In these circumstances, the Governing Body, if it wishes to make the Article 6.11 option the default option, could consider radically increasing the Article 6.7/6.11 ratio — that is, decreasing the percentage of a breeding pool that is needed to trigger a user's decision to move to the Article 6.11 option — in one of four ways:
 - ii. It could drastically raise the relative cost of the Article 6.7 option, but if this is raised too high, it will seriously reduce a company's economic ability to use SMTA material at all. Moreover, the higher the relative rates for Article 6.7 are set, the lower will be the theoretical maximum.
 - iii. It could drastically reduce the relative cost of the Article 6.11 option, but this would result in risible income for the Benefit-sharing Fund.
 - iv. Or it could try to vary the rates in both options, and in the process increase the spread between the two payment rates. This is unlikely to be effective, because of the real world ability to avoid, or segregate the use of, SMTA material.
 - v. It might offer only an Article 6.11 option, but this would probably lead to users accepting no SMTA materials at all, as they would be required to pay on *all* their products, even when few descended from SMTA materials. This would create a structural disincentive to introducing SMTA materials into their breeding pool, particularly when they had, as yet, a limited number.
52. The inevitable conclusion of the dynamic analysis is that it would be extremely difficult to create an effective balance of Article 6.7 and 6.11 options, such that the Article 6.11 option can be the default option, by structural economic incentives alone.

Policy modifications of the Parity Point

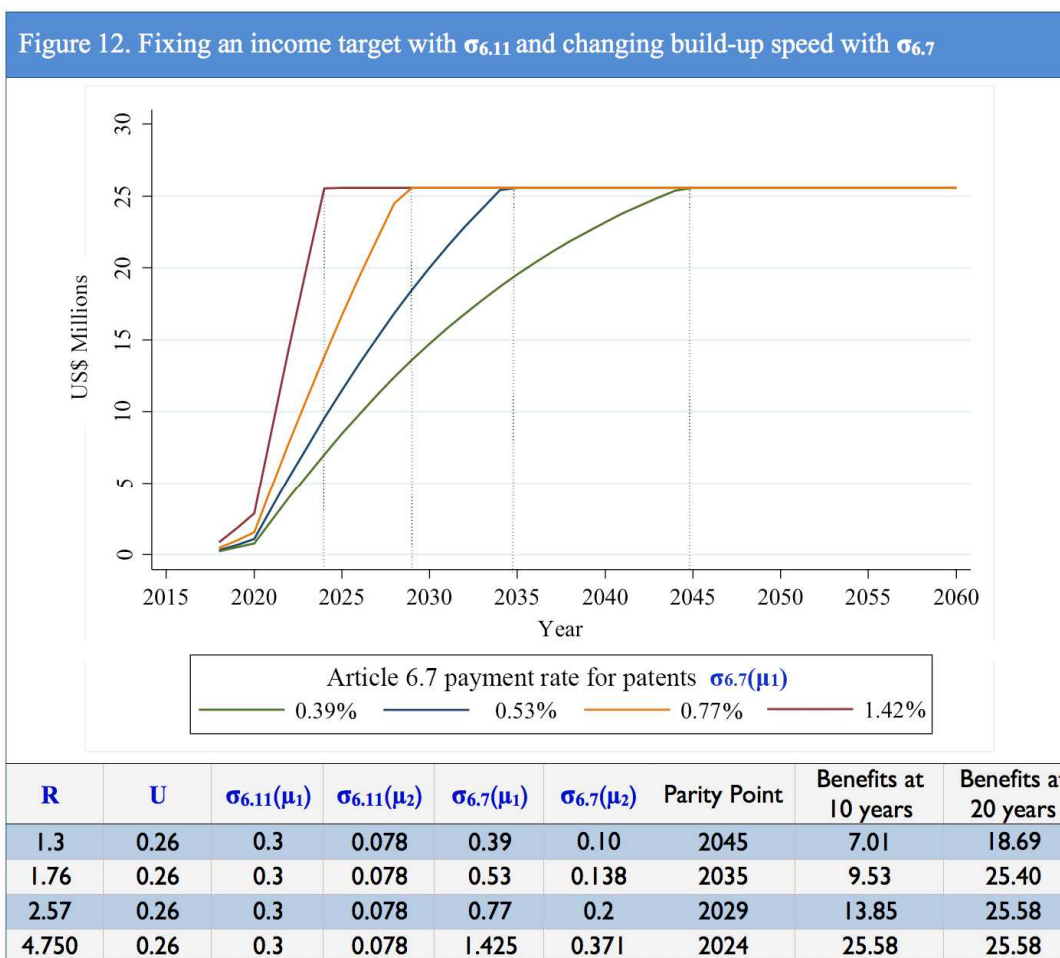
53. Fig. 11 demonstrates the way the Parity Point Methodology can be used to establish parameters for **R** (the ratio of Article 6.7 rates to Article 6.11 rates), in order to realize a specific theoretical maximum income, on the basis of specific payment rates. Since Article 6.11 governs the

theoretical maximum, a number of Article 6.11 rates are offered, in the row entitled “Article 6.11 rates”, which generate different incomes. **U** (the ratio of PVP to Patent rates) is constant at 0.5. From each choice of 6.11 rates, a theoretical maximum follows, and these are listed in the row entitled “Benefit flow at Parity Point”. A variety of values of **R** are given in the relevant column, which govern the rates, in Article 6.7, which patents and PVP would need to pay. **R** also governs the Parity Point year.

Figure 11. Parity Point, Article 6.11/6.7, patent and PVP rates, and income to the Treaty

Article 6.11 rates	Patent	0.5	0.4	0.3	0.2	0.1	
	PVP	0.25	0.2	0.15	0.1	0.05	
Parity Point Year	R	Art 6.7 patent rate					Art 6.7 PVP rate
		2.375	1.900	1.425	0.950	0.475	
2025	4.75	1.188	0.950	0.713	0.475	0.238	
2035	1.79	0.895	0.716	0.537	0.358	0.179	
		0.448	0.358	0.269	0.179	0.090	
2046	1.30	0.650	0.520	0.390	0.260	0.130	
		0.325	0.260	0.195	0.130	0.065	
2056	1.15	0.575	0.460	0.345	0.230	0.115	
		0.288	0.230	0.173	0.115	0.058	
2066	1.08	0.540	0.432	0.324	0.216	0.108	
		0.270	0.216	0.162	0.108	0.054	
2075	1.05	0.525	0.420	0.315	0.210	0.105	
		0.263	0.210	0.158	0.105	0.053	
Benefit flow at Parity Point (\$ Million)		49.19	39.35	29.51	19.68	9.84	

54. For example, if patent and PVP rates in Article 6.11 are established at 0.3% and 0.15%, respectively, the theoretical maximum will be US\$ 29.51 million. To reach this in 2035 — in other words, in 21 years — it would be necessary to set the patent rate at 0.537% and the PVP rate at 0.269%.
55. Fig. 12 demonstrates the way in which, instead, a target may be established, and the Parity Point date varied. With the Article 6.11 rates held constant — which governs the theoretical maximum — varying **R** changes both the Parity Point year, and the speed of build-up of income.

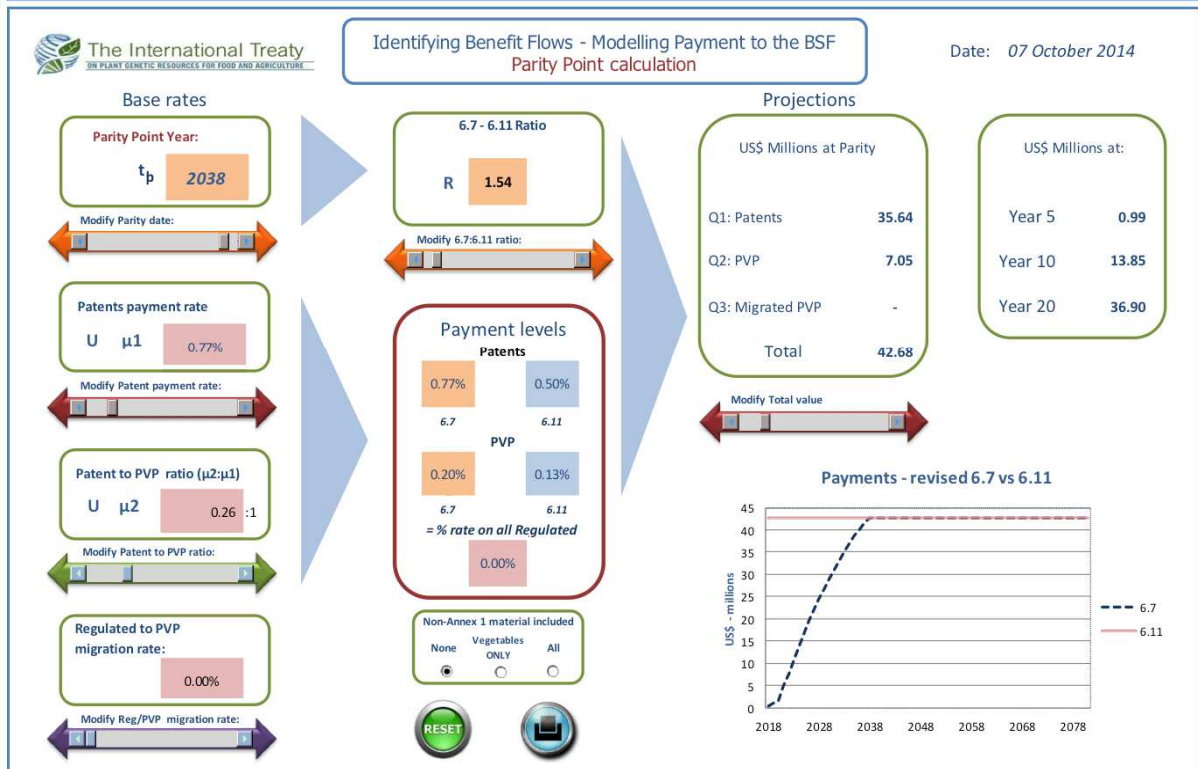


56. It is important to note that there is no reason for the Governing Body to establish rates for Articles 6.7 and 6.11 in accordance with the Parity Point methodology, which is an analytical tool only. It may, however, provide a starting point from which to consider setting rates, on the basis of policy objectives, for example, to create an incentive or a disincentive for one or other of the options. This could be done respecting the Parity Point, or arbitrarily.

Using the “New Interface” to the Computer Model

57. A “New Interface” to the reference model was prepared, which makes it possible to vary the various parameters of the Parity Point analysis independently, and to set and test the effect of different payment rates. The elements and the lay-out of the New Interface are shown in fig.13. This was the tool used to develop the analysis presented here.

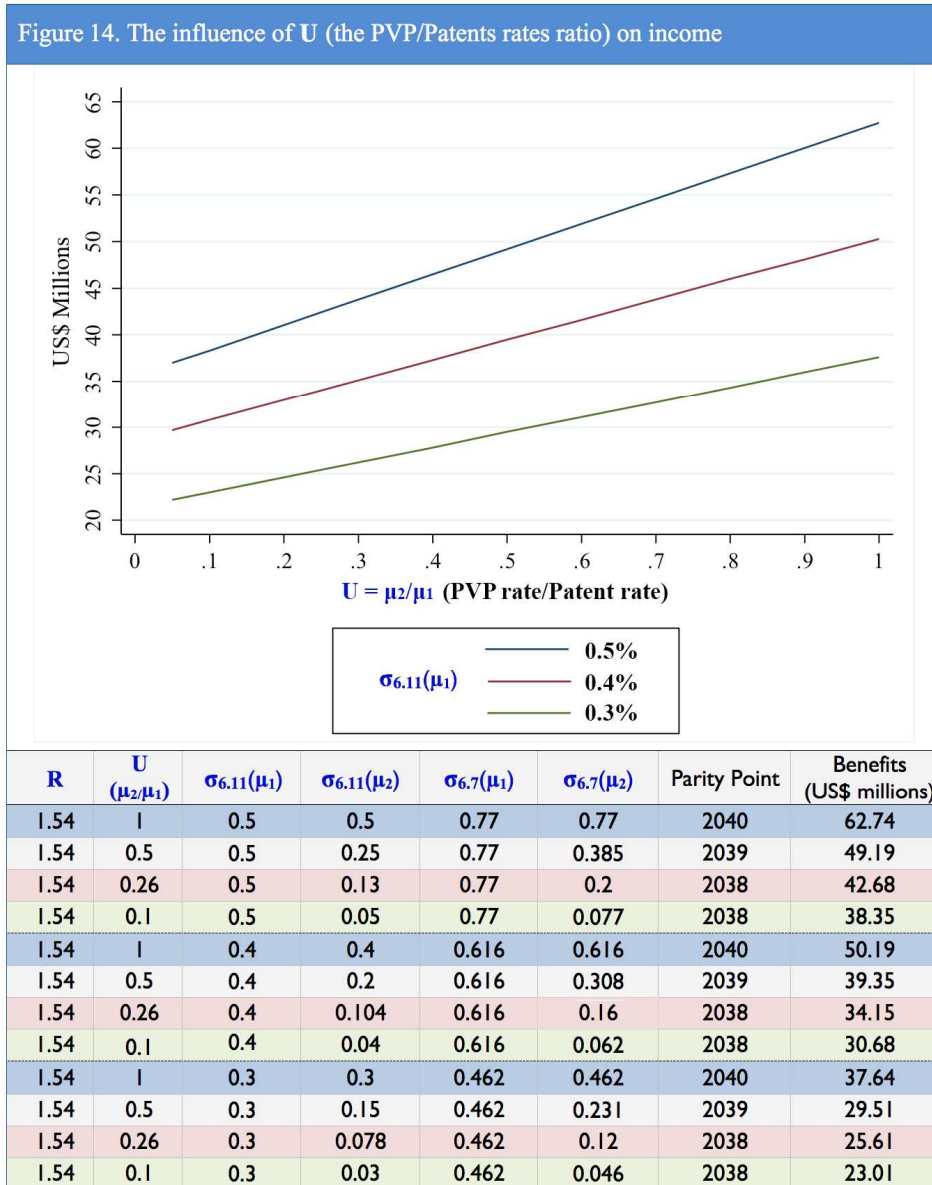
Figure 13. The “New Interface”



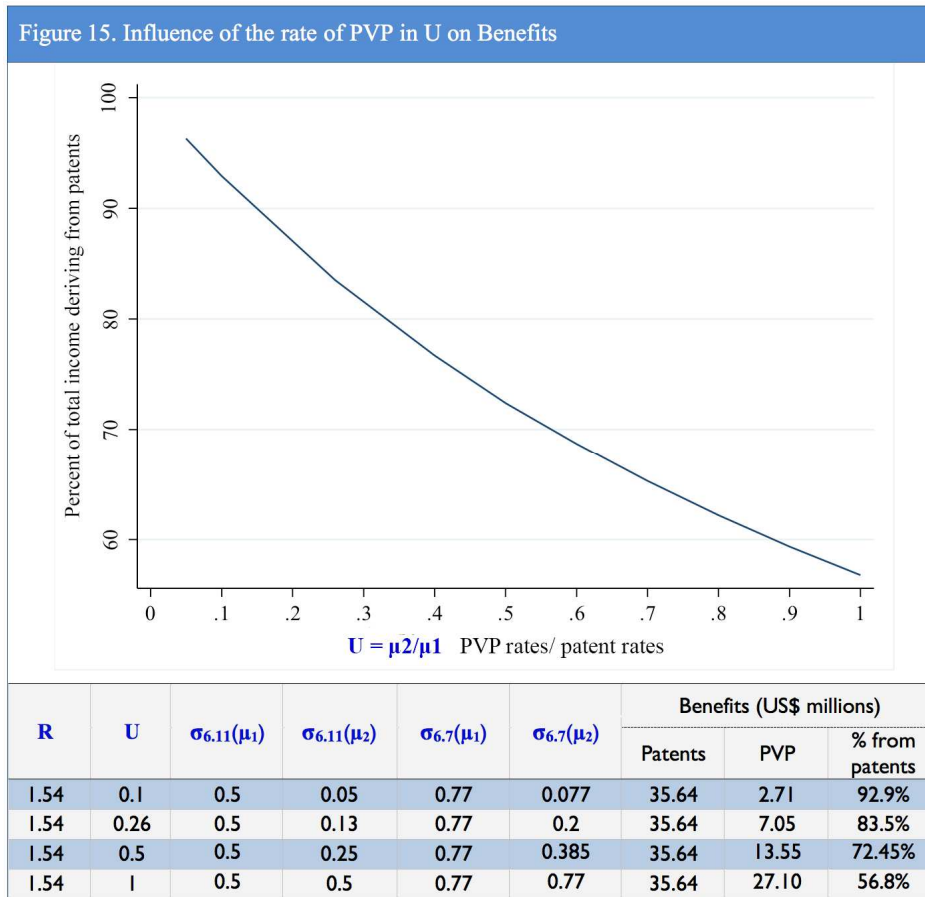
58. The New Interface may be accessed at <http://www.planttreaty.org/content/background-study-paper-1>, and used to test the effects of varying parameters and values. It is hoped that this will provide the Working Group with a flexible instrument to use in its further work.
59. It must once again be stressed that a model is not an estimation of real world values, but an analytical tool. The reference model involves a large number of assumptions, though no major new structural assumptions have been added in developing the New Interface, beyond those regarding the possible structure of revisited Articles 6.7 and 6.11, which were needed in order to make a coherent model.
60. The New Interface is initially set to Parity Point at the parameters used in fig. 4, as in the illustration, and it is possible to return to these, at any time, with the “reset” button.
61. The values of the individual items of the Parity Point status may be changed with the “sliders” under the individual components, which in turn recalculate the other values.
- The payment rates may be varied: the patents rate (μ_1) may be varied directly, and the PVP rate — which is locked, as a ratio (U), to the PVP rate (μ_2) — may be then varied by varying U .
 - The ratio of Article 6.7/6.11 payment rates (R), and the Parity Point year (t_p), may both be varied separately.
 - The payment rates in both Articles 6.7 and 6.11 that result appear in the box, “Payment Levels”.
 - The buttons in the box, “Non-Annex 1 material included”, will add either vegetables only, or all non-Annex 1 material, to the analysis.
 - The possible migration of Regulated materials to PVP may be tested by the slider below the relevant box: this adds a percent of the World’s Regulated products to the calculations, at PVP rates, and, for comparison, the equivalence of a payment rate on all regulated products is shown.

