Forecasting the Economic Impact of New Policies

Nicolas D. Savio, **Konstantinos Nikolopoulos**

Business Systems Division

Manchester Business School

Manchester, M15 6PB, U.K.

Email: Nicolas.Savio@postgrad.mbs.ac.uk ; Kostas.Nikolopoulos@mbs.ac.uk

www.publicpolicyforecasting.com

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Abstract

In relation to other forecasting applications, policy impact forecasting is an important application which has received surprisingly little attention in terms of research from the field in the past. Once policies proposed by the EC are approved by the Council or the Parliament, it is the responsibility of the Member States to implement them, with the EC overseeing this process. In many instances, particularly for environmental policies, the implementation strategy will attempt to promote the use of a new eco-friendly technology through a series of incentives, to aid in hitting the EU target. Generally, there will be many different strategies available to Member State governments for reaching the goals and targets set by the EU legislation. To aid in this decision making process, forecasts of the adoption rate of each of the different strategies will be an indication as to their effectiveness. This in turn can be used to estimate the financial investment required by each, an important criterion as the governments will have fixed budgets for such undertakings. This research highlights the importance and need for such forecasts. Furthermore, it proposes a new hybrid approach for producing these forecasts which combines structured analogies and econometric modelling.

Keywords: Environmental Policies, Policy Implementation Strategy, Forecasting, Structured Analogies

1. Introduction

Relative to other areas of forecasting research, policy impact forecasting has seen considerably less interest from the field in the past. Possible reasons could include the high levels of complexity and low success rate associated with forecasting the impact of a new policy. Nonetheless, it must be said that such a forecasting application is key for any government when assessing whether to implement a policy and hence very important for long range planning and strategy in any governance structure.

The notions of sustainable development, climate change and nature conservation are undoubtedly high priorities on the EU's political agenda. It is the EU's responsibility to set the European standard and lead the way for other countries and organisations around the world in combating the negative effects of humanity's development. This stresses the importance of environmental policies and their successful implementation. As part of the latter, the ability to forecast the economic impact of these new policies and hence improve decision making for the relevant governance structures is vital, assuming of course that better forecasts improve decision making.

The following paper focuses on how to assess the economic impact of new environmental policies and recognises the importance of such a sound prediction and the potential benefits it can offer. More specifically, it focuses on policies which are implemented through initiatives (also known as policy implementation strategies) promoting a new type of eco-friendly technology via incentives. The rate of adoption of the new technology is seen as an indication of the effectiveness of the initiative. With various possible policy implementation strategies, of different shape and specifications, available for attaining the same objectives, any government will strive to opt for the most cost effective. Having fixed budgets for such projects, ex-ante forecasts of such adoption rates are strong indicators of the financial investment required by each alternative implementation strategy and hence very important for deciding which is to be chosen. Clearly, this will be significant for budgeting purposes. As a result, the paper proposes a method based on combining econometric modelling and structured analogies for producing such ex-ante adoption rate forecasts.

The paper starts with a discussion on policy implementation strategies and the need for such forecasts. The proposed approach for producing these forecasts and the requirements for developing such an approach are then described. Finally, the paper concludes and makes suggestions for further research.

2. Policy Implementation Strategies

As the main executive branch of the EU, one of the European Commission's (EC) principle roles is to co-ordinate the policies between the Member States to be adopted by the EU. They do so by proposing legislation and consequently overseeing their implementation. The principle of subsidiarity says however, that it is the duty of the Member States to implement this legislation and hence the strategy for doing so is entirely their prerogative.

Many policy implementation strategies, or initiatives, stem from and are made possible by the advent of new environment and clean technologies (ECT), used to confront existing problematic situations. A significant challenge faced by governance structures is to reduce the delay between the identification of such problems and the development and implementation of the policy strategies to cope with them (Eder and Leone, 1999). Appropriate foresight exercises and forecasting approaches are needed to help policy makers design policies capable of "pre-empting rather than remedying environmental damage" (Eder and Leone, 1999, p.548). In order to do so, we need to improve our ability to assess the consequences of ECT progress. Such a need is particularly relevant in view of the EU's over-arching goal of sustainable development where Johnston (2001) rightly highlights a need for both "intergenerational" and "transversal" solidarity.

Tavares (2002) emphasises the importance of technology foresight in development policies and similarly, ECT foresight is important in environmental policies. The task of foreseeing the impact of new ECTs is a rather complicated one because their adoption is dependant on so many conditions. E.g. Oil price gas a direct influence on the economic rate of adoption of alternative energy technologies (Dearing, 1999). This difficulty is then "transmitted" to the ability to forecast the impact and adoption of the policy implementation strategies promoting the new ECTs.

