



**D9-2** | *Report on proposal for modifying the NEMESIS model, based on the analysis of the European innovation and the analysis of the 34 commitments*

**Deliverable:** *Synthesis Report on European Innovation System*  
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**Version:** Draft 2  
**Quality review:** **ISINNOVA**  
**Date:** 01/01/18

**Grant Agreement N°:** 645884  
**Starting Date:** 01/01/2015  
**Duration:** 36 months

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### *Modifications made in the revised report compared to the first version submitted in October 16, 2017*

The following modifications were made compared to the previous version of the deliverable D9.2:

1. An index of content and a conclusion have been added.
2. The classification of the 34 commitments and some sub-commitments into the three categories has been revised after the discussions in Paris, the interactions between each working party, SEURECO and UNU-MERIT, the exchanges with EC officials and the validation workshop in Brussels. A paragraph to that effect was added in section 2. Ten more commitments or sub-commitments were added to the final list of commitments that would formally be included in NEMESIS (2.2, 3, 4.2, 7, 14, 16, 17, 19.2, 30, 34).
3. In section 3, an explanation is given as to why the commitments that fall in the first category of “mere statements” cannot be included in the NEMESIS model despite their usefulness for the Innovation Union. At some places suggestions are given as to how these commitments could be evaluated in the future, once data become available. Some of these commitments are also still in their inception.
4. In section 4, an explanation is given for why the commitments in the second category are not included in spite of the presence of quantifiable data to measure their effect.
5. A section 6 has been added that explains how the NEMESIS model is enlarged in this I3U project to include some of the 34 commitments, those that can be quantified.

Comments that were not included in this revision are:

1. The collection of data to measure some of the commitments. Section 3 explains why some commitments cannot be included in NEMESIS. For some commitments, e.g. commitment 8, surveys were conducted to get some measurement of the success of those commitments. But even this data is not sufficiently detailed at the sectoral and country level to be included as a parameter or a variable in NEMESIS. And even if we could possibly collect data at the sector and country level, it would take a huge effort to collect data in a scientific way. Those are tasks that we leave to statistical offices. Data to monitor and benchmark the innovation performance can be gathered at the input level, but the interesting thing is to measure the outputs, impacts and outcomes of their introduction, e.g. global research infrastructure, consultation of social partners.
2. True, the evaluation of the IU that will be conducted via the NEMESIS model will not include all the commitments for the reasons mentioned, but it will nevertheless provide a first evaluation of the IU on the basis of what can be reasonably measured at this point.
3. The questionnaire that was sent to each WP to find out what could be included in NEMESIS was useful to come to a first selection of commitments that could be included in NEMESIS. Appendices A and B are added to document how we have proceeded. Trilateral discussions between each WP, SEURECO and UNU-MERIT allowed to revisit the first selection and include a few more commitments in the NEMESIS model. Discussions with EC representatives during the Summer and Fall and at the validation workshop were also helpful. If new data or parameters become available, we still remain open to enrich the NEMESIS model.



# *Report on proposal for modifying the NEMESIS model, based on the analysis of the European innovation and the analysis of the 34 commitments*

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Revised draft, December 31, 2017

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### 1. Introduction

At the Zagreb and Paris meetings, all WP leaders discussed whether and how each of the 34 commitments could be introduced into the NEMESIS model. In preparation to the Zagreb meeting, the SEURECO team had set up and circulated a questionnaire to all work package leaders. In appendix A, there is a copy of the questionnaire and in appendix B the guidelines for filling out the questionnaire.

The present document summarizes the outcome of this survey and of the discussions we had in Zagreb and in Paris. Subsequently, with the help of Hinano Spreafico, each WP contacted officials from the European Commission to find out whether additional data, information or studies existed that could be added to the reports regarding each individual commitments. We also had triangular contacts between each WP leader, SEURECO and UNU-MERIT to make sure that as many



commitments as possible could somehow be integrated in the NEMESIS model as parameters or data. And, finally, a validation workshop took place in Brussels where the interim reports from each WP were presented to EU officials for comments and criticisms. This document explains why some of the commitments cannot make it in the NEMESIS model despite their importance for innovation in Europe, and for those commitments that can be incorporated into NEMESIS, it explains how they will be incorporated.