- f. Projections at parity are broken down by IP, and projections at years 5, 10 and 20 are given. The total income may then be varied with the slider.
- g. A graph shows the rate of increase of income under the Article 6.7 option, until the theoretical maximum deriving from the Article 6.11 rates is reached.

Projections of possible income from the revisited Articles 6.7 and 6.11



- 62. Fig. 14 shows the potential the relative importance of materials sold under PVP in the potential income flow. In the graph, three projection are given, where the rate for patents is constant, and **U** is varied, which varies the relative rates for PVP accordingly. In the figures below the box, the difference between **U** at 0.1 and 1, in each projection, shows the relative importance of PVP in total income.
- 63. Fig. 15 plots the percent of potential income that could derive from patents. The rates for PVP are constant, and **U** is varied, to create different rate for patents. 56.8% of potential income would come from products marketed under patents, if the rates for parents and PVP were the same (**U = 1**).



64. Fig. 16 gives a picture of total potential income, with the same parameters as in fig. 4, by crop/crop group, with vegetable crops specifically identified, both those currently in Treaty *Annex 1*, and those not currently included, as well as other non-*Annex 1* crops. As vegetable breeders have consistently pointed out, during discussions with members of the industry in the preparation of this study, vegetable crops are sorely under-represented in *Annex 1*, which limits their potential contribution to benefits. Moreover, vegetable breeders are not able to benefit from the facilitated access provided by the Treaty, and the legal certainty provided by use of the SMTA, which is becoming increasingly important, as the *Nagoya Protocol to the Convention on Biological Diversity, on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization* is translated into national implementing legislation and regulations. As was also pointed out in these discussions, vegetable breeding enjoys a higher profit margin than most of the seed industry, and vegetable breeders are accordingly the most anxious to see the rapid extension of the crop coverage of the Treaty, and the best placed to be able make effective contributions to the Benefit-sharing Fund.
65. Vegetable crops currently not in *Annex 1* represent 28% of the total potential value of non-*Annex 1* crops/crop groups.
66. As is immediately evident, maize marketed under patents represents by far the largest potential income. The huge imbalance of potential income towards patented maize is a structural problem in the workings of the Treaty's benefit-sharing system, because it creates a strong incentive to avoid the use of maize under SMTAs, which drastically reduces potential income. Patented products account for 66% of the potential income from crops/crop groups not currently in *Annex 1* (oil seeds, soya, etc.)

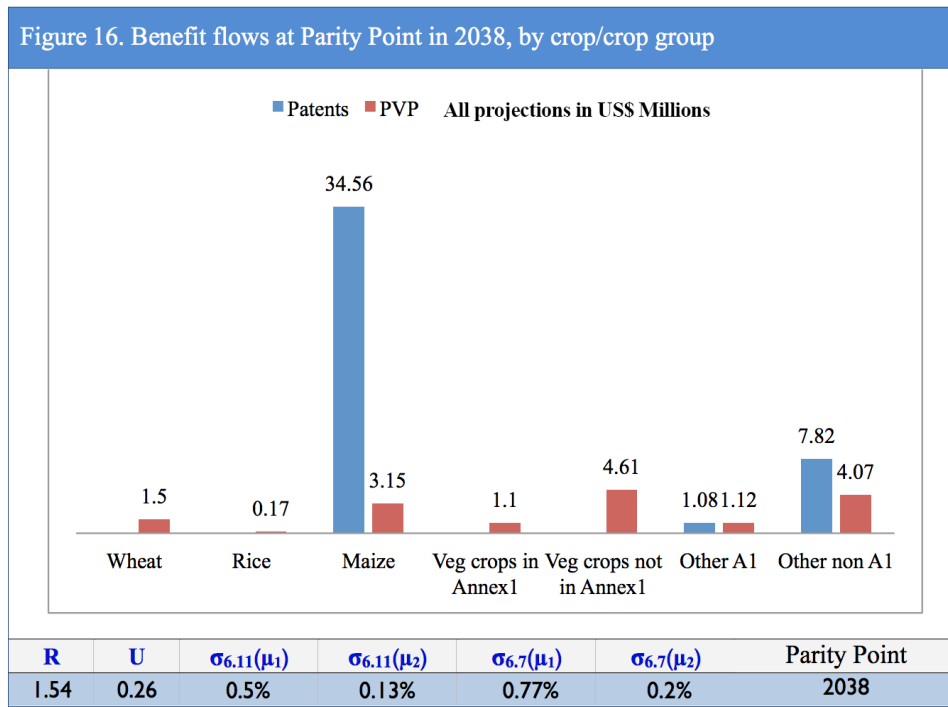
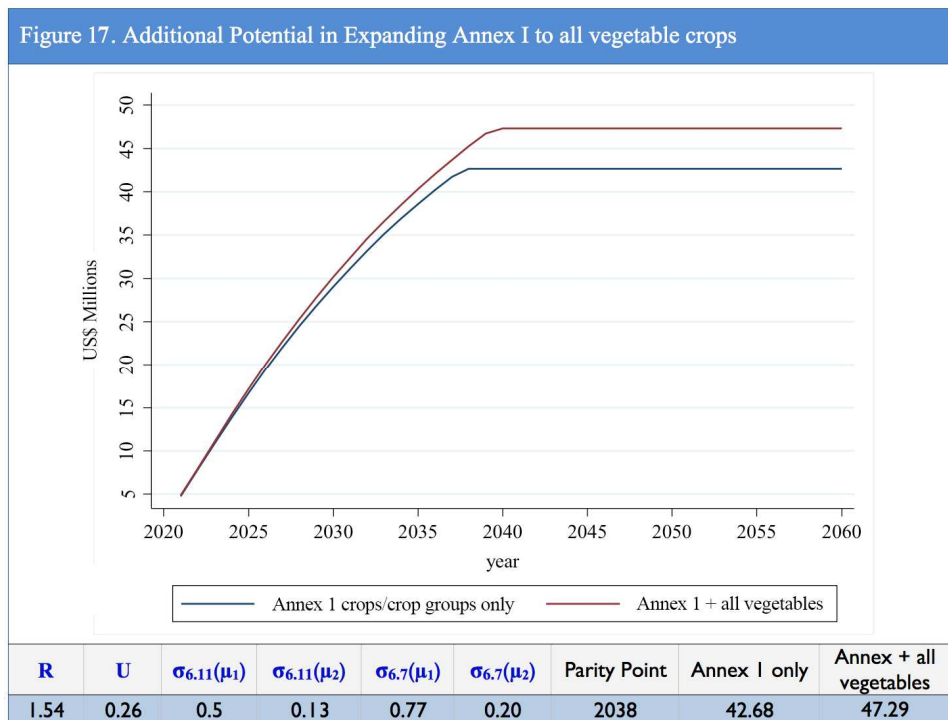


Fig. 17 provides a picture of the possible build-up of income projections, over time, using the same parameters as in fig. 4, both without the expansion of *Annex 1*, and with the inclusion in *Annex 1* of all vegetable crops not currently included. As vegetable seeds and planting materials are not marketed to a significant extent under patent protection, by far the larger part of this potential comes from PVP.



67. In the preparation of the new interface, Regulated products were specifically identified, because the obligations of members of the World Trade Organization to provide intellectual property protection for seeds and planting materials, and the increasing growth of markets and market sophistication in developing countries and emerging economies, will over time lead to a considerable portion of Regulated products passing to commercialization under ~~broken~~. The total potential of Regulated products, assessed on the same parameters as in fig. 4, is some US\$

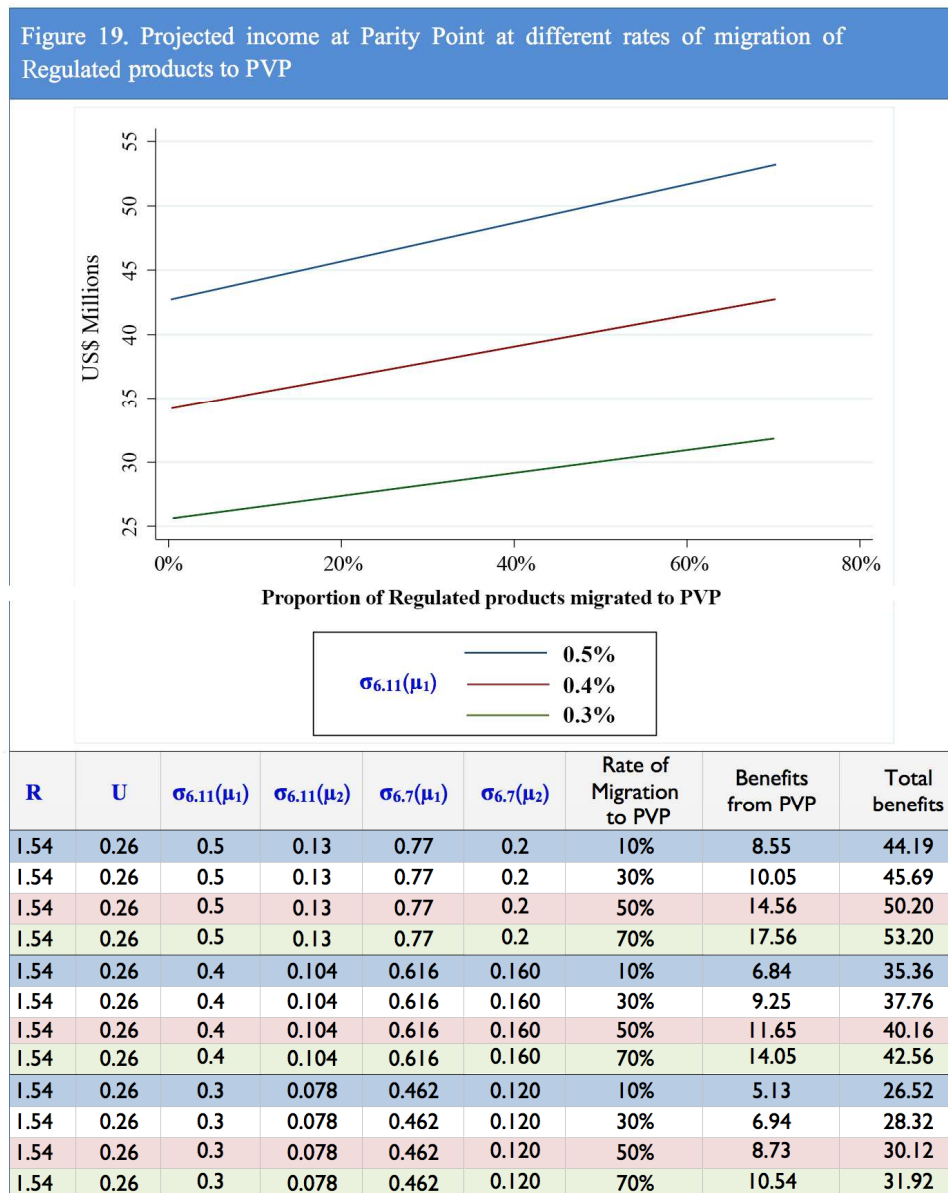
15.02 million annually, at Parity Point in 2038. The break-up of this potential by crops/crop groups is shown in fig. 18.

Figure 18. Maximum potential of Regulated Products at Parity Point (US\$ Millions annually), at 100% migration

Wheat	Rice	Maize	Annex I Vegetables	Non-Annex I Vegetables	Other Annex I	Other Non-Annex I	Total Annex I
3.49	3.22	3.62	0.47	1.97	4.21	14.23	15.02

R	U	$\sigma_{6.11}(\mu_1)$	$\sigma_{6.11}(\mu_2)$	Parity Point
1.54	0.26	0.5	0.13	2038

Fig. 19 assumes that *all* Regulated products will have migrated to PVP by that date, which is, of course, very improbable. Fig. 19 accordingly plots the potential contribution of Regulated products to PVP, at migration rates of 10%, 30%, 50% and 70%. Four different sets of rates are graphed, with the Article 6.11 PVP rate set at 0.3%, 0.4% and 0.5%, $U = 0.26$, and $R = 1.54$.



68. The various projections made in the previous discussions are based on relatively high payment rates. Fig. 20, constructed with the same methodology as fig. 11, accordingly presents a range of potential incomes, with the aim of more closely approximating to the real world. Even these projections, it must be stressed, are theoretical, and certain to be far too optimistic, for a number of reasons:
- The model assumes that all Contracting Parties have already made all their *ex situ* holdings available, and as the *Appendix to The current status of the Multilateral System of Access and Benefit-sharing*,¹⁴ shows, this is not the case. The projection must therefore be discounted by this factor. Every delay in making material effectively available also pushes potential benefits further forward in time.
 - The model also makes no allowance for avoidance of SMTA material, while it is clear, and corroborated by discussions with members of the industry, and the results of the simulation exercise,¹⁵ that users have been avoiding SMTA materials, when they are breeding for a product that is to be marketed under patent protection. They have been using materials in cases, where, in accordance with the current SMTA, only *voluntary* contributions are foreseen, and none have been made.¹⁶ If mandatory payment is now extended to PVP, it is likely that the level of avoidance of SMTA materials will rise substantially, particularly when, as is often the case, alternative sources of materials are available. The projections should be further discounted to allow for this.
69. The values given in fig. 20 are maximum potentials at Parity Point in 2038. In the first row of projections, no payment is made for PVP. Potential benefit flows are projected at between US\$ 7.16 and 35.63 million annually, at a rate for patents of between 0.1% and 0.5%. With PVP paying at half the rate of patents, the projections are between US\$ 9.84 and US\$ 49.19 million annually. With patents paying at the same rate as PVP, the projections are US\$ 12.55 to 62.74 million annually.

Figure 20. Article 6.11 rates: Maximum potential at Parity Point (US\$ Million), at different U						
Patent	at U = 0	0.5	0.4	0.3	0.2	0.1
PVP		0	0	0	0	0
US\$ Millions		35.64	28.51	21.38	14.26	7.13
Patent	at U = 0.5	0.5	0.4	0.3	0.2	0.1
PVP		0.25	0.2	0.15	0.1	0.05
US\$ Millions		49.19	39.35	29.51	19.68	9.84
Patent	at U = 1	0.5	0.4	0.3	0.2	0.1
PVP		0.5	0.4	0.3	0.2	0.1
US\$ Millions		62.74	50.19	37.64	25.09	12.55

¹⁴ IT/OWG-EFMLS-2/14/inf.3, <http://www.planttreaty.org/content/background-study-paper-1>.

¹⁵ *Preferences and Behaviour*.

¹⁶ These factors are discussed in more detail in paragraphs 31–47 of *Background*.

70. The projections made in the new analysis are substantially lower than those in *Potential*, when allowance is made for the fact that the calculations in this paper have been made from a higher estimate for the world seed market (*Potential* estimated it at US\$ 36.8 billion annually,¹⁷ whereas the calculations new analysis assumes a market worth US\$ 44.8 billion).¹⁸ Moreover, the increased membership of the Treaty, and the fuller information on material available have been taken into account.