A particularly high-profile environmental policy which has seen an increase in political pressure in recent times is that of climate change. Research and development institutes in both the public and private sector, on both a European and Member State scale, are continuously trying to develop new eco-friendly technologies to improve efficiency, quality, reliability, etc with this policy in mind. The government then attempts to promote the change over from the old wasteful technologies to the newer, more efficient ones through government funded policy implementation strategies, or initiatives.

It is often the case that the EU policy will have objectives or targets that, through legislation, will be compulsory for the Member States and it is these new technologies that will provide the means for hitting these targets. To illustrate these ideas, the example of road transport emission reduction can be used:

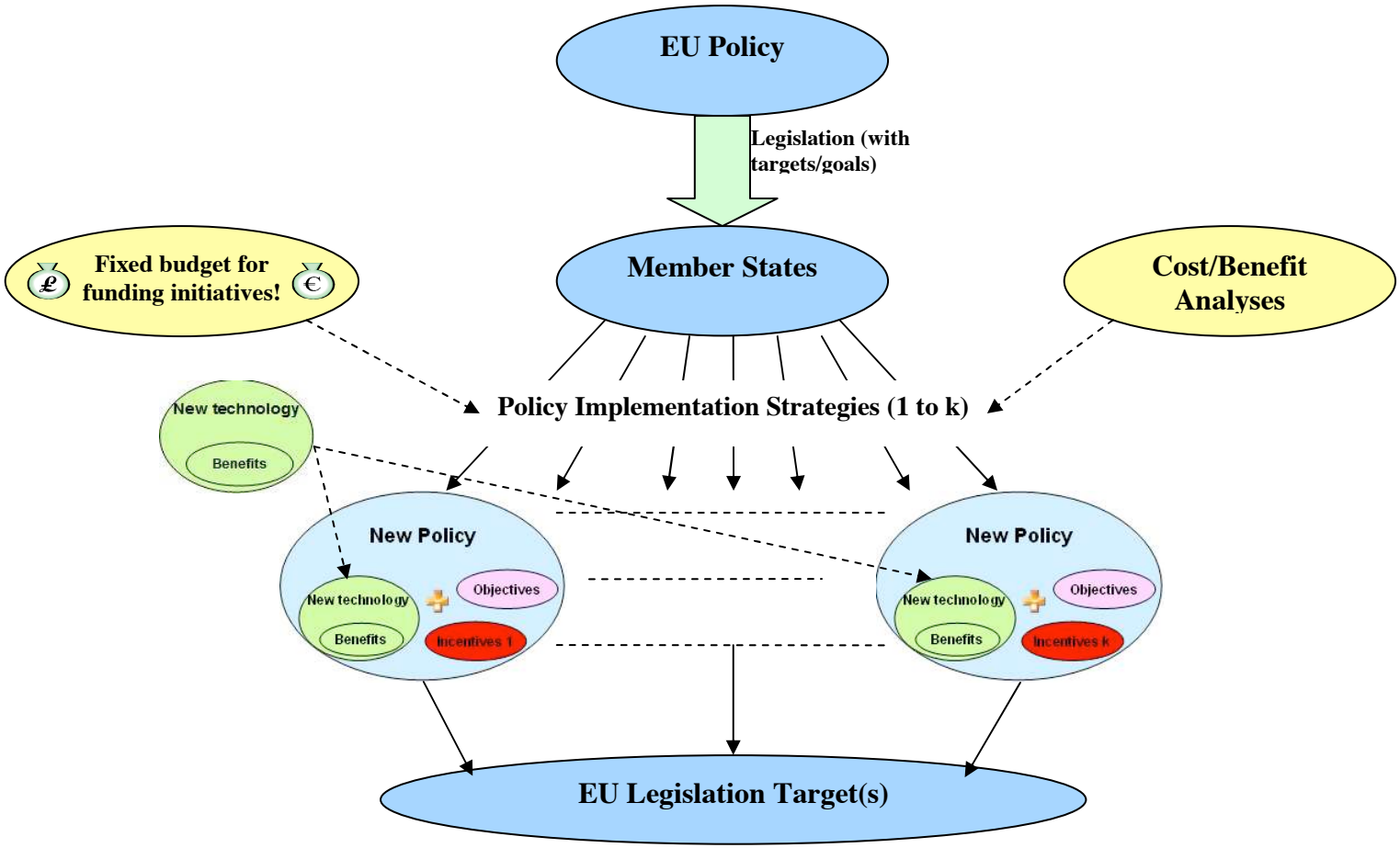
Table 1: Example of EU Policy Implementation

EU Policy	Combat the negative effects of climate change
EU legislation/directive to Member States for such a policy	Reduce average vehicle CO_2 emissions by 2012 to 120g/km
Member State strategy to comply with directive	Initiative launching new type of eco-friendly engines (e.g. hybrid), with promotion of change over via incentives

As May (2004) rightly explains, the automotive industry is undergoing a transition period in which the actors in the industry must work together with the governance structures in reducing the environmental impact of road vehicles. Certainly, there must be co-ordination between the developers of the ECT and the developers of the policies which aim to promote their adoption in order to maximise the chance of success.