## **2. Structure of a questionnaire sent to each work package leader to find out which commitments can be included in NEMESIS**

A questionnaire was thus sent to each WP to find out which commitments could be included somehow into NEMESIS. The questionnaire basically asked 5 questions:

- 1) Can the commitment be integrated in NEMESIS or is it merely a statement?
- 2) Describe the action of the commitment in the European innovation system?
- 3) Entries in NEMESIS: equation, parameter, variable?
- 4) Primary inputs that will be produced for NEMESIS, together with data sources, methodology used to produce it (econometrics, meta-analysis,...) and coverage (countries, sectors,...)?
- 5) How the primary inputs can be transformed to fit the NEMESIS model?

On the basis of the survey outcomes, the discussions between working parties and with EU officials, we came to the conclusion that there are 3 categories of commitments as far as their implementation in the NEMESIS model is concerned. First, you have the commitments that we qualify as mere statements, i.e. which cannot be quantified or for which no data are available and which therefore cannot be introduced in NEMESIS. Second, you have the commitments that are considered as candidates, i.e. for which the data and parameter estimates for their inclusion in NEMESIS exists, but for which either the data are incomplete or the parameters needed for their inclusion in the model are not sufficiently robust. Third, you have the commitments that can be introduced in the NEMESIS model. As the project develops and new data or robust estimates become available some of the candidate commitments may be incorporated into NEMESIS.

## **3. Commitments that are considered as mere statements**

As table 1 (taken from D10.2) explains, certain commitments do not lend themselves to a modeling within the NEMESIS model for various reasons:

- they intend to produce useful statistics to monitor the progress of the Innovation Union but without a direct impact on innovation in particular sectors;
- their implementation has not occurred yet or has been delayed, so that it is not yet possible to quantify their effects on innovation and other measures of economic performance;
- the data needed to measure them do not yet exist;
- their effect can best be analysed qualitatively.

Let's go over these commitments one by one.



*Commitment 2.1* on university rankings is not included in NEMESIS because it is unclear what exactly these rankings measure. If they just measured the strength of academic research, they could be used as a sign of a higher productivity of academic research. If, however, they just measured the quality of education, then their usefulness for innovation is only indirect, as they would measure the preparation of human capital for future research. The U-Multirank system is based in addition to research and teaching on knowledge transfer, international orientation and regional engagement (see deliverable 1.1). As it is not clear at all what the university rankings measure we have not included them in NEMESIS. This commitment ought to be reconsidered to clarify what it is supposed to capture, and then construct a ranking that would be based on those criteria.

*Commitment 4* – European Research Area Communication – is again an amalgam of various dimensions. We have divided it up into three elements: creation of pan-European pension funds for researchers (4.3), ERA international collaboration (4.1), and ERA research mobility (4.2). Commitment 4.3 has not been included in NEMESIS because pension systems for foreign researchers in EU countries are not transparent and solid data on it are therefore unavailable. Collecting data on this would be a project in itself. It is expected that the lack of harmonization in this regard constitutes a barrier to research mobility in Europe.

*Commitment 8* – JRC and forward looking activities is a commitment that is hard to quantify and therefore to include in NEMESIS. Deliverable D2.2 has examined the productivity of funds invested in JRC in terms of publications or publications per JRC employee. It also reports the results of a survey conducted among policy makers to find out the importance JRC and forward looking activities had on various stages of policy making and their perceived economic, social and environmental impact.

*Commitment 9*. Once more the EIT strategic agenda is an institutional or organizational innovation the impact of which is not easy to quantify in terms of the sector and country detail of the NEMESIS model. Deliverable 2.2 has provided an impact assessment of the EIT in terms of economic, social and environmental dimensions on the basis of interviews with EIT officials.

*Commitment 15* is also a recommendation to regularly screen the usefulness and effectiveness of regulations, such as the eco-regulation or European Innovation Partnerships. Some regulations have been assessed, others not. Deliverable 4.2 presents an evaluation of eco-innovation. This commitment concerns particular regulations. It is hard to quantify the impact of this commitment. What could be done at some stage is a diff-in-diff analysis comparing the performance of economies in terms of innovation before and after the introduction of the regulation screenings.