71. With these provisos, a number of observations may be made:

- a. Under the current SMTA, Article 6.7 provides for mandatory payments, effectively only for products marketed under patents, and Article 6.8 foresees voluntary payments. The figures from *Potential*, for voluntary payment are based on a notional rate equal to the rate for mandatory payment, that is, 0.77%. In the case of the revisited Article 6.7 and 6.11, however, the basis of voluntary payments fall away, leaving a substantially lower set of material with obligations to pay.
- b. Nonetheless, the projected income from patents is higher in the new analysis than in *Potential* (where all mandatory payment derived from patents), despite the effect of the Article 6.11 PVP rate capping the theoretical maximum at Parity Point.
- c. It should be stressed that, though the potential migration of Regulated products to PVP may to some extent compensate for the loss of “voluntary” payments, this is a very long-term possibility, that does not add to income for many years.

Figure 21. Projections of potential income at 2081, by <i>Potential</i> and the new analysis						
Potential, p. 143, tab. 3.4				US\$ Millions annually		
Mandatory only				23.0		
Mandatory + 33% Voluntary				47.0		
Mandatory + 66% Voluntary				69.0		
Mandatory + 100% Voluntary				97.0		
New Analysis						
Patents				35.6		
PVP				7.0		
				42.6		
				US\$ Millions		
+ 10% Migration of Regulated		1.5		44.1		
+ 30% Migration of Regulated		4.5		47.1		
+ 50% Migration of Regulated		7.5		50.1		
+ 70% Migration of Regulated		10.5		53.1		
+ 100% Migration of Regulated		15.0		57.6		
New Analysis	R	U	$\sigma_{6.11}(\mu_1)$	$\sigma_{6.11}(\mu_2)$	$\sigma_{6.7}(\mu_1)$	$\sigma_{6.7}(\mu_2)$
	1.54	0.26	0.5%	0.13%	0.77%	0.2%

72. It is important to stress, once more, that these are theoretical, maximum projections only, and that, when real world factors are considered, the actual sums that it may be possible to mobilise are likely to be considerably lower.

¹⁷ *Potential*, p. 76.

¹⁸ This estimate of the world seed market was prepared on the basis of FAOSTAT data, in the context of the parallel study, *Innovative approaches for enhancing the flow of funds into the Benefit-sharing Fund of the International Treaty on Plant Genetic Resources for Food and Agriculture: An evaluation of options*, which forms the basis of the next section of this paper, and will hereinafter be referred to as *Static*.

4.1.3 EVALUATION OF INNOVATIVE OPTIONS : ASSESSING POTENTIAL INCOME FLOWS IN THE CURRENT GLOBAL SEED MARKET

73. Apart from the *dynamic* analysis of potential benefit flows and the interrelation of Articles 6.7 and 6.11, Study 1 also includes an examination of the potential income flows into the Benefit-sharing Fund from a *static* perspective. This analysis is based on the *current structure of the seed industry* in developed and developing countries, as well as *current levels of innovation* in different crops.
74. Plant breeding is a dynamic process and its sequential effects are captured in the dynamic analysis presented above, projecting future use of SMTA materials. The static analysis, presented in this section in a summary form,¹⁹ reflects the potential for payments based on the current state of plant variety innovation and the global seed market.

Static Analysis Methodology

75. In order to assess the potential flow of revenue into the Benefit-sharing from a static perspective, the following steps were undertaken:
- a. The size of national seed markets for *Annex 1* crops, and four key non-*Annex 1* crops, was determined and further broken up into the commercial markets for three intellectual property categories: patented varieties, varieties under PVP, and non-protected, regulated varieties;
 - b. The value of the national seed markets for *Annex 1* crops, and four key non-*Annex 1* crops, was estimated;
 - c. The share of products incorporating materials under SMTA conditions in different national markets was assessed to derive the payment obligations under the SMTA;
 - d. The potential flow of revenue to the Benefit-sharing Fund was calculated under different scenarios, using different payment rates for different intellectual property categories.
76. Before the results of the static analysis will be presented and discussed in the next section, each methodological step will be briefly considered in turn.

SIZE OF COMMERCIAL SEED MARKET

77. Variety-level information on commercial seed markets, critical for this analysis, is generally unavailable. Given these data constraints, this analysis uses figures from FAOSTAT, the largest and most comprehensive database of country and global level agricultural statistics available. The analysis is based on figures from 2011, the most recent year for which country level data for most *Annex 1* crops were fully available.
78. For each crop included in the analysis,²⁰ data were extracted from FAOSTAT on area harvested, crop production, yield and seed use for the top 30 producing countries of each crop²¹. These top 30

¹⁹ Readers are encouraged to consult the full research study report, *Innovative approaches for enhancing the flow of funds into the Benefit-sharing Fund of the International Treaty on Plant Genetic Resources for Food and Agriculture: An evaluation of options*, online at <http://www.planttreaty.org/content/background-study-paper-1>. It is here referred to as *Static*.

²⁰ Some *Annex 1* crops had to be excluded from the analysis, as FAOSTAT data for them was insufficient. Breadfruit (*Artocarpus*), forages and horticultural crops are hence not included in this analysis. Moreover, it has been assumed that there is no commercial seed or planting material market for the root and tuber crops cassava, yams, and taro.

²¹ The rationale for including only the top 30 producers of each crop in the analysis was that no significant payments into the BSF could be expected from entities in contracting parties that were only minor producers of a crop. Top 30 producers were selected from all countries covered in FAOSTAT including those which are not currently members of the International Treaty. The rationale for this was that SMTA-users in non-contracting parties are also bound by payment obligations to the Benefit-sharing Fund. For instance a seed company in the US (a non-contracting party) that accesses material under an SMTA would be bound by payment obligations.

countries were classified as developed and developing countries based on the World Bank classification.

79. First, the size of the commercial seed market for each crop in each country was derived from 'seed use' data in FAOSTAT. 'Seed use' data reflects the total seed used for a crop, including farm-saved seed. However, *total seed use* is not a good indicator for *commercial seed use* as farm-saved seed can account for a large portion of total seed use. The size of the commercial seed market in each crop and country was hence derived from FAOSTAT 'seed use' data by using the Seed Replacement Rate (SRR) parameter. The SRR represents the proportion of total seed use which is purchased in the market rather than saved on farm – it is the proportion of seed that is “replaced” through bought-in seed. SRRs vary over a wide range across crops and countries, with SRRs being significantly higher in developed countries in relation to developing countries. Fig. 22 shows the SRRs used in the present analysis.

Figure 22. Seed Replacement Rates Used²²

	Developed Countries	Developing Countries
Patented Varieties	100%	80%
Non-patented Varieties	60%	20%

80. The commercial seed market for each crop and country was further broken up into:
- Commercial seed market for patented varieties.
 - Commercial seed market for varieties under PVP.
 - Commercial seed market for regulated varieties.
81. In order to do so, it was assumed that only genetically modified varieties, developed through the application of biotechnology, are protected by patents, and furthermore that such patents are currently only available in a small number of countries. Values were estimated by using data available on genetically modified varieties (from ISAAA), and well-founded assumptions on PVP use in developed and developing countries (100% and 10% of non-GM varieties respectively). It was assumed that regulated materials make up the part of the commercial seed market that is not covered by patents nor PVP.
82. While non-protected, non-regulated materials may be transacted in village markets, rural seed exchanges, farmer-to-farmer exchange, and may form an important part of overall seed use of the crop, they are not part of the commercial seed market, and have therefore not been assigned any value in this analysis.
83. Fig. 23 summarizes the ratios of different product categories, by intellectual property status, for the main crop categories studies here.²³

Figure 23. Intellectual Property Status (ratio)

	Wheat	Rice	Maize	Annex 1 vegetables	Annex 1 other crops	Non-Annex 1 vegetables	Non-Annex 1 other crops
Patents	0%	0%	57%	0%	5%	0%	10%
PVP	30%	5%	20%	70%	20%	70%	20%
Regulated	70%	95%	23%	30%	75%	30%	70%

²² Values taken from Table 2 of *Static*.

²³ Figure 23 also undergirds the dynamic analysis of the parity point, and especially Figs. 16 and 18 above.

VALUE OF COMMERCIAL SEED MARKET

84. As the market price of seed is largely unavailable, the value of commercial seed use was derived by using the Seed Price Factor (SPF) parameter which links the price of seed of any crop to this crop's price as a commodity on the market. The SPF expresses seed price for a crop as a multiple of the prevailing price of that crop as a commodity. For example, if a tonne of wheat costs US\$ 200, and the average price of wheat seed is US\$ 400 per tonne, the SPF is 2. The SPFs used in this study are in figs. 24 and 25.

Figure 24. Seed Price Factor²⁴

	Seed Price Factor for all crops, except vegetable crops
Patented Varieties	4
PVP varieties	2.5
Non-protected (regulated) Varieties	2

85. SPF values for vegetable crops are of entirely different order of magnitude than the values of fig. 24, as seed prices by weight are often several hundred times higher than commodity prices. Values were estimated by examining seed use rates per hectare, the seeds per gram and bulk seed prices in developed country markets.

Figure 25. Seed Price Factors for Annex 1 Vegetable Crops²⁵

	Asparagus	Beet	Carrots	Cabbage	Eggplant
Patented Varieties	96	1600	160	160	240
PVP Varieties	60	1000	100	100	160
Regulated Varieties	48	800	80	80	120

86. The values of the commercial seed market, derived by application of the SPF on the market size, are presented, by crop, in fig. 26.

²⁴ Cf. p. 20, *Static*.

²⁵ Table 3, *Static*.

Figure 26. Value of Commercial Seed of Annex 1 and Major Non-Annex 1 Crops (US\$ million)

Annex 1 crops	Value of Commercial Patented Seed	Value of Commercial PVP Seed	Value of Commercial Regulated Seed
Wheat	0.00	3114.70	2185.99
Rice	0.00	679.77	2427.67
Maize	11188.17	2238.98	5139.22
Barley	0.00	1084.43	395.92
Oats	0.00	297.62	105.64
Rye	0.00	206.07	37.37
Triticale	0.00	172.53	16.59
Millet	0.00	13.99	86.45
Sorghum	0.00	20.86	86.71
Beans	0.00	97.34	294.95
Pigeonpea	0.00	12.47	89.44
Chickpea	0.00	40.09	110.81
Peas	0.00	160.68	69.85
Cowpeas	0.00	17.96	105.67
Lentils	0.00	85.69	31.42
Rapeseed	136.64	130.56	90.60
Mustard	0.00	2.95	1.53
Sunflower	0.00	42.72	110.24
Potatoes	0.00	1996.27	2579.90
Sweet Potatoes	0.00	221.82	806.37
Cassava	0.00	0.00	0.00
Taro	0.00	0.00	0.00
Yams	0.00	429.78	2874.56
Asparagus	0.00	1.62	2.19
Beet	0.00	1470.42	670.27
Carrots	0.00	38.77	38.89
Cabbages	0.00	2.97	4.59
Eggplant	0.00	3.98	11.57
	11324.80	12585.05	18374.41
Non-Annex 1			
Soybeans	7088.62	229.49	360.30
Cotton	1936.67	48.74	74.72
Tomatoes	0.00	395.52	581.35
Onions	0.00	489.16	1601.90
	9025.29	1162.91	2618.26

SHARE OF VARIETIES INCORPORATING MATERIALS UNDER SMTA CONDITIONS IN THE COMMERCIAL SEED MARKET

87. The non-availability of variety-level information on the seed market has as a consequence that there are no reliable data on the share of varieties incorporating materials under SMTA conditions in the seed market. Values derived from previous studies²⁶ were hence used. These values are based on the current share of varieties that incorporate material sourced from the CGIAR and its predecessor institutions. A key assumption here is that the share of varieties incorporating plant genetic resources from the CGIAR can serve as a reasonable approximation of the share of varieties incorporating materials under SMTA conditions in the near term.
88. It needs to be noted that past releases of materials from the CGIAR also means that these materials are now available elsewhere, outside of CGIAR institutions. Such materials have over time been incorporated into other collections and companies' in-house repositories. This fact makes avoidance of materials under SMTA conditions possible, and influences the realisation of potential benefit flows in important ways, a point which will be picked up again below.
89. It has furthermore been assumed that the share of commercial plant varieties incorporating materials under SMTA conditions is larger in developing countries than it is in developed countries – as NARS in developing countries remain the largest users of the Multilateral System. It has also been assumed that the share of commercial plant varieties incorporating materials under SMTA conditions is smaller for patented varieties than for varieties under PVP, and that the share for varieties under PVP is smaller than for regulated varieties.

²⁶ In particular the studies contained in the 2013 publication *Identifying Benefit Flows: Studies on the Potential Monetary and Non-monetary Benefits Arising from the International Treaty on Plant Genetic Resources for Food and Agriculture*, which includes *Potential*, and is available at <http://www.planttreaty.org/content/identifying-benefit-flows>

90. Fig. 27 shows the share of varieties incorporating materials under SMTA conditions used in the calculations.

Figure 27. Share of SMTA derived PGR in different Seed Market Product Categories²⁷

	SMTA-share Patented varieties	SMTA-share PVP varieties	SMTA-share Regulated varieties
Developed countries	5%	10%	15%
Developing countries	10%	15%	30%

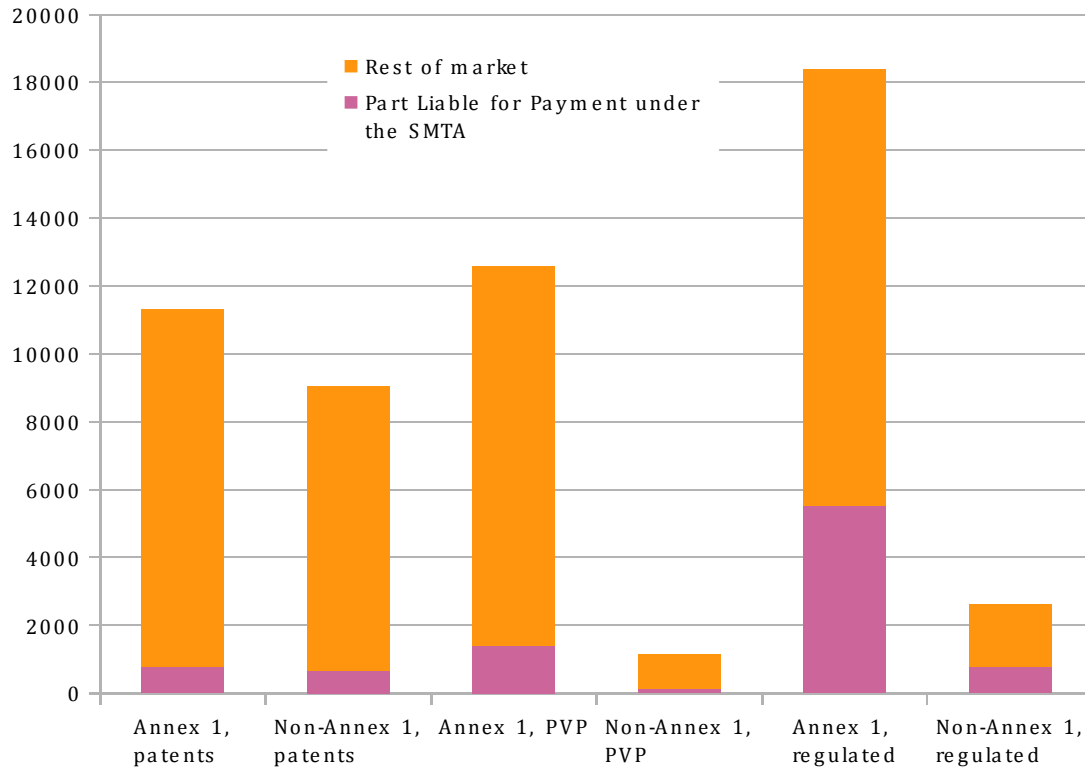
POTENTIAL PAYMENT FLOWS INTO THE BENEFIT-SHARING FUND

91. The various parameters described above were used to derive the values for seed sales in those patented varieties, PVP varieties and regulated varieties which might incorporate material under SMTA conditions for each *Annex 1* crop in the top 30 producer countries (see fig. 28).