Taking the above example, several strategies will exist for attaining such a target set by the legislation and it will be in the interest of the government of that Member State to evaluate which initiative strategy will be the most effective (through a cost/benefit analysis for example). This is illustrated in Figure 1.

Figure 1: Graphical illustration of policy development and implementation in the



As can be seen in the illustration above, when implementing such legislation, the governments of the Member States will have different, rivalling, strategies available for attaining the same objectives. Each of these strategies will be shaped differently with different characteristics in terms of incentives, which will have a direct bearing on the rate at which the new technology is adopted, an indication of the effectiveness of the strategy. This then will imply how much money is to be invested in the implementation.

Based on the characteristics of the strategy, ex-ante forecasts for such an initiative adoption rate can be made. These ex-ante forecasts will provide a means for rating the effectiveness of the policy implementation strategy, or initiative, before it is introduced, thereby making these a key tool in the governmental decision making. Taking the example from the diagram above,

Table 2: Alternative Policy Implementation Strategies Example

EU legislation target	Reduce average vehicle CO_2 emissions by 2012 to 120g/km	
Possible policy implementation strategies		Cost (£)
	A: - 10% subsidisation of hybrid cars purchase price - 100% discount on road tax (road tax exemption) - 100% discount on congestion charge (congestion charge exemption)	L M N
	Total	L+M+N

	B: - 40% subsidisation of hybrid cars purchase price - 85% discount on road tax - 85% discount on congestion charge	X Y Z
	Total	X+Y+Z

In such a situation, a typical decision making process for choosing which of the two policy implementation strategies to adopt, would have to consider aspects such as

- Will both A and B attain the required target?
- How long will it take for each strategy to hit the target?
- Which strategy then is the most cost effective?
- Etc.

Any governance structure will have a fixed budget available for funding such initiatives. The way the initiative is perceived by the public will depend on various criteria, such as the perceived attractiveness of the incentive(s), the image of the new technology being produced (perceived ease of use, perceived usefulness), etc. Such criteria will then determine how the new policy is perceived by the public and will be an indication as to how quickly it will be adopted. This notion of limited funding for these initiatives stresses the importance of being able to produce ex ante forecasts of how each strategy, defined by its different characteristics, will perform in achieving the desired targets and objectives set out by the EU policy.

The reason for this is because such predictions of policy take up rates will be an indicator as to the economic investment needed for its implementation and so will be decisive in helping the concerned decision maker select the most cost effective strategy to adopt. Decision making in governance structures is just as important, if not more so, as in profit organisations, because such decisions will affect millions of people as well as the multitude of environmental, social and economic systems in place.

Forecasting the economic impact of new policies in this way is often challenging because each situation is unique. The high level of uncertainty surrounding the forecasts is generally consistent but the extent and availability of quantitative as well as qualitative data can vary considerably from one situation to the next. Like for any forecasting task, it's important to use all available information, of both nature, that will help improve forecast accuracy and to use analysis methods that capitalise fully on their availability.

Currently, during any policy proposal process, in order to assess the impact the policy will have on an environmental, social and economic scale, the EC conducts impact assessments (IA). Different models[1] are available for such assessments and the availability of data for each particular case as well as the requirements of the IA will determine how quantitative or qualitative the analysis is and which model is to be used (see Table 3). In many cases a mixture between the two is used and it is common to make use of external expertise if necessary.

[1] Computable General Equilibrium (CGE), Sectoral Models, Macro-Econometric Models, Environmental Impact Assessment Models, and Micro-Simulation Models (Annexes to EC Impact Assessment Guidelines, 2006).

Table 3: Suitability of models with respect to selected criteria (Annexes to EC Impact Assessment Guidelines, 2006, p.22)

	CGE models	Sectoral models	Macro-econometric models	Environmental impact assessment models	Micro-simulation models
Range of coverage of measure					
Single-market analysis without economy-wide impacts		X			
Single-market analysis with economy-wide impacts	X		X		
Multi-market analysis with effects in secondary markets	X		X		
Ecosystem				X	
Purpose of model analysis					
Simulation (long-term)	X	X		X	X
Forecasting (short-/medium term)			X		
Effects to be analysed					
Economic effects (within given model framework)	X	X	X		
Ecological effects of economic activities	X	X	X	X	
Ecological effects				X	
Distributional effects					
between countries	X	X	X	(X)	
between sectors	X		X		
between households	X		X		X
Degree of disaggregation					
Between sectors or households					
potentially high	X				X
potentially