Regarding *commitment 18*, too little time has passed since the inception of this commitment to find out the effects it had on eco-innovation. Deliverable 4.2 conducts an analysis of the impact of eco-innovation using micro data from Germany, but not of the eco-innovation action plan. This plan is again a one-time measure that can best be analysed by a diff-in-diff analysis. It cannot be incorporated in NEMESIS because it cannot be quantified.



*Commitment 23.* Guidelines intended to prevent anti-competitive use of patent rights in the form of standardization agreements and technology transfer agreements, such as patent pools, have been introduced in the EU in the last 10 years. Data on their effects do not yet exist. For example, a revised version of the Technology Transfer Guidelines and the Block Exemption Regulation were only introduced in 2013 (see deliverable 5.2).

Regarding *Commitment 26*, work is still underway, funded by the European Commission, such as the Social Innovation Europe Initiative, the European Social Innovation Competition to measure and to evaluate the impact of social innovations (see deliverable 6.2). Lessons are being learned but data on their impact do not yet exist. It is premature to include this commitment in the NEMESIS model.

The Public Sector Innovation Scoreboard – *commitment 27* - is supposed to benchmark public sector innovations in EU countries. It has not yet been fully implemented and no data exist up to this point. It is a useful tool to monitor and benchmark innovation performance in the public sector, has no direct impact of private innovation. Maybe at one point it will turn out that this sharing information exercise will improve the performance of public sector innovation performance, but it is too early to put a figure on this.

*Commitment 28* – consultation with social partners is still in its inception. It is an attempt to get social partners involved in the innovation effort and can best be evaluated qualitatively once sufficient data are available.

*Commitment 29* – European Innovation Partnerships – is also still in its inception. A few EIP's have been set up but lessons from these EIP's still need to be learned (see deliverable D8.1) and data assembled to perform their evaluations.

*Commitment 32* – Global Research Infrastructure . As deliverable 7.2 indicates, the performance indicators for the 12 Global Research Infrastructures set up so far are too fragmented to measure their leverage effect. Qualitative analysis like the ones described in D7.2 can be done and provide useful results, but at this stage this commitment cannot be included in the NEMESIS model.

*Commitment 33* – Self-assessments of the R&I systems by the member states – is again a monitoring tool, very important as such, but again with no immediate measurable effects on innovation at the sectoral level in each member state.

*Commitment 34.1* – new indicators and monitoring – is also as such an effort to monitor the innovation performance in the IU by collecting statistics. As such it also has no direct impact on innovation performance and hence cannot be inserted in NEMESIS.

Table 1  
Commitments that are considered as mere statements



Commitment	WP	Team	Explanation
2.1 University ranking	1	TIK	The ranking will present material for policy makers but will not have a direct impact on innovation.
4.3 Creation on pan-European pension funds for researchers	2	TIK	Lack of data, funding principle and responsible actors difficult to identify, legal obstacle in MS
8 JRC and Forward looking activities	2	WERI	Not quantifiable
9 Set out EIT strategic agenda	2	WERI	Not quantifiable
15 Screening of regulatory framework	4	ZEW	Not quantifiable
18 Eco-innovation action plan	4	WIIW	Not quantifiable
23 Safeguard rules for IP	4	ZEW	Need for data and empirical evidence of its effects
26 European social innovation pilot	6	WIIW	Many heterogeneous programs have been initiated. No clear evidence of their effects.
27 Public sector innovation scoreboard	6	WERI	Useful statistics for policy makers, but no direct impact on innovation
28 Consultation of social partners	6	WIIW	Policy in inception, will be only introduced in particular sectors
29 European innovation partnership	7	WIIW	Possible new sources of spillovers, finance and actions to market. Lack of data (no systematic evidence on EIPs actual performance and effects)
32 Roll-out global research infrastructures	7	WERI	Lack of data, lends itself better to a qualitative approach
33 Member States self-assessments R&I systems	8	ISINNOVA	Qualitative
34.1 New indicators and monitoring	8	ISINNOVA	Useful statistics for policy makers, but no direct impact on innovation