Figure 28. Value of Commercial Seed of Annex 1 and Major Non-Annex 1 Crops Potentially Liable for Payment under the SMTA (US\$ million)

Annex 1 crops	Value of Patented Commercial Seed Liable for Payment	Value of Commercial PVP Seed Liable for Payment	Value of Commercial Regulated Seed Liable for Payment
Wheat	0.00	326.65	655.80
Rice	0.00	84.84	728.30
Maize	781.05	259.59	1541.77
Barley	0.00	111.19	118.78
Oats	0.00	30.50	31.69
Rye	0.00	20.87	11.21
Triticale	0.00	17.37	4.98
Millet	0.00	2.00	25.94
Sorghum	0.00	2.69	26.01
Beans	0.00	11.78	88.49
Pigeonpea	0.00	1.87	26.83
Chickpea	0.00	4.78	33.24
Peas	0.00	16.55	20.96
Cowpeas	0.00	2.53	31.70
Lentils	0.00	8.79	9.43
Rapeseed	6.83	13.68	27.18
Mustard	0.00	0.31	0.46
Sunflower	0.00	5.04	33.07
Potatoes	0.00	217.54	773.97
Sweet Potatoes	0.00	27.78	241.91
Cassava	0.00	0.00	0.00
Taro	0.00	0.00	0.00
Yams	0.00	62.94	862.37
Asparagus	0.00	0.18	0.66
Beet	0.00	151.70	201.08
Carrots	0.00	4.15	11.67
Cabbages	0.00	0.33	1.38
Eggplant	0.00	0.48	3.47
	787.88	1386.10	5512.32
Non-Annex 1 crops			
Soybeans	486.69	25.45	108.09
Cotton	169.54	5.39	22.42
Tomatoes	0.00	43.59	174.40
Onions	0.00	60.06	480.57
	656.23	134.49	785.48

92. The relative proportions of the values of these different markets are visualised in fig. 29.

Figure 29. Value of Commercial Seed Market by Product Category (US\$ million)

93. Different payment rates for each category of intellectual property, under SMTA Article 6.7 and SMTA Article 6.11, were then applied to these figures in order to derive the potential flow of revenue into the Benefit-sharing Fund.

Static Analysis Results

94. It bears mentioning that the values derived through the methodological steps described refer to the maximum potential theoretically flowing into the Benefit-sharing Fund. This potential is simply a function of the value of the seed market and the rates at which certain innovations would pay benefit-sharing obligations for their incorporation of SMTA material. The values are meant to serve as measure to compare relative potentials of various payment structures and rates, rather than give an indication of actually realizable flows.
95. The real world conditions bearing on these potential flows, and severely restricting their actual manifestations, will be discussed below.

POTENTIAL OF BENEFIT FLOWS FROM PATENTS

96. The potential for payments into the Benefit-Sharing Fund stemming from the commercialization of patented varieties is a particularly important figure, as patented varieties are currently the only category attracting mandatory payments under Article 6.7 of the SMTA.
97. Potential value for patents can be derived from the value of two crops only, reflecting the assumption that only genetically modified varieties are likely to be subject to patents and that such patents will be available only in a limited number of countries. Among *Annex 1* crops, only maize and oilseed rape have seen the significant introduction and adoption of genetically modified varieties.
98. It is important to note that the development of genetically modified varieties through the application of biotechnology may not require the use of material under SMTA conditions, i.e., material accessed from the MLS after the coming into force of the International Treaty, and that hence the theoretical potential presented here is tenuous.
99. Fig. 30 shows the potential values for income to the Benefit-sharing Fund from patented varieties under the current payment rate of 0.77%, as well as the higher payment rate of 1.1% which is the rate set in *Annex 2* to the SMTA, but without the 30% reduction for marketing and sales costs which it usually allows.

Figure 30. Potential annual payments under Article 6.7 (from patented varieties) (US \$ million)²⁸

Crop	0.77%			1.10%		
	DCs	LDCs	Total	DCs	LDCs	Total
Maize	2.601	3.413	6.014	3.715	4.876	8.592
Rapeseed	0.053	0.000	0.053	0.075	0.000	0.075
TOTAL	2.653	3.413	6.067	3.791	4.876	8.667

100. Under current rates and conditions, the highest potential for mandatory payments into the Benefit-sharing Fund is estimated at US\$ 6.06 million, rising to US\$ 8.66 million if the reduction for marketing and sales costs would be revoked.
101. The contribution of 56% of total value (US\$ 3.41 million or US\$ 4.87 million) from developing countries is related to the significant adoption of genetically modified maize in South Africa and Brazil. This however, assumes that genetically modified varieties can be protected by patents in these countries. While both South Africa and Brazil appear to allow for dual protection of genetically modified varieties through patents and PVP, this may not be the case in other developing countries.

²⁸ Figure adapted from Tables 5 and 9, *Static*.

POTENTIAL OF BENEFIT FLOWS FROM PLANT VARIETIES UNDER PVP

102. As plant variety innovations under PVP which incorporate material under SMTA conditions in their parentage, are encouraged to make voluntary payments under SMTA Article 6.8, the potential for payments into the Benefit-sharing Fund originating from these plant varieties is considered here.
103. No payment rate is specified in the SMTA for voluntary payments. Should the Governing Body of the Treaty decide, as part of an overall revision of payment obligations, to extend mandatory payments to products incorporating material from the Multilateral System which are protected by PVP, it would likely do so at a rate lower than that for patented innovations. The total potentials at rates equal to and lower than the rates for patents are presented in fig. 31.

Figure 31. Potential of PVP varieties under Article 6.8 or under a revised Article 6.7 at different rates²⁹
(US\$ million)

Crop	0.77%			0.5%			0.2%		
	DCs	LDCs	Total	DCs	LDCs	Total	DCs	LDCs	Total
Wheat	2.165	0.351	2.515	1.406	0.228	1.633	0.562	0.091	0.653
Rice	0.264	0.389	0.653	0.171	0.253	0.424	0.069	0.101	0.170
Maize	1.174	0.824	1.999	0.763	0.535	1.298	0.305	0.214	0.519
Barley	0.793	0.064	0.856	0.515	0.041	0.556	0.206	0.016	0.222
Oats	0.218	0.017	0.235	0.141	0.011	0.152	0.057	0.004	0.061
Rye	0.155	0.006	0.161	0.100	0.004	0.104	0.040	0.002	0.042
Triticale	0.131	0.003	0.134	0.085	0.002	0.087	0.034	0.001	0.035
Millet	0.002	0.014	0.015	0.001	0.009	0.010	0.000	0.004	0.004
Sorghum	0.007	0.014	0.021	0.004	0.009	0.013	0.002	0.004	0.005
Beans	0.043	0.047	0.091	0.028	0.031	0.059	0.011	0.012	0.024
Pigeonpea	0.000	0.014	0.014	0.000	0.009	0.009	0.000	0.004	0.004
Chickpea	0.019	0.018	0.037	0.012	0.012	0.024	0.005	0.005	0.010
Peas	0.116	0.011	0.127	0.075	0.007	0.083	0.030	0.003	0.033
Cowpeas	0.003	0.017	0.019	0.002	0.011	0.013	0.001	0.004	0.005
Lentils	0.063	0.005	0.068	0.041	0.003	0.044	0.016	0.001	0.018
Rapeseed	0.091	0.015	0.105	0.059	0.009	0.068	0.024	0.004	0.027
Mustard	0.002	0.000	0.002	0.001	0.000	0.002	0.001	0.000	0.001
Sunflower	0.021	0.018	0.039	0.014	0.011	0.025	0.005	0.005	0.010
Potatoes	1.261	0.414	1.675	0.819	0.269	1.088	0.328	0.107	0.435
Sweet Potatoes	0.085	0.129	0.214	0.055	0.084	0.139	0.022	0.034	0.056
Cassava	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Taro	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Yams	0.024	0.461	0.485	0.015	0.299	0.315	0.006	0.120	0.126
Asparagus	0.001	0.000	0.001	0.001	0.000	0.001	0.000	0.000	0.000
Beet	1.061	0.108	1.168	0.689	0.070	0.758	0.275	0.028	0.303
Carrots	0.026	0.006	0.032	0.017	0.004	0.021	0.007	0.002	0.008

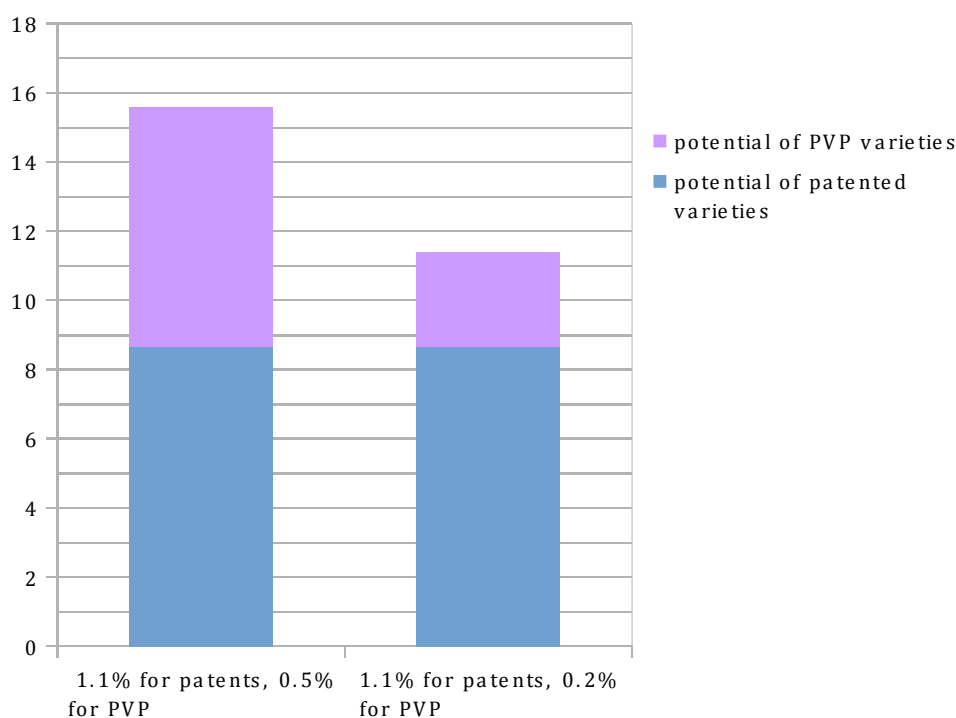
²⁹

Figure adapted from Tables 6 and 9, *Static*.

Cabbages	0.002	0.001	0.003	0.001	0.000	0.002	0.000	0.000	0.001
Eggplant	0.002	0.002	0.004	0.001	0.001	0.002	0.000	0.000	0.001
TOTAL	7.725	2.948	10.673	5.017	1.914	6.931	2.007	0.766	2.772

104. Nearly 72% of the payments for PVP varieties would come from developed country SMTA-users reflecting well-established PVP systems in these countries, where most commercial plant variety innovations are subject to some form of protection.
105. One of the innovative approaches under consideration by the Working Group is the revision of Article 6.7. The potential values of patented varieties presented in the previous section (fig. 30), and the potential values of PVP varieties documented here (fig. 31), can be used to consider two cases. Each case is represented by one column in fig. 32 below.
106. It is assumed that a revision of Article 6.7 would include the extension of mandatory payments to product innovations protected by PVP, which incorporate material from the Multilateral System. Payment rates for mandatory payments under Article 6.7 are assumed to vary by product category – that is, a higher payment rate would apply to patented varieties, and a lower to PVP varieties.
107. In the first case under consideration, patented products would attract mandatory payments at a 1.1% rate, whereas PVP products would attract mandatory payments at a 0.5% rate. The potential for mandatory payments would be US \$ 15.59 million of which US \$ 6.93 million (44%) would come from PVP varieties and US \$ 8.66 million (56%) would come from patented varieties. Developed country SMTA-users would contribute 56% of overall payments and developing country users 44%.

Figure 32. Potential Benefit Flows under a Revised Art. 6.7 (US\$ million)



108. In the second case, with a lower payment rate of 0.2% applied to PVP varieties, the potential for mandatory payments would be US \$ 11.44 million with PVP varieties contributing US \$ 2.72 million (24%) and patented varieties contributing US \$ 8.66 million (76%). Nearly 51% of the potential payments would come from developed countries, and 49% from developing countries.
109. The main implication of these considerations is that the extension of mandatory payments to PVP varieties will result in a very significant expansion of the innovation base from which payments into the Benefit-sharing Fund are derived. A large part of the enhanced payment flows would in this case come from SMTA-users in developed countries, and the enhancement will be significant even if a relatively low rate of payment is applied to PVP varieties.

POTENTIAL OF BENEFIT FLOWS FROM REGULATED MATERIALS

110. In most developing countries, new varieties developed by NARS are subject to evaluation through national trials before being released to farmers through variety release procedures. Such new varieties are generally brought within the ambit of seed quality control regulations, as seed sales of these varieties are expected to be commercially significant. Once the new varieties are brought under the purview of quality control regulations, the production and distribution of seeds of these varieties may be subject to a number of restrictions designed to ensure that only quality seeds of these varieties are sold to farmers. Bringing varieties developed by NARS under the purview of the quality control system is what enables public and private sector seed producers to develop and sustain a commercial market for seeds of these varieties and obtain an economic return from their multiplication and distribution.
111. Thus it ought to be noted that, mainly in developing countries, a large subset of plant variety products which incorporate material under SMTA conditions in their parentage are commercially exploited, even though not (yet) subject to any form of intellectual property protection. These products are subject to seed quality control, multiplication and marketing regulations, which facilitate and sustain the commercial exploitation of these varieties, despite their “unprotected” status.
112. As already mentioned above, many developing countries have introduced or are in the process of introducing some form of PVP legislation, as a consequence of Article 27 (3) of the TRIPs Agreement. In developing countries where PVP systems have been introduced (e.g., India, Brazil), NARS appear to have been quite active in seeking protection for their innovations. In countries where the PVP legislation permits, NARS have also sought retrospective protection for their innovations developed before the entry into force of the PVP legislation. If this trend continues, a large part of the innovations of NARS in developing countries will become subject to PVP over time.
113. When such “regulated products” incorporate material under SMTA conditions, they are already encouraged to make voluntary payments. If they migrate to some form of intellectual property protection over time, there may even be a potential for mandatory payments being generated from these regulated products. While it needs to be clear that they are not likely to produce any mandatory payment flows in the current state of the seed market and structure of benefit-sharing under the Treaty, these innovations nonetheless reflect a potential source of payment flows over time.³⁰ Their potential is significant, in comparison to varieties currently under PVP.
114. As per our assumptions, 100% of unprotected, regulated plant variety innovations come from developing countries. Fig. 33 is hence not split by country category.

Figure 33. Potential of non-protected, regulated varieties under Article 6.7 at different rates (US\$ million)³¹

Crop	0.77%	0.5%	0.2%
Wheat	5.050	3.279	1.312
Rice	5.608	3.641	1.457
Maize	11.872	7.709	3.084
Barley	0.915	0.594	0.238
Oats	0.244	0.158	0.063
Rye	0.086	0.056	0.022
Triticale	0.038	0.025	0.010

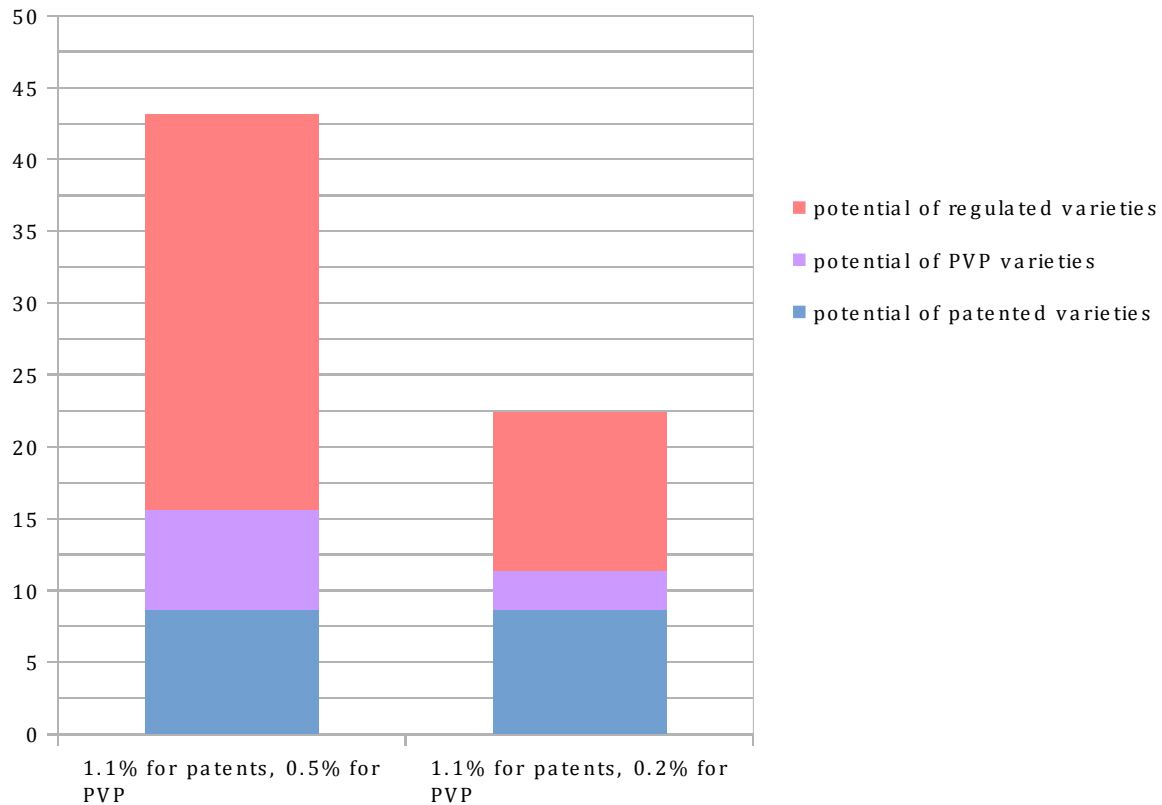
³⁰ Some industry stakeholders have expressed a strong preference for the extension of payment obligations to all plant variety products incorporating material under SMTA conditions, rather than an extension to products under PVP only, as the latter is felt to undermine UPOV regulations and disregard its breeders' exemption.

³¹ Figure adapted from Tables 6 and 11, *Static*.

Millet	0.200	0.130	0.052
Sorghum	0.200	0.130	0.052
Beans	0.681	0.442	0.177
Pigeonpea	0.207	0.134	0.054
Chickpea	0.256	0.166	0.066
Peas	0.161	0.105	0.042
Cowpeas	0.244	0.159	0.063
Lentils	0.073	0.047	0.019
Rapeseed	0.209	0.136	0.054
Mustard	0.004	0.002	0.001
Sunflower	0.255	0.165	0.066
Potatoes	5.960	3.870	1.548
Sweet Potatoes	1.863	1.210	0.484
Cassava	0.000	0.000	0.000
Taro	0.000	0.000	0.000
Yams	6.640	4.312	1.725
Asparagus	0.005	0.003	0.001
Beet	1.548	1.005	0.402
Carrots	0.090	0.058	0.023
Cabbages	0.011	0.007	0.003
Eggplant	0.027	0.017	0.007
TOTAL	42.445	27.562	11.025

115. These potential values of regulated materials, can be used to elaborate the cases considered in the previous section (fig. 32). Fig. 34 allows for comparison of the value that regulated materials might contribute if they were to effect payments, first at a 0.5% rate, and second, at a 0.2% rate.
116. The total potential in the first case amounts to US\$ 43.15 million, and in the second to US\$ 22.46 million. These potentials could stem from an effective performance of voluntary payments, or from mandatory payments under a revised SMTA.

Figure 34. Potential Benefit Flows under a Revised Art. 6.7, with regulated materials effecting payments (US\$ million)



117. Fig. 34 visualises the considerably higher contribution of regulated materials compared with PVP or even patents. The large share of developing countries in these two cases, at almost 80% in the first, and 74% in the second, would reflect the size of the seed markets in these countries and the role of plant variety innovations derived from materials from the Multilateral System in these markets.

118. These results highlight the fact that the current architecture of payment options under the SMTA relies on a very narrow sub-set of innovations for generating mandatory payments. Patent-protected innovations constitute a very small proportion of innovations generated through the use of material under SMTA conditions. The revision of Article 6.7 and extension of mandatory payments to PVP varieties would significantly broaden the base for innovations generating flows into the Benefit-sharing Fund. However, figs. 33 and 34 show that even the extension to PVP varieties would leave out a very significant proportion of innovations which incorporate material under SMTA conditions, and are commercially exploited. If the intention behind the architecture of payment options in the SMTA is that benefit-sharing payments should be triggered by commercial exploitation of innovations incorporating material accessed by means of the SMTA, then there may be a strong case for not restricting the set of innovations to those protected by intellectual property rights and for adopting a wider definition of commercial use.

POTENTIAL OF PAYMENTS UNDER A REVISED ARTICLE 6.11

119. Another innovative approach currently under consideration is the revision of Article 6.11, and the potential of different product categories under Article 6.11 benefit-sharing arrangements are presented here.

120. As illustrated clearly by the Parity Point analysis, Article 6.11 rates would have to be lowered significantly in order to incentivize its adoption. Changing its payment conditions to require payments not on all seed sales of an individual crop for which material has been accessed via an SMTA, but only on seed sales of patented and PVP varieties of that crop, with rates varying

between patented and PVP varieties, is also likely to make the “6.11 option” more attractive to users.

121. Fig. 35 shows projections of flows into the Benefit-sharing Fund from patented varieties, PVP varieties as well as from regulated materials (for example from the effective performance of voluntary payments), at different rates, with the ratio of the rates being the same as those of the ratio of Article 6.7 rates applied above.

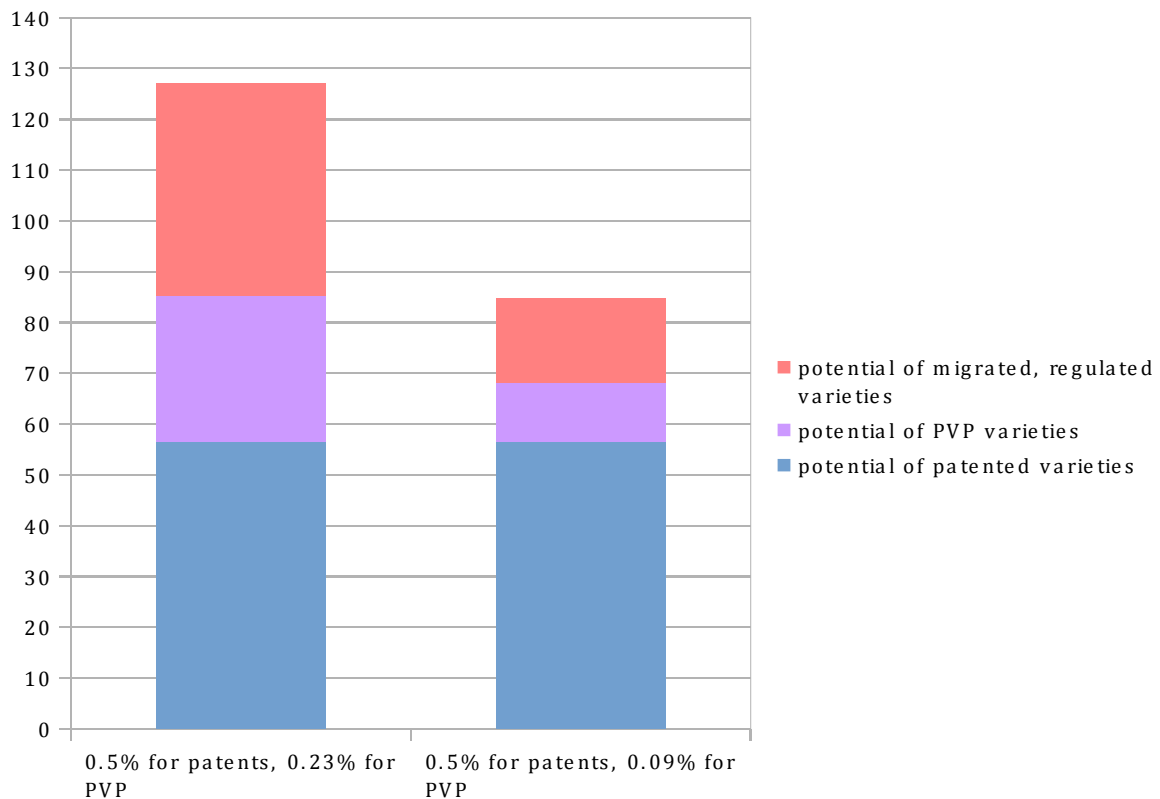
122. Overall potentials are significantly higher in the two different cases of a revised Article 6.11 scenario, as payment would be due on all sales of protected products per crop, rather than just on the individual products which incorporated materials under SMTA conditions (as in Article 6.7). Methodologically, payment rates under 6.11 are applied to the total value of the commercial seed market per crop, whereas payment rates under Article 6.7 are applied only to the fraction of the value of the commercial seed market which has been estimated to incorporate material from the Multilateral System (per crop).

Figure 35. Payment potential under a revised Article 6.11 (US \$ million)

Product category	Patents	PVP	Regulated materials	TOTAL	Patents	PVP	Regulated materials	TOTAL
Payment rate	0.50%	0.23%	0.23%		0.50%	0.09%	0.09%	
Annex 1 crops								
Wheat	0.00	7.08	4.97	12.05	0.00	2.83	1.99	4.82
Rice	0.00	1.54	5.52	7.06	0.00	0.62	2.21	2.82
Maize	55.94	5.09	11.68	72.71	55.94	2.04	4.67	62.65
Barley	0.00	2.46	0.90	3.36	0.00	0.99	0.36	1.35
Oats	0.00	0.68	0.24	0.92	0.00	0.27	0.10	0.37
Rye	0.00	0.47	0.08	0.55	0.00	0.19	0.03	0.22
Triticale	0.00	0.39	0.04	0.43	0.00	0.16	0.02	0.17
Millet	0.00	0.03	0.20	0.23	0.00	0.01	0.08	0.09
Sorghum	0.00	0.05	0.20	0.24	0.00	0.02	0.08	0.10
Beans	0.00	0.22	0.67	0.89	0.00	0.09	0.27	0.36
Pigeonpea	0.00	0.03	0.20	0.23	0.00	0.01	0.08	0.09
Chickpea	0.00	0.09	0.25	0.34	0.00	0.04	0.10	0.14
Peas	0.00	0.37	0.16	0.52	0.00	0.15	0.06	0.21
Cowpeas	0.00	0.04	0.24	0.28	0.00	0.02	0.10	0.11
Lentils	0.00	0.19	0.07	0.27	0.00	0.08	0.03	0.11
Rapeseed	0.68	0.30	0.21	1.19	0.68	0.12	0.08	0.88
Mustard	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00
Sunflower	0.00	0.10	0.25	0.35	0.00	0.04	0.10	0.14
Potatoes	0.00	4.54	5.86	10.40	0.00	1.81	2.35	4.16
Sweet Potatoes	0.00	0.50	1.83	2.34	0.00	0.20	0.73	0.93
Cassava	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Taro	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Yams	0.00	0.98	6.53	7.51	0.00	0.39	2.61	3.00
Asparagus	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
Beet	0.00	3.34	1.52	4.87	0.00	1.34	0.61	1.95
Carrots	0.00	0.09	0.09	0.18	0.00	0.04	0.04	0.07
Cabbages	0.00	0.01	0.01	0.02	0.00	0.00	0.00	0.01
Eggplant	0.00	0.01	0.03	0.04	0.00	0.00	0.01	0.01
TOTAL Annex 1	56.62	28.60	41.76	126.99	56.62	11.44	16.70	84.77

123. Fig. 36 visualises the combined potential of each of these product categories under Article 6.11 at two different ratios between payment rates for patents and PVP. Both cases assume universal adoption of Article 6.11, as for example, if payment options under Articles 6.7 and 6.8 were withdrawn, leaving Article 6.11 as the sole option available to SMTA-users. It is also assumed that regulated materials would effect payments at the PVP rate.

Figure 36. Potential Benefit Flows under a Revised Art. 6.11, with regulated materials effecting payments (US\$ million)



124. In the first case under consideration, developing countries contribute almost 55% of the potential overall value (US\$ 69.72 of 126.99 million), again due to the extensive use of the Multilateral System in plant breeding in developing countries, and the relative size of their seed markets. Without migration of regulated materials to PVP, this contribution would be reduced to 22% (US\$ 27.96 million).

125. In the second case, developing countries' contribution to the overall value of benefit flows would amount to almost 49% (US\$ 41.18 of 84.77 million). This would be reduced to almost 29% (US\$ 24.48 million) if regulated materials had not migrated to PVP.

POTENTIAL VALUE OF ANNEX 1 EXPANSION

126. As the expansion of the Treaty's crop coverage also constitutes an innovative approach which is due to be explored by the Working Group, the potential of benefit-sharing flows from non-*Annex 1* crops is considered here.

127. While data on the full range of food, fodder and industrial crops is not available, the potential impacts of the expansion of *Annex 1* on revenue of the Benefit-sharing Fund will be illustrated by an examination of the effects of including four key non-*Annex 1* crops:

- a. Tomatoes
- b. Onions
- c. Soy bean
- d. Cotton

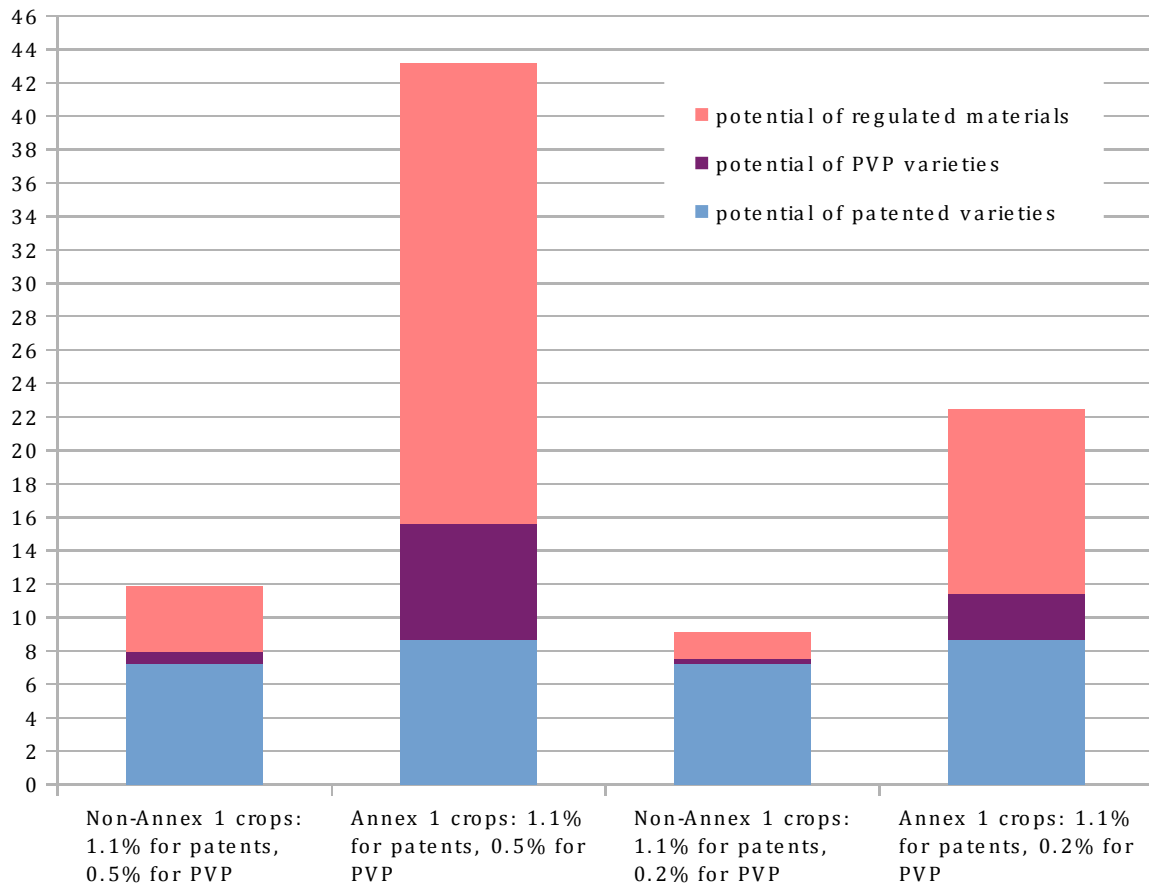
Figure 37. Potential of Key Non-Annex 1 Crops (US\$ million)

Product category	Patents	PVP	Regulated materials	TOTAL	Patents	PVP	Regulated materials	TOTAL
Payment rate	1.10%	0.50%	0.50%		1.10%	0.20%	0.20%	
Non-Annex 1 crops								
Soybeans	5.35	0.13	0.54	6.02	5.35	0.05	0.22	5.62
Cotton	1.86	0.03	0.11	2.00	1.86	0.01	0.04	1.92
Tomatoes	0.00	0.22	0.87	1.09	0.00	0.09	0.35	0.44
Onions	0.00	0.30	2.40	2.70	0.00	0.12	0.96	1.08
Total	7.22	0.67	3.93	11.82	7.22	0.27	1.57	9.06

128. Fig. 37 shows that the largest effect of inclusion of the four crops in *Annex 1* will be on the potential of benefit flows from patented varieties. This is on account of the large global area share for genetically modified varieties of soy bean and cotton which are assumed to be patented products.
129. The potential income from patented varieties to the Benefit-sharing Fund could be increased by 83% through the inclusion of soy bean and cotton (compare fig. 30 above). The income from varieties under PVP would increase by a bare 10%, and if regulated materials had migrated to PVP by 13%.
130. It is interesting that the potential for payments in respect of varieties of tomatoes under PVP is larger than potential payments from varieties of soy bean and cotton under PVP. This is on account of the extraordinarily high seed price factor (SPF) for tomatoes (tomato seeds are priced at US \$ 100-300,000 per tonne) with the commercial seed market for tomatoes valued at nearly US \$ 1.6 billion in 2013. Onions also command a high seed price factor (with seed prices of nearly US \$ 160,000 per tonne).³²
131. Fig. 38 allows for comparison of potential income from *Annex 1* crops and potential income from the four key non-*Annex 1* crops, in terms of potential of each product category.
132. The large potential contribution of regulated materials again highlights the role of resources from the Multilateral System in commercial plant variety innovations not (yet) protected by any form of intellectual property rights in developing country markets.