#### 4. Commitments that are considered as candidates

The following commitments are classified as “candidates”, that’s to say as commitments that will have an effect on innovation, and indirectly on other measures of economic performance, in the NEMESIS model, but that, at this stage, cannot be incorporated in the model either because data are missing, imperfect or incomplete, or because the parameters that are needed to quantify their impacts are too uncertain (i.e. not robust to small changes in the sample or the estimation method, or not significantly estimated). If data exist but are incomplete (e.g. available for only one or two countries or sectors) there is little point of including these commitments in NEMESIS. The same holds if data exist but the parameters needed to include their immediate effect in NEMESIS are too unstable or statistically insignificant.

Regarding *commitment 1.1*, as D1.2 reports the elasticity of scientific productivity with respect to research training is not significant for the 10 year panel data available. Maybe the effect of



researchers' training will show up in the long term. But at this stage, the estimated coefficient is not sufficiently informative to include this commitment in NEMESIS.

For *commitment 1.2*, D1.2 reports that the available data on researchers' satisfaction with respect to their employment conditions is limited to one year. Given this small dataset and possible problems of multicollinearity with respect to other explanatory variables, it is safer not to include this commitment in NEMESIS.

For *commitment 4.1*, international research collaboration, the results reported in D1.2 show that the relationship between scientific productivity and the share of collaborative patents in total patents granted varies across countries and is often negative and significant. This result is counterintuitive and therefore we have preferred not to include this dimension in the model at this stage waiting to get more solid and reasonable results with perhaps other measures of scientific productivity than publications and other measures of research collaboration than co-patents.

Regarding *commitment 5* - EU research infrastructure - deliverable D2.2 reports that 22% of the priority research infrastructures of ESFRI (European Strategy Forum on Research Infrastructure) Roadmap 2008 and 2010 were abandoned or not yet initiated. There has been a leverage effect, in the sense that other funds, private or public, came to complement these EU ESFRI funds. There is, however, a scarcity of statistical data on the performance of research infrastructure.

*Commitment 19.1* – establish a European creative industries alliance could be considered as a source of spillovers, but the available data are too scarce to use the estimated elasticities of GDP or employment with respect to activities in creative industries.

As D5.2 reports, *Commitment 20* – Open access to research results - there are data on open access depositories but few evaluations of their importance for research. One such survey was conducted for Croatia. Data for other countries on the importance of open access for researchers do not exist. In any case, even if data are available it is not easy to quantify this impact.

For *commitment 21* - Collaborative research and knowledge transfer – a study was conducted on the performance of Croatian technology transfer offices in D5.2. even if data from other countries were available, the importance of TTO's is difficult to quantify and insert in NEMESIS despite the fact that they help in diffusing knowledge.

The European market for patents – *commitment 22* – has not yet been implemented. It is therefore impossible to estimate its impact on innovation and introduce it in NEMESIS. If a study is available that has estimated the impact of a market for technology (i.e. patents and licensing) for the U.S, it could be envisaged to apply this estimate to the European data of the NEMESIS model. However, since there is no suggestion at all how such online technology platforms would look like at the EU level, and obviously the functioning of such a market critically depends on the specific design of the platform, it is not clear whether such an exercise makes a lot of sense.

Regarding *Commitment 31* - scientific cooperation with third countries – as D7.2 reports many



countries have implemented this commitment and increased their scientific cooperation with third countries in terms of joint publications or graduation of foreign students, but little information exists so far regarding the quantitative monitoring of this commitment.

Table 2  
Commitments that are considered as candidates

Commitment	WP	Team	Explanation
1.1 Researcher's training	1	TIK	Data exist, but are too scarce to achieve robust estimations of the impacts
1.2 Employment conditions	1	TIK	Data exist, but too scarce to achieve robust estimations of the impacts
4.1 ERA – International collaboration	2	TII	Data exist, but too scarce to achieve robust estimations of the impacts
5 EU research and innovation infrastructures	2	WERI	Some data are available on the allocation of funds in FP7 and H2020, but data from national and private sources for research infrastructure are limited. Geographical distribution of EU funds can be investigated. An analysis, infrastructure per infrastructure, looks more appropriated to assess the impacts on scientific productivity and innovation.
19.1 Creative industries alliances	5	ULB	Drivers of innovation and sources of spillovers, but data too scarce.
20 Open access to research results	5	EIZ	Source of spillover, diffusion of knowledge, but difficult to quantify and to measure its impacts
21 Collaborative research and knowledge transfer	4	EIZ	Source of knowledge spillovers, but its impact and direction can hardly be quantified given present data.
22 European market for patent and licensing	6	ZEW	No policy change has yet been implemented
31 Scientific cooperation with third countries	7	EIZ	Source of spillovers (international) and knowledge capital, but data deficiency for inclusion in NEMESIS

The biggest problem with the commitments listed in table 2 is to have the data available at a sectoral level and for all EU countries in order to be able to build these commitments into NEMESIS, which is a sectoral model. For some commitments it is, at this stage, not yet certain whether the data are available. For instance, if good data are available for 1.1, 1.2, 2.2, 3, 4.1, 4.2, maybe the respective commitments can be introduced in NEMESIS.

## 5. Commitments that are selected for inclusion in NEMESIS

The following commitments are classified as “selected”, i.e. that they can be incorporated into



NEMESIS because they are sufficiently well measured and their effect is sufficiently robust. Those are the variables that will ultimately be implemented in the NEMESIS model.

Table 3  
Commitments that are selected for inclusion in NEMESIS

Commitment		WP	Team	Method of integration
2.2	Knowledge alliances for skill gaps	1	TIK	The integration in NEMESIS will be based on econometric estimations of the impact of knowledge transfers on public research productivity
3	Propose an integrated framework for e-skill	1	TIK	The integration in NEMESIS will be based on econometric estimations of the impact of share of workers with advanced e-skills on public research productivity
4.2	ERA - research mobility	2	TIK	The integration in NEMESIS will be based on econometric estimations of the impact of the share of foreign researchers employed in each country on public research productivity
6	EU research and innovation programmes	2	WERI	The implementation in NEMESIS will be based on eCORDA data on H2020 programmes and on the methodologies developed for the interim evaluation of H2020 (see EC, SWD(2017) 220 final and PPMI , 2017)., the report of the independent high level expert group on maximizing the EU R&I programmes (EC, 2017b) and on the preparatory works at European Commission on the post-H2020 research programme.
7	SMEs in research and innovation programmes	2	EIZ	As for commitment C6, the implementation in NEMESIS will be based on eCORDA data on H2020 programmes and on the methodologies developed for the interim evaluation of H2020 (see EC, SWD(2017) 220 final and PPMI , 2017), the report of the independent high level expert group on maximizing the EU R&I programmes (EC, 2017) and on the preparatory works at European b on the post-H2020 research programme. The methodology will be adapted to the case of SMEs concerning notably the leverage effect and the economic performance of FP funding.
10	Put in place EU financial	3	ULB	The implementation in NEMESIS will



	instruments to attract private finance			focus on RSFF's crowding-in effect on R&D investment by private firms (from EIB data and econometric works)
11	Access to finance- Venture capital	3	ULB	The implementation in NEMESIS will focus on VC's funding crowding-in effect on R&D investment by private firms (from EVCA data and econometric works)
12	Access to finance - Matching	3	ULB	The implementation in NEMESIS will focus on VC's funding crowding-in effect on R&D investment by private firms (from EVCA data and econometric works)
13	Review State aid framework for R&D and innovation	3	ULB	The implementation in NEMESIS will focus on the impact of R&D expenditures funded from abroad on the decision to invest in R&D by the business sector (from Global Innovation Index, EUROSTAT data and econometric works)
14	Unitary patent	4	ZEW	The unitary patent is not already introduced and assumptions should be made on the date of adoption by the different countries. The instruction in NEMESIS will be based on the impact of the UP on the fall of patent renewable fees and on cost of innovation for EU firms
16	Standardisation	4	ZEW	After a more in depth examination of this commitment a final decision is still to be taken on its implementation in NEMESIS. There exists only very few exploitable data and for Germany only. The empirical evidence on the impacts of standards on firms' innovation behavior is therefore very limited
17	Innovative Public Procurements	4	ZEW	The implementation in NEMESIS will be based on existing time series on innovative public procurements in the different EU countries and on future targets on IPP in % GDP for every countries. The impacts will pass by the demand-driven effects of IPP on the decision of firms to invest in innovative assets (R&D, ICT, software and training)
19.2	EU design leadership board	5	ULB	The introduction in NEMESIS will be based on the impact of the number of Community Design Application on GDP growth in the different EU countries (from econometric works). It will be translated in the model through the impact of design activities on product innovation
24/25	Improve/increase the use of	6	WIIW	As for FP (commitments 5 and 6), the