³² It should be noted that the estimated potential flows from onions may be overstated because the analysis assumes that all onions will be planted from seeds. In practice, a large proportion of the onion crop is planted from "onion-sets" or bulbs that cost significantly less - which implies that the size of the commercial market for onion seed may be much lower than what we have projected in the simulation.

Figure 38. Potential Benefit Flows of Annex 1 and Non-Annex 1 crops, under SMTA Art. 6.7, with regulated materials effecting payments (US\$ million)



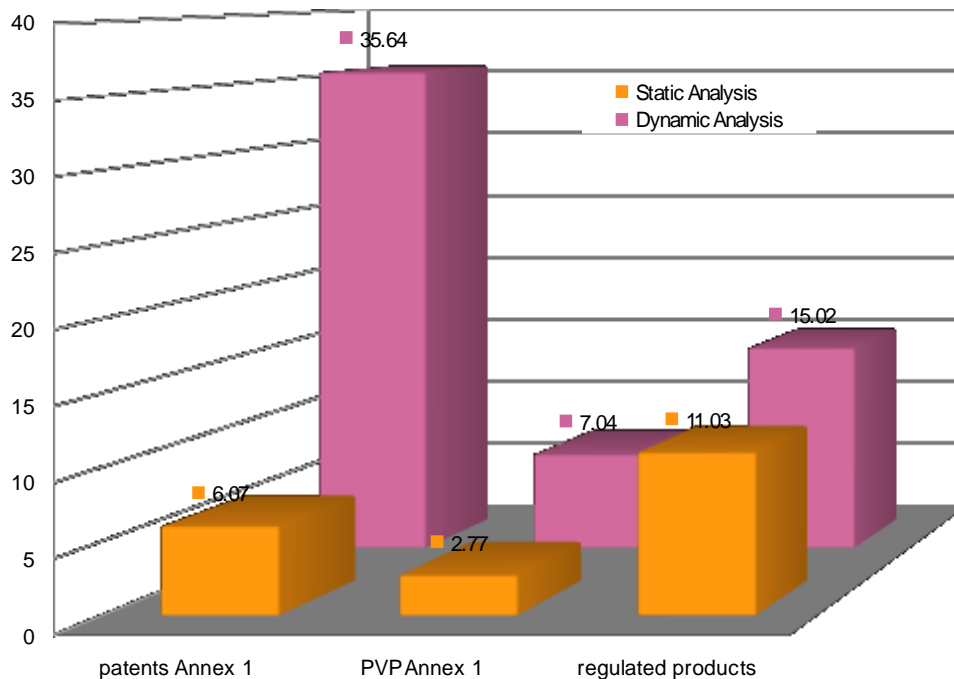
133. Bearing in mind that this analysis is based on only four major non-*Annex 1* crops, the expansion of *Annex 1* to include all crops can be said to substantially enhance the potential for payment flows into the Benefit-sharing Fund. The potential of payments from patented varieties will in particular be enhanced by the inclusion of crops such as soy bean and cotton that have seen application of biotechnology in the development of innovations.

134. There is also a potential for increased payment flows from varieties of high value vegetable crops where the seed price to commodity price ratios tend to be radically different from that of cereals crops. The inclusion of high value vegetable crops in *Annex 1* will also have the effect of bringing the most profitable and dynamic sector of the plant breeding industry within the ambit of SMTA-mediated exchange of plant genetic resources, thereby providing a major stimulus to innovation through more intensive use of resources available in the Multilateral System.

Comparing the maximum potentials of the static analysis with those of the dynamic analysis

135. Both the dynamic analysis of the inter-relationship of Articles 6.7 and 6.11, and the static analysis of the values of the current seed market, have produced estimates of the maximum potential income to the Benefit-sharing Fund, as a result of proposed changes to the Treaty's benefit-sharing mechanisms, using different and separate methodologies. This gives a more robust overall picture.
136. The values in both analyses are of *theoretical* maximum potential income, and, under real world conditions, income is expected to be much lower, as discussed in the next section.
137. Fig. 39 gives a picture of, and compares, total potential annual incomes, per product category, projected by the two analyses. The dynamic analysis values are at Parity Point (here, the year 2038) with the current Article 6.7 rate of 0.77% for patents, and an assumed rate of 0.2% for PVP. The static analysis estimates values through a study of the current seed market, and applies the same rates (0.77% for patents and 0.2% for PVP, under Article 6.7) to the estimated commercial seed market share of products that might incorporate SMTA materials. The value of Regulated products has been calculated at a PVP rate of 0.2%.

Figure 39. Maximum Potential Annual Benefit Flows (*Annex 1*), per product category, according to the dynamic and static analyses (US\$ million)



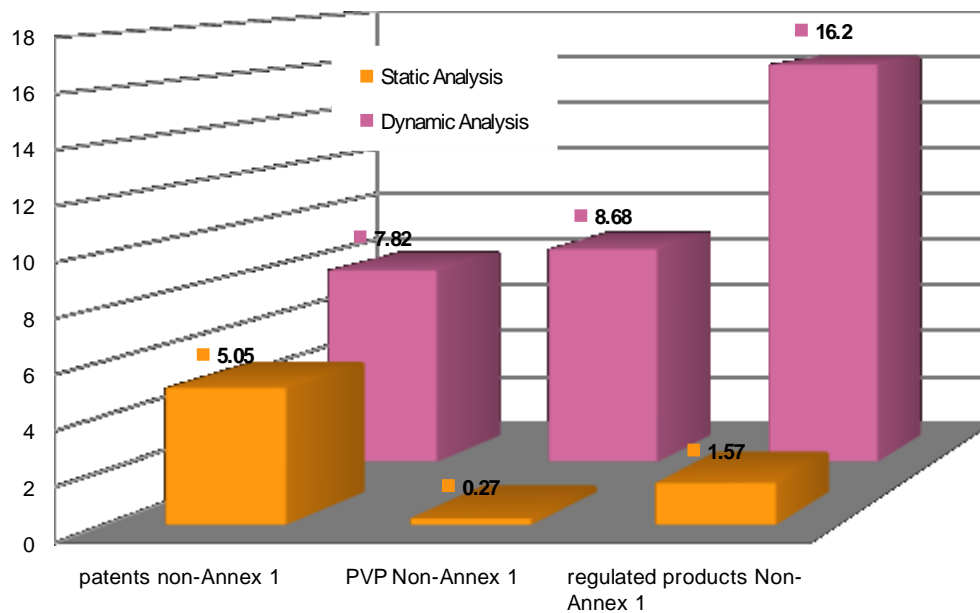
138. Values generated by the two analyses differ, because of the different methodologies, and the diachronic character of the dynamic analysis, in contradistinction to the static analysis. Both are based on reasonable, if optimistic, assumptions about the value of the world seed market, and are limited by severe data constraints, including a total lack of global variety-level information. One technical difference is that the static analysis employs information about past use of SMTA materials, or materials released by preceding institutions, while the dynamic analysis begins from the present, and assumes likely future use of SMTA materials.
139. Products marketed under patents represent by far the largest potential income, with maize being the sole *Annex 1* crop with a large proportion of products marketed under patents (as is rapeseed, to a lesser extent). The dependence for income on patented maize is a structural problem,

as users have a strong incentive to avoid the use of maize germplasm, when this would require acceptance of an SMTA, which drastically reduces potential income.

140. Although over time the migration of Regulated products to PVP may partly compensate for the failure to realize “voluntary” payments under Article 6.8, this is a very long-term possibility.

141. Fig. 40 gives a picture of total potential income, with the same parameters as in Fig. 1, by product category, for crops currently not in *Annex 1*.

Figure 40. Maximum Potential Annual Benefit Flows from non-Annex 1 crops, per product category, in the dynamic and static analyses (US\$ million)



142. The difference in values between the two analyses illustrates the difficulty of obtaining a relatively accurate projection of potential benefit flows. However, the theoretical projections under both the dynamic and the static analysis are relatively small and, once real world factors are considered, the actual sums that may be possible to mobilise will be considerably lower.

143. No data on the full range of food, fodder and industrial crops is available. The dynamic analysis estimates non-*Annex 1* values on the basis of IP strategies for crops in world *ex situ* holdings generally. The static analysis considers four key crops for which data was obtainable: tomatoes, onions, soy bean, cotton. Because of the large global area share for genetically modified varieties of soy bean and cotton, with a high percentage of patented products, the static analysis values for patents (Fig. 40) are very high.

144. The dynamic analysis estimates that 36% of total potential benefit-flows would come from the expansion to all crops, the static analysis, 25%.

145. Regulated products were also investigated as part of the static analysis, to have an idea of potential, as if they had already migrated to PVP: this suggest they might, in the long term, account for 95% of the income from crops not currently in *Annex 1* (oil seeds, soya, etc.). The dynamic analysis estimates 66%.

146. As vegetable breeders have consistently pointed out, vegetable crops are sorely under-represented in *Annex 1*, which limits their potential contribution to benefits. Moreover, they are not able to benefit from the facilitated access provided by the Treaty, and the legal certainty provided by use of the SMTA, which is becoming increasingly important, as the Nagoya Protocol is translated into national implementing legislation and regulations. Vegetable breeding enjoys a higher profit margin than most of the seed industry. They are most anxious to see the rapid extension of the crop coverage of the Treaty, and best placed to be able make effective contributions to the Benefit-sharing Fund.

147. The two analyses project maximum potential income assuming high payment rates, and these are certain to be far too optimistic, because:
- a. The dynamic analysis assumes that all Contracting Parties have already made all their *ex situ* holdings available, and as the *Appendix to The current status of the Multilateral System of Access and Benefit-sharing* shows, this is not the case. The projection must therefore be discounted by this factor. Every delay in making material effectively available also pushes potential benefits further forward in time.
 - b. Neither the dynamic nor the static analysis make allowance for avoidance of SMTA material, even though it is clear, and corroborated by discussions with members of the industry, and the results of the simulation exercise, that users have been avoiding SMTA materials, when they are breeding for a product that is to be marketed under patent protection. They have been using materials in cases, where, in accordance with the current SMTA, only voluntary contributions are foreseen, and none have been made. If mandatory payment is now extended to PVP, it is likely that the level of avoidance of SMTA materials will rise substantially, particularly when, as is often the case, alternative sources of materials are available. The projections should be further discounted to allow for this.

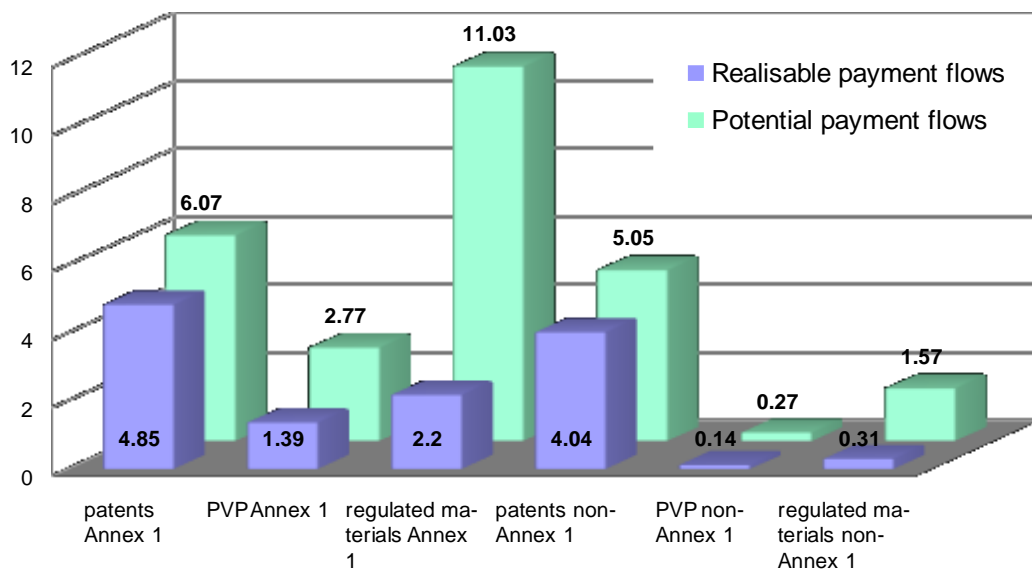
Actual Payment flows into the Benefit-Sharing Fund

148. The figures of the potential of different product categories under different payment conditions and rates described as part of the static analysis reflect the current size of the commercial seed markets for different crops, as well as an assessment of the shares of varieties incorporating material accessed by means of the SMTA for each crop.
149. As already pointed out, the extent to which these maximum potentials are realised will depend on the actual performance of payments. That is to say that, in the real world, only a fraction of the *potential of payment* for different product categories will translate into *actual payment flows* into the Benefit-sharing Fund.
150. Real world potential is influenced less by fixing payment rates and more by complex user decision-making which is based on cost-benefit analyses of a large matrix of conditions that needs to be taken into account in the competitive context of plant breeding innovation.
151. It is the complexity of circumstances that each breeding programme faces, and the set of problems that it needs to overcome, which will in the end determine the decision of whether or not to sign an SMTA, as well as determine the success or failure of the development of a new plant variety product.
152. As interviews with industry stakeholders have confirmed, avoidance of material under SMTA conditions, or strict segregation of breeding programmes, is common, especially amongst plant breeders pursuing a strategy of patent protection for their products. Such avoidance is possible due to the ready availability of commercially useful germplasm in collections which are not part of the Multilateral System.
153. Moreover, plant breeding is a risky process and only a fraction of crossings with materials under SMTA conditions would ever develop into a commercializable plant variety product, and require benefit sharing under the SMTA.
154. It also needs to be pointed out that the current architecture of Access and Benefit-sharing under the Treaty relies entirely on SMTA-users to (i) monitor the use and incorporation of materials under SMTA conditions in different commercialized products, (ii) accurately assess the quantum of payment obligations under the SMTA and (iii) effect the payments in a timely fashion.
155. The Benefit-sharing Fund has thus far not received any mandatory or voluntary payments related to the use of materials from the Multilateral System in commercial products, although this analysis clearly shows that such payment obligations may exist in the current global seed market.³³

³³ It needs to be noted, however, that at the time of writing, due to the time-consuming nature of plant breeding, products possibly incorporating materials under SMTA conditions are only starting to enter

156. Until reliable information flows on the use of materials under SMTA conditions in commercial plant variety innovations are built up from intellectual property rights databases or other innovation databases, a large gap between potential and actual payment flows into the Benefit-sharing Fund may persist, even when the revisions to the SMTA being considered by the Working Group are implemented. This suggests that in addition to modifying the structure of payment obligations under the SMTA for enhancing payment flows, it may also be necessary to revisit the exclusive reliance on user-adherence to contractual obligations under the SMTA.
157. The magnitude of the gap between potential and realisable flows is likely to be different for different product categories. It can be expected that adherence to payment obligations will be greater when more information on innovations is available in the public domain. Information on intellectual property rights-protected innovations is generally available from patent and PVP databases. Intellectual property rights applications may also generally call for disclosure of parental material used in the breeding of plant variety innovations. Effective performance of payment obligations is more likely to be achieved for these product categories.
158. Fig. 41 shows the levels of payment flows which might be realisable, according to the static analysis, under Article 6.7, and compares these to the maximum potential flows. The payment rates for each product category are the same as those used in figs. 39 and 40.

Figure 41. Potential and realisable annual payment flows, per product category, under SMTA Art. 6.7 (US\$ million)



159. The gap between potential and realisable payment flows into the Benefit-sharing Fund for different product categories and payment options must be assumed to be even larger under Article 6.11, revised or in its current form, or for voluntary payment under Article 6.8.
160. This gap is captured by the “performance factor” parameter, which is the proportion of the potential payment flows which can be expected to be realised. Fig. 42 indicates the performance factor values which have been assumed in this analysis.

Figure 42. Performance factors used³⁴

Performance factor for payments for patented varieties under Article 6.7	80%
Performance factor for payments for PVP varieties under Article 6.7	50%
Performance factor for payments for regulated varieties under Article 6.7	20%
Performance factor for payments for PVP varieties under Article 6.8	10%
Performance factor for payments for regulated varieties under Article 6.8	5%
Performance factor for Article 6.11 payments	10%

161. The high compliance factor assumed for payments for patented varieties under Article 6.7 of the SMTA reflects the fact that these innovations will be relatively few and will be easily identifiable from patent databases that also provide information on the provenance and genealogy of these varieties. Varieties protected by PVP can also be readily identified from PVP databases, but much less information is available from these databases on the breeding history or genealogy of the protected varieties. Much less information is likely to be available on the genealogy of regulated varieties not subject to any form of intellectual property protection. The performance factor for voluntary payments under Article 6.8 is assumed to be considerably lower than that for mandatory payments under Article 6.7. The very low compliance factor assumed for Article 6.11 payments reflects the fact that these payment obligations may arise from a complex maze of transactions where material under SMTA conditions is transferred from one Recipient to another (and hence may be difficult to monitor and track), and the difficulties in obtaining reliable crop level seed sales data of SMTA-users bound by Article 6.11 payment obligations.
162. The large gap between potential and realisable payments highlights the need to address issues influencing the performance factor. It also suggest that exclusive reliance on SMTA-based innovative approaches would constitute an unreliable approach to the enhancement of income to the Benefit-sharing Fund.

³⁴
Cf. p. 34, *Static*.

4.2. OTHER INNOVATIVE APPROACHES: UPFRONT PAYMENTS ON ACCESS, TO BE DISCOUNTED AGAINST PAYMENTS DUE ON THE COMMERCIALIZATION OF A PRODUCT

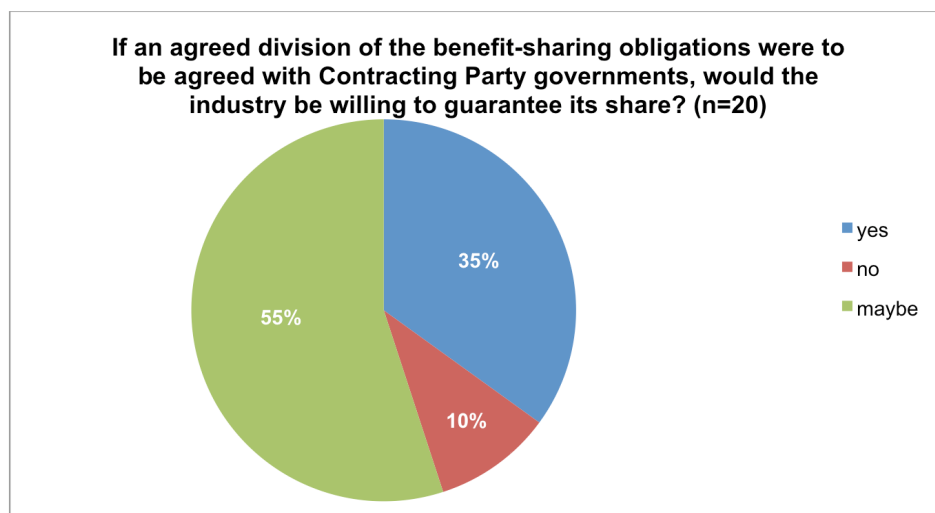
163. This innovative approach would apply to Articles 6.7/6.8, and its objective would be to shorten the time between accessing a material under an SMTA and receipt of income for the Benefit-sharing Fund. It would trade a reduction in overall income to the Benefit-sharing Fund against earlier income. Recipients would be provided with an option to make a payment on receipt of a material, and in exchange pay at a reduced rate when a product is commercialized.
164. This approach would generate benefit-sharing flows even lower than those projected, and presented in the previous sections. It does not show any improvements in terms of sustainable and predictable income, and user acceptance. Transaction costs, both to the user, as well as those arising in the administration of payments, are more likely to be raised than reduced.
165. There are a number of ways in which such an approach could be operationalized, but many technicalities would need to be addressed. Factors that might be taken into account have been listed in *Background*, paragraph 98. They would include:
- i. Whether upfront payments would be counted against individual products derived from individual materials, or whether they might be counted against any product, for which payment to the Benefit-sharing Fund is due;
 - ii. Whether discount rates should vary over time, and on what basis;
 - iii. What discount rates would, in practice, attract commercial users; and
 - iv. Whether the possible speeding-up revenue to the Benefit-sharing Fund would be worth the added transaction costs, for the Treaty, of accounting for upfront payments, and the lower overall income.
166. Consultations with industry reveal that an upfront payment would be welcomed, if it took the form of a low access fee, as an alternative to the current benefit-sharing provisions, but this is not the same as the current innovative approach. In that case, it was felt that any further payment on the commercialization of a product would have to be extremely low, or include a *de minimis* clause.

4.3. NON-SMTA-BASED APPROACHES

4.3.1. PROMOTING REGULAR SEED SALES-BASED CONTRIBUTIONS BY CONTRACTING PARTIES

167. The *Ad Hoc* Advisory Committee considered this approach on the basis of the Norwegian decision to make an annual contribution 0.1% of the value of all seed sales on its national territory (both *Annex 1* and non-*Annex 1* crops), separate from the workings of the SMTA. In announcing the decision, Norway estimated that, if all developed countries made similar contributions, about US\$ 200 million would flow to the Benefit-sharing Fund over ten years. Between 2009 and 2014, Norway contributed US\$ 648,178 through this initiative
168. The Governing Body has appealed to other Contracting Parties to take similar decisions, and so provide the Benefit-sharing Fund with substantial and reliable income, but to date no other country has done so.
169. In technical terms, it would be possible to structure user-based contributions on a territorial basis, similar to this initiative. Territorial approaches could provide a framework for innovative arrangements between the Treaty and user groups in the territory of individual Contracting Parties, for example, to promote non-monetary benefit-sharing, or to make coordinated contributions to the Treaty, and perhaps be recognized for doing so. A Contracting Party might decide how to raise those funds, from users directly, or, as in Norway's case, from central resources.
170. There is support from industry for such approaches. The interviews held with stakeholders demonstrated a recognition of social responsibility, for food security and sustainable agriculture, but also a sense that the attempt to put the entire cost of benefit-sharing for access to plant genetic resources for food and agriculture on the seed industry is not equitable. They feel that the benefits of access are reaped not only by seed breeders, but also by farmers, marketing chains, and ultimately by consumers. The seed industry would be able to commit to make contributions, if other beneficiaries also did. The simulation exercise showed a willingness for cooperation with Governments in providing resources for benefit-sharing, as Fig. 43 shows. A general preference for each Contracting Party being free to decide how to raise the funds was displayed in the interviews.

Figure 43. Burden-sharing between Contracting Parties and the seed industry³⁵



171. In order to operationalize this approach, ways need to be found to make contributions mandatory.

³⁵ Figure 27 in *Preferences and Behaviour*.

172. The Norwegian seed-sales based contributions are currently the only predictable income to the Benefit-sharing Fund. The Working Group might therefore wish to clarify whether other Contracting Parties would be prepared to make regular seed sales-based contributions, and under what conditions, within a larger package of innovative benefit-sharing approaches, to provide sustained and predictable income. It may also consider other approaches that might create predictability in Contracting Party contributions, such as a periodic pledging conference, possibly at the time of the periodic establishment of the funding target. In this light, this concept could be considered more of the nature of a way of structuring contributions from Contracting Parties, than a user-based approach.

4.3.2. NOVEL WAYS TO ATTRACT USE-BASED VOLUNTARY FUNDING

173. The identification of this innovative approach arose from direct discussions regarding the proposed Industry Licensing Platform (ILP), between the *Ad Hoc* Advisory Committee and the Vegetable Industry Working Group and other stakeholders. These discussions had not been completed at the end of the last biennium, and are extensively covered in the reports of the *Ad Hoc* Advisory Committee. At that stage, consideration was given to the ILP making a voluntary payment to the Benefit-sharing Fund, in the form of a percentage of licensing fees. There is no indication that this has been retained in any current plans for the ILP. Until further information regarding the possible establishment of an ILP appears, little more can be said about this specific proposal.
174. This specific example apart, the extensive discussions between the Vegetable Industry Working Group and the *Ad Hoc* Advisory Committee demonstrate that a private industry initiative, based on an association of group of companies, could include benefit-sharing, perhaps as part of its membership agreement, if a *modus vivendi* between that group and the Governing Body could be reached.
175. This is a cutting-edge innovative approach, and appears to have considerable potential, but there are currently no relevant on-going discussion with any such group of industries.
176. Such approaches, if agreements are reachable with adequately representative industry bodies, could provide a way in which the Governing Body could extend the governance of the system, and the scope of user-based benefit-sharing, towards a downstream, pooled good, managed by end-users according to collectively agreed principles that facilitate access to proprietary materials. Such approaches could maintain intact the principle of different levels of payment between different levels of restriction over access, and could be combined with “subscription” models designed to reduce transaction costs for users.
177. There are, however, many practical and institutional questions that would need to be addressed, and any final approach can only be structured in direct consultations with possible industry partner groups. Major questions to be addressed would include:
- a. How payments under this scheme would relate to any payments due under SMTA Articles 6.7/6.8 and 6.11.
 - b. Whether payment obligations and levels, due under SMTA Articles 6.7/6.8 and 6.11, could be varied, in the context of an overall scheme that created an acceptable income stream from such an industry group.
 - c. Whether an agreement between the Governing Body and such a group would be necessary, and what form this would take.

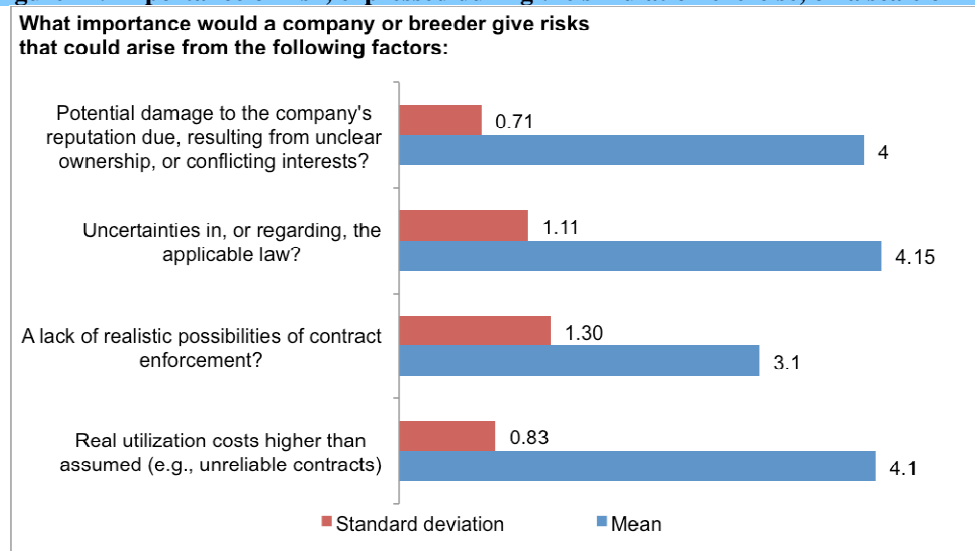
4.4. MANAGING REGULATORY INTERACTIONS BETWEEN THE TREATY, AND THE CONVENTION ON BIOLOGICAL DIVERSITY AND ITS NAGOYA PROTOCOL

178. The Governing Body, in Resolution 5/2013:
 “Look[ed] forward to the entry into force of the *Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization* and its full implementation, in harmony with the Treaty, in the interest of the conservation and sustainable use of biodiversity;
 “Again, calls on Contracting Parties to ensure that any legislative, administrative or policy measures taken for the implementation of both the Treaty and the Convention on Biological Diversity (CBD) or its Nagoya Protocol, are consistent and mutually supportive.”
179. The Working Group, at its first session:
 “noted that the Nagoya Protocol would probably come into force in the near future and agreed that it will be crucial to continue to stress the special features of plant genetic resources for food and agriculture. In this context, the Working Group provides a unique opportunity for the Treaty community to work together to strengthen its mechanisms for access and benefit-sharing so that the key role of the Treaty in the International Regime of access and benefit-sharing is fully respected by all forums and processes.”
180. The Working Group accordingly requested that the Studies take into account the interface between the Treaty and the Nagoya Protocol.
181. Discussions with members of the seed industry showed that there is much apprehension regarding the regulatory burden for the seed industry that is likely to result from legislation for the implementation of the Nagoya Protocol, at national and regional level, even for breeders who are not using any materials accessed in accordance with the provisions of the Convention on Biological Diversity. These matters were raised, in particular, in relation to the possibility of substantially reducing transaction costs for users of Article 6.11, as discussed in *Background*.³⁶
182. It is important to be clear: the perceived additional transaction costs falling upon breeders do not derive from the CBD itself, and few breeders and seed companies access materials under use-licenses issued within the framework of the CBD. They arise rather from the implementation of Nagoya Protocol at national level, pursuant to, in particular, Articles 15 and 16, in compliance with domestic legislation, and Article 17, on the monitoring of the utilization of genetic resources. The regulatory pressures arise when added burdens are imposed, for the sole purpose of ensuring that benefits due under CBD use-licenses are paid.
183. The Treaty and the CBD are in harmony, and Article 4.2 of the Nagoya Protocol provides that:
 “Nothing in this Protocol shall prevent the Parties from developing and implementing other relevant international agreements, including other specialized access and benefit-sharing agreements, provided that they are supportive of and do not run counter to the objectives of the Convention and this Protocol”.
184. Moreover, Article 8c provides that:
 “In the development and implementation of its access and benefit-sharing legislation or regulatory requirements, each Party shall:
 “Consider the importance of genetic resources for food and agriculture and their special role for food security.”

³⁶ *Background*, paragraphs 84–96.

185. Because of the apprehension of the seed industry, a comparative analysis was made of the transaction costs involved in accessing and using materials under SMTAs — including in the context of a revisited Article 6.11, and under regulations established for the implementation of the Nagoya Protocol, at national level — in the light of the possible revisiting of Articles 6.7 and 6.11 of the SMTA, as discussed in *Background*.³⁷ The only such implementing regulation, to date, is the *European Union Regulation on Compliance Measures for Users from the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization in the Union*, and this was therefore taken as the model, for the analysis.³⁸
186. The matter of the probable impact of these regulations, in the context of the possible simplification of Article 6.11, was also identified as one of the subjects to be investigated in the simulation exercise.
187. Both the simulation exercise and the consultations with members of the seed industry confirmed that legal uncertainties arising from the Nagoya Protocol (as implemented in the European Union regulations) are especially worrying to plant breeding companies, as these create unknown costs, which is an unacceptable risk. Specifically mentioned were on-the-spot checks of material records and certificates, as well as a heavy bureaucratic load for market approval of new plant varieties, particularly the role of the “internationally recognized certificate of compliance”.
188. A majority of interviewees were of the opinion that access and benefit-sharing under the CBD is not adapted to the realities of plant breeding, and expressed their clear preference for working within the framework of the Treaty. Many feared that the implementation of the Nagoya Protocol will lead to increasing complications in accessing and using plant genetic resources for food and agriculture, and to a consequent narrowing of the resource base used in plant breeding. The consequences of such a narrowing for agricultural genetic diversity would be detrimental to world food security. Moreover, many felt that the increasing regulatory burden would favour larger companies, with substantial legal departments, to the detriment of smaller companies, and promote industry concentration, and the development of monopolies.
189. During the simulation exercise, players rated a number of risks to companies that could result from national regulations for the implementation of the Nagoya Protocol, as shown in fig. 44.

Figure 44. Importance of risk, expressed during the simulation exercise, on a scale of 1–5³⁹



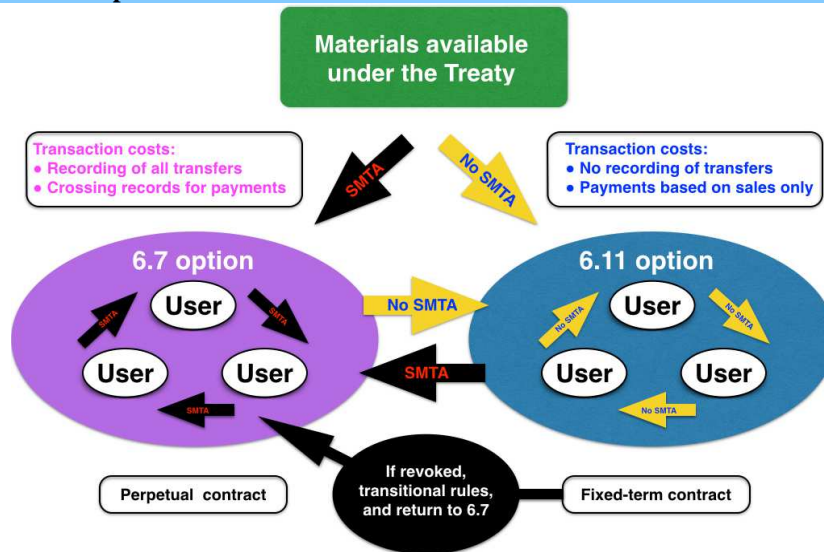
³⁷ *Analysis of the transaction costs occurring for the user, under the SMTA of the International Treaty on, Plant Genetic Resources for Food and Agriculture, and the EU Regulation on Implementation of the Nagoya Protocol*, by Petra Engel, available at <http://www.planttreaty.org/content/background-study-paper-1>.

³⁸ Regulation ((EU) No 511/2014), adopted on 16 April 2014, available at <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32014R0511>.

³⁹ Figure 26, *Preferences and Behaviour*.