	Structural Funds for R&I			implementation in NEMESIS will be based on the temporal and geographical allocation of the ESI funds for R&I and on the leverage and economic performance effects of the funding. Different types of activities will be distinguished (Basic research, infrastructures, public/private partnership, training for researchers)
30	Foreign talents	7	TIK	The integration in NEMESIS will be based on econometric estimations of the impact of the attractiveness of each country for foreign scientists on public research productivity
34	Innovation Scoreboard	8	SEURECO	This commitment was already implemented in NEMESIS and the results are displayed in the deliverable D8.2. The introduction in the model have been based on the evolution of public and private research expenditure between 2007 and 2015 to proxy the progresses reached by the IU on that period.

Ways in which commitments can enter the model: human capital (especially skilled capital entering R&D, ICT and other intangibles), financing that reduce the cost of capital and thereby encourage investment in R&D, ICT and other intangibles, ways to increase the diffusion of knowledge entering as another determinant of innovation, ways in which spillovers occur in the transmission of knowledge or in the transmission of rents from innovations that benefit other sectors that the generators of R&D, infrastructures that facilitate innovation, public investment in the generation of knowledge. Deliverable 10.2 contains the details of which data are requested from each work package and which parameters have to be provided to NEMESIS. Basically the data and parameters necessary will serve to add the equations that correspond to the demand for each technological component, i.e. the productivity parameters, distribution parameters, elasticities of substitution, spillover parameters and the effects of product and process innovations on output.

## 6. Modification of the NEMESIS model to incorporate the IU commitments

NEMESIS is a large scale multi-country, multi-sector macroeconomic model that was set up in 2000 and has been improved since then. It has been used for many years by the European commission for forecasting, simulations and assessments of the effectiveness of various policies. It contains 28 EU countries and 10 non-EU countries and has a sectoral breakdown of 30 sectors, which operate under monopolistic competition. It is recursively dynamic and its parameters are estimated from structural models and calibrated. There is in this model heterogeneity among sectors - this is one of the major features of this model that distinguishes it from other models - as well as among countries. It is an open macro model with partial adjustments to long-term equilibrium levels



of the endogenous variables.

Here we give a quick sketch of the model. For more detail, the reader is referred to deliverable D10.2 and to Brécart, D. and Fougeyrollas, A. and Le Mouël, P. and Lemiale, L. and Zagame, P., “Macro-economic consequences of European research policy: Prospects of the Nemesis model in the year 2030”, *Research Policy*, vol. 35, n°7, pp. 910-924, 2006. For every sector, the production is modelled by nested CES production functions. There are variable inputs (materials, energy, low-skilled and high-skilled workers) and two quasi-fixed inputs (capital stock and innovation services). The technological input is a CES aggregate of R&D (research and development), investments in ICT (information and communication technologies) and other intangibles, namely training and software. The demand for the variable inputs are derived from the first-order conditions of variable cost minimizations, the demand for the quasi-fixed inputs are in the long run determined by the envelope conditions and in the short run by a partial adjustment model plus an error correction mechanism. On the labor market, labor supply is exogenously determined by population data and participation rates. The equilibrium in the labor market is modelled by a wage bargaining process following an augmented Phillips curve. Real wages in each sector change with productivity shocks, changes in the unemployment rate and changes in the real wages in other sectors. The representative household’s aggregate consumption depends on the disposable income, itself depending on wages, revenues of capital, taxes and redistributions, as well as child and old age dependency rates. Once aggregate consumption is determined, it is split into 27 consumption categories depending on relative prices, substitution elasticities, income effects and demographic changes. Government consumption is split into defence, health, education and other expenditures. Housing investments are treated separately. International trade is disaggregated into intra-European trade and extra-European trade. Imports and exports are a function of relative prices, income and non-price effects (relative innovation stocks). Trade prices are set as in oligopolistic markets.

The modelling of innovation is at the heart of the I3U project. The innovation services are a CES aggregator function of the respective stocks of technological knowledge (R&D, ICT and other intangibles) in proportion to the absorptive capacities. The stocks of knowledge are the weighted sum of the stocks available in all sectors and countries in proportion to patent citations and given certain predetermined lags. Complementarities between the different innovation services are allowed for and explicitly modelled. There are two kinds of innovation: product innovations, which increase the quality of the products and therefore affect the demand for the products by the consumers, and process innovations, which are cost-saving and reduce the demand for the other inputs.

To IU commitments will enter the NEMESIS model by increasing the stocks of public knowledge (e.g. knowledge alliances), the productivity of private research (e.g. e-skills), the diffusion of knowledge (e.g. mobility of researchers), the demand for R&D (e.g. EU innovation programs or access to venture capital), the user cost of R&D (e.g. unitary patent), and the distribution parameters (e.g. structural funds or EU design leadership board). The inclusion into NEMESIS will require new data on these variables and new parameters to determine the impacts of these variables on the endogenous variables of the model (production, consumption, prices, wages, trade, etc). Sensitivity



analyses will be done by taking upper and lower bounds of some of these parameters. And finally different scenarios will be run to determine different responses depending on the state of implementation of some of these commitments. Only quantifiable and measurable impacts of the 34 commitments can be incorporated in NEMESIS. This is a short summary of how the NEMESIS model will be changed to incorporate some of the 34 IU commitments. For a more detailed explanation of those changes, the reader is referred to deliverable D10.2.

Complementarity between commitments can and will be analysed with the NEMESIS modelling complementarity directly through a CES aggregator function leading to interaction terms in the marginal effects so as to capture synergy effects in the simultaneous fulfilment of two or more commitments, and/or by comparing through simulations the outcomes from joint versus non-joint implementations of certain commitments.

## **7. Actions to be taken from here on**

For the commitments that are considered to be implementable in the NEMESIS model, the SEURECO team has indicated to each work package what data or parameters (marginal effects, elasticities or semi-elasticities) need to be provided for inclusion in NEMESIS, as deliverable 10.2 indicates. There might be a need to aggregate or disaggregate certain variables to fit the level of classification (e.g. the industrial classification) used in the model. It is possible that some variables do only exist for certain countries or certain industries. In that case, the respective package leaders and SEURECO, in agreement with UNU-MERIT, will have to decide whether a particular commitment should be dropped, modified or partially implemented in the model.

## **8. Conclusion**

After a first round of analysis of the stage of implementation of the 34 commitments of the innovation union and a qualitative impact of their effects, a discussion took place in Zagreb between the various working parties to determine which commitments could be included in the macro-economic NEMESIS model. A specific questionnaire was set up and distributed to the different program leaders to that effect. At the Paris meeting the proposals of SEURECO on the basis of the returned questionnaire were discussed by all parties. Then over the Summer and Fall 2017 contacts were made with EU officials to find out where more data, parameters or measurable effects would exist for each commitment. Finally, at a validation workshop in Brussels the analysis of each of the 34 commitments were presented to EU officials for validation and last quest for more measurable effects for incorporation in NEMESIS.

In the end, 17 commitments or sub-commitments will be included in the NEMESIS model in order to evaluate its effects on the endogenous variables of the model. The program leaders have now to provide the necessary data and parameters to SEURECO. During the implementation stage it may be possible that some additional changes have to be made depending on available data and their quality.



**Appendix A** Questionnaire for integration of commitments in NEMESIS, prepared by SEURECO



QUESTIONNAIRE-CX.  
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**Appendix B** Guidelines for filling out the questionnaire, prepared by SEURECO



Guidelines for Filling  
the QUESTIONNAIRE.pdf