190. The simplified Article 6.11 option envisaged and diagrammed in *Background*, reproduced here as fig. 45, foresees no requirement to record crossings in the breeding pools of subscribers to the option, and for transfers between subscribers. As subscribers pay on *all* their products, whether or not they derive from material received under an SMTA, *no* tracking of *any* of their breeding materials would be required by the Treaty. This is seen as a particular attraction of a simplified Article 6.11, but would be valueless, if Nagoya implementation regulations were to overrule the Treaty, and create a separate additional burden. In simple terms, it was felt that the burden of proof of non-use of material received under a CBD use-license should not be imposed upon users of the Treaty's systems, in particular in the context of a simplified Article 6.11.

Figure 45. The possible reduction of transaction costs under Articles 6.7/6.8 and 6.11⁴⁰



191. For this reason, in order to provide for administrative simplicity and legal certainty:
- The SMTA should be accepted as the internationally recognized certificate of compliance for *all* products of subscribers to a simplified Article 6.11, and
 - An accompanying declaration of non-use of materials accessed under a CBD user-license should fully suffice for the market approval of new plant varieties of subscribers to the Article 6.11 option.
192. Moreover, members of the seed industry stressed that the immediate expansion of the Treaty's crop coverage to all plant genetic resources for food and agriculture, including for industrial and all other uses, was highly desirable, for the system as a whole to be coherent and meaningful and constitute an desirable alternative to bilateral MTAs.
193. It would become increasingly difficult over time, if the missing crops were be covered only by the CBD and its Nagoya Protocol, in the interim period. This is particularly the case for vegetables. Vegetable breeding is characterized by fast innovation, as market demands change faster (particular qualities sought by the consumer can change annually). This implies that there is a higher, more frequent need to access new materials in vegetable breeding. For the vegetable industry, a failure to expand the crop coverage would mean that vegetable breeders would have to work under two separate legal systems — the Treaty and the CBD and its Nagoya Protocol — which would involve substantial extra transaction costs, and legal uncertainty.

194. Most interviewees did not believe that breeders would abandon crops, but would continue to breed with their own materials, and those available from competitors on commercial terms, or from the market, under the breeder's exemption in the UPOV Convention. But the constriction of access to crop genetic resources would lead to slower and less effective breeding, to the detriment of food security, and to genetic erosion. The crops most likely to suffer would be minor and under-utilized crops of particular importance to food security in developing countries.

5. CONCLUSION

*The first principle is that you must not fool yourself,
and you are the easiest person to fool*

*Richard Feynman,
Caltech commencement address, 1974*

195. A number of general conclusions can be drawn, to bring together the results of the various approaches adopted in this study.

5.1. THE THEORETICAL ANALYSIS OF POTENTIAL INCOME, AND LIMITING FACTORS, IN THE REAL WORLD

196. Both the static and dynamic analyses of potential values suggest that the theoretical maximums are relatively low, at levels of payment that breeders and seed companies are able to afford, and are willing to pay. As was repeatedly stressed, as part of both the dynamic and static analyses, potential values should not be understood as values that can be realized. Real world conditions all combine to suggest that, with the current structure of the Treaty's access and benefit-sharing system, a number of contradictions in practice extrapolate to low limits on what can realistically be expected.
197. The SMTA is a private instrument, to which breeders and seed companies voluntarily subscribe, which applies to individual samples ("accessions") of plant genetic resources, usually of little proven value, and where there is a supply of the identical or alternative material outside the Treaty, often free.⁴¹ Moreover, many Contracting Parties have not yet taken steps to make their material available,⁴² and according to interviews with representatives of the seed industry, a number are not, *de facto*, providing materials in accordance with the provisions of the Treaty.
198. Potential commercial users of material under SMTAs are rational economic agents, who must take these and other factors into account when deciding to access materials under SMTAs. They weigh the costs and benefits.
199. To date, there has been no income to the Benefit-sharing Fund, from either Article 6.7 of the SMTA (mandatory payments for patented products that have incorporated SMTA material), or from Article 6.8 (voluntary payments, when patents or similar restrictions on use of the genetic material of the product are not claimed).
200. Nothing suggests that the lack of Article 6.7 income is because users have not made payments that were due: the conclusion must be that those who intended making patented products avoided using SMTA materials, and interviews with members of the industry, as well as the simulation exercise, confirm this. Both the static and the dynamic analyses confirm that patented materials would be the largest potential source of income, if avoidance were not the case.
201. The simulation exercise has shown that many users have been willing to access SMTA materials "under Article 6.8", in other words, in the full knowledge that there are no binding obligations. That users then make no payment is not purely a matter of opportunism: seen in terms of profit, rather than of sales, payments at or near the level foreseen in Article 6.7 represent a substantial part of profit. Even more critical is the linkage of two facts: competitors may be able to access equivalent materials at lower or no cost elsewhere, and — as the games theory analysis in

⁴¹ *Background*, paragraphs 38–39.

⁴² The current availability of materials is given in fig. 1 of IT/OWG-EFMLS-2/14/inf.3, *The current status of the Multilateral System of Access and Benefit-sharing*, at <http://www.planttreaty.org/content/background-study-paper-1>.

fig. 46 shows — no user can afford to be the first payer, without a high risk of losing market competitiveness, as a result of an uneven playing field.

Figure 46. Games theory and voluntary payment — a lose-lose scenario⁴³

		Company 2 cooperates	Company 2 defects
Company 1 cooperates	0,0	-,+	
Company 1 defects	+,-	0,0	

If one company makes a voluntary payment (cooperates), and the other does not (defects), the company that defects has a strategic advantage over the company that cooperates. This advantage can:

- be taken as increased profit,
- provide an research and development advantage, or
- be used to lower the sales price of a competitor product.

The advantage is always to the company that defects, and represents a substantial part of profits.

Profit in plant breeding is low. If we assume a profit range of 4% to 6%, 0.77% of sales equals 19.25% to 12.83% of profits.

No company can therefore make the first move and cooperate, because of the risk that other companies defect.

202. Commercial users do not have the latitude to take decisions against their economic interests, when these could put their enterprises at risk. A provision in a contract that appears to put a moral obligation on a user, coupled with a *de facto* understanding that it will be ignored, can only be a source of tension and cynicism.
203. It is not only commercial companies in developed countries that are ignoring the obligations of Article 6.8, because no contributions have been received, either, from state, parastatal and private bodies in developing countries, which commercialize products that incorporate materials received under an SMTA.
204. These real constraints mean that commercial producers who make a payment, under either Articles 6.7/6.8 or 6.11, cannot simply recoup all or part of the cost of access, as a production factor, in setting prices, which would allow them to pass this cost up the chain of consumers of their products and the products of their products — that is, to seed users, and ultimately to the consumers of agricultural commodities — as they could do with a tax on the whole industry. The whole burden therefore falls on seed sales, in an imperfect market, and individual companies have legitimate economic reasons to work around the Treaty.
205. The simulation exercise confirmed that, should the Governing Body decide to make mandatory payments voluntary, the phenomenon of avoidance will extend to the category or categories of products where payments are made mandatory.

5.2. TRANSACTION COSTS AND REGULATORY INTERACTIONS

206. The Working Group has stressed the importance of making the Treaty attractive to commercial users. But there is an economic paradox to overcome. Companies express strong support for the Treaty and its objectives. They are strongly of the opinion that the management of the crucial agricultural genetic resources on which food security depends should be in the food and

⁴³ *Potential*, p. 144, box 3.1, and *Background*, fig. 4.

agriculture sector. They share an opinion that an ineffective Treaty, within the wider international regulatory framework deriving from the Nagoya Protocol, will be deleterious to plant breeding, with negative knock-on effects on world food security, and the conservation and sustainable use of plant genetic resources for food and agriculture. They wish to see the Treaty work, but find it difficult to contribute on a practical level, within the contradictions surrounding the use of the SMTA.

207. However, interviews with members of the seed industry also showed a belief, shared between large and small companies, that larger companies, with substantial legal and financial resources, are most likely to be able to acquire agricultural resources for exclusive use, outside the Treaty, under the provisions of the CBD, and often relatively cheaply. But smaller companies stressed that the effect would be to drive the whole industry towards horizontal and vertical consolidation, with the risk of monopolies developing.
208. The seed industry believes that the benefit-sharing provisions of the CBD, and the enforcement provisions of its Nagoya Protocol, are applicable primarily to bioprospecting in the pharmaceutical sector, where a single sample may prove to have in it a synthesizable, patentable chemical, that can then be the basis for large profits. This is a very different situation to plant breeding, where the raw materials are of very low value, and where substantial value added through research and breeding builds up only late in the process, when a wide range of materials have been combined, and repeated selections made. This is clear from prices in commercial practice.
- “Genetic resources that simply widen a company’s gene pool but are without identified properties of interest have essentially no commercial value, as they require long-term investment and the return on that investment is risky. Much material, including pre-bred material, is available free from the public sector. Payment, if any, for exotic and unadapted material, and even pre-bred materials, will normally not exceed a nominal fee, such as US\$ 5-20.
- “The value of material will increase with characterization and evaluation, if there is an indication of a trait or characteristic of potential commercial interest. Primarily in the vegetable area, if pre-bred material shows a potential value, lump sums in the range of US\$ 5,000 to 50,000 may be paid for a limited number of pre-bred lines, in advanced development stage, which require only another 2-3 years development before commercialization. Such material will normally be obtained on a non- exclusive basis. There will normally be no prohibition of seeking IP protection for research results. Royalty rates will normally not be paid.”⁴⁴
209. The costs of ingressing raw materials and cleaning out deleterious or worthless traits are high. Most of the new value in commercial plant breeding is first introduced through stabilized and pre-bred materials, most usually by national public institutions, and in particular the International Agricultural Research Centres of the Consultative Group on International Agricultural Research, all of whose materials are released under SMTAs.
210. The major perceived value to breeders and the seed industry is that the Treaty facilitates access to plant genetic resources on a non-rival and non-excludable basis, and provides its user with a coherent legal framework, and legal certainty in the use of these resources. The proposed innovative approaches before the Working Group foresee further simplification of the Treaty’s access and benefit-sharing systems, particularly in the context of a revisited Article 6.11.
211. The comparative analysis of transaction costs involved in using the SMTA, in the context of revisited Articles 6.7 and 6.11, and of the national implementation of the Nagoya Protocol, using the example of the recent European Union Regulations, underlines the willingness of breeders to support the Treaty, and seek ways to create effective benefit-sharing, as long as the Treaty is able

⁴⁴ Walter Smolders, *Commercial practice in the use of plant genetic resources for food and agriculture*, Commission on Genetic Resources for Food and Agriculture acting as Interim Committee for the International Treaty on Plant Genetic Resources for Food and Agriculture, Background Study Paper No. 27, at [ftp://ftp.fao.org/docrep/fao/meeting/014/aj346e.pdf](http://ftp.fao.org/docrep/fao/meeting/014/aj346e.pdf), paragraphs 29–29.

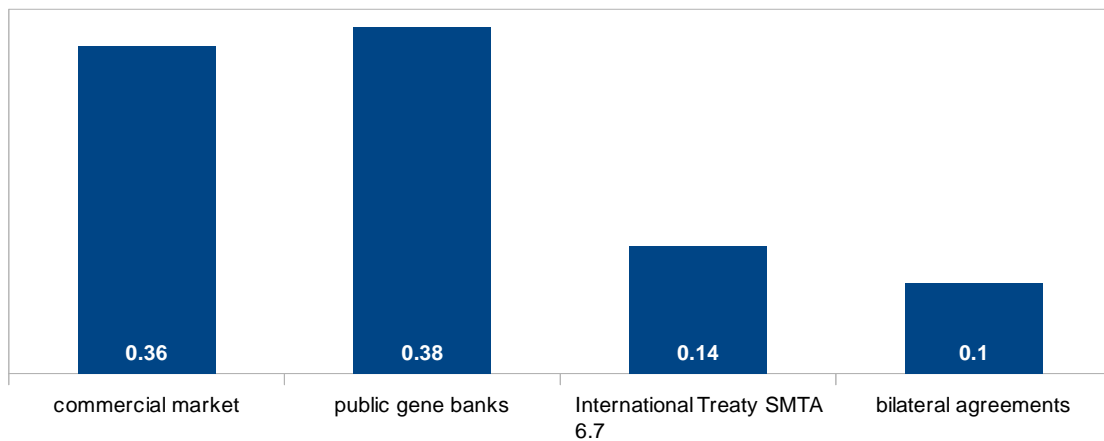
to maintain an effective legal system for plant breeding, that resolves the question of regulatory overlap with the CBD. Such overlapping regulations, the industry believes, create legal uncertainty, and put a heavy and expensive burden on breeders and companies that are working entirely without the use of materials acquired through use-licenses established in the context of the CBD. This provides a favourable climate for establishing a simplified Article 6.11 subscribers' club, as is outlined in *Background*, which does away with tracking and tracing obligations, for all the materials in a subscriber's genepool, and for exchange between subscribers. For this to be possible:

- a. The SMTA would need to be accepted as the internationally recognized certificate of compliance for *all* products of subscribers to a simplified Article 6.11, and
 - b. An accompanying declaration of non-use of materials accessed under a CBD user-license should fully suffice for the market approval of new plant varieties of subscribers to the Article 6.11 option.
212. Moreover, members of the seed industry — particularly the vegetable industry — stressed that the immediate expansion of the Treaty's crop coverage to all plant genetic resources for food and agriculture, including for industrial and all other uses, is highly desirable, for the system as a whole to be coherent and meaningful and constitute an desirable alternative to bilateral MTAs.
213. There is a willingness for cooperation with Governments in contributing to the Benefit-sharing Fund, as was shown in fig. 43 above.
214. In this context, the current access and benefit-sharing procedures of the Treaty involve high but hidden transaction costs for Contracting Parties, including the costs of negotiating its elements, and of maintaining its oversight, management, and enforcement systems. To these must be added the costs to users of issuing and receiving SMTA, and tracking and reporting upon their use. If benefits in the range of, say, US\$ 25 to 50 million annually were to be considered reasonable — benefits similar to the estimates deriving from the static and dynamic analyses — the transaction costs involved in managing the SMTA as a private contract are relatively very substantial.

5.3. THE ATTRACTIVENESS OF THE INNOVATIVE APPROACHES

215. If the willingness of the seed industry to contribute to solutions has grown strongly, a number of technical and institutional economic problems remain.
216. As long as users of plant genetic resources for food and agriculture have access to alternative sources of material, they will always select the cheapest and easiest option, and seek to avoid mandatory payments. The results of the simulation exercise visualised in fig. 47 show that under current conditions, users prefer accessing new genetic material via public gene banks with easy access (such as USDA), or via the commercial market, to using the Treaty's Multilateral System or bilateral agreements, such as under the Convention on Biological Diversity.

**Figure 47. Preferred source of genetic material, relative weighting⁴⁵
(median value consolidated and normalised on a scale from 0=least to 1=most)**



217. The seed industry, in the interviews and in the simulation exercise, expressed the opinion that the SMTA did not reflect normal commercial practice. A specific problem that was frequently raised was the fact that payment obligations devolved on the enterprise commercializing the final product, whereas, in many cases, these companies were no more than multipliers of seed, who pay a royalty to the breeder, and have no understanding of, or interest in, questions of access. Seed breeders feel that, in real market situations, they are unable to negotiate royalty contracts with these companies, if they also have to impose the SMTA.
218. Other matters which have been raised include the lack of a *de minimis* provision in the SMTA, or the ability to renounce the contract. These provisions may be necessary for the context of benefit-sharing based on a private instrument, in the specific circumstances of the Multilateral System, but they are felt to conflict with normal commercial practice.
219. The dynamic analysis has revealed the inherent technical problems involved in managing a benefit-sharing system that offers two payment options, as well as the fact that breeders can easily avoid reaching a point where the quantity of materials in their breeding pool makes it economically worthwhile to pass to the Article 6.11 option. Attempts to make the Article 6.11 option more attractive, by raising the rates of the 6.7 option, or dropping the rates of the 6.11 option, would need either to raise the Article 6.7 rates so high that breeders would be unable to use material from the Treaty, or drop the 6.11 rates to a level where the projected income is risible.
220. The results of this economic analysis suggest that a solution to the need to generate acceptable, sustainable and predictable income for the Benefit-sharing Fund cannot be found by manipulating the rates alone.
221. Moreover, the expansion of the Treaty's crop coverage to all plant genetic resources for food and agriculture, which is highly desired by many members of the plant genetic resources community, would not necessarily generate higher income for the Treaty, unless the basic contradictions of the current system are resolved, because the economic logic of decisions as to whether or not accept materials under SMTA would not have changed.
222. The findings of the different approaches brought together in this study seem to indicate that innovative collaborations between Contracting Parties and the seed industry operating in their territories might hold the greatest promise for generating acceptable levels of income for the Benefit-sharing Fund, in a sustainable and predictable manner.

⁴⁵

Figure 12, *Preferences and Behaviour*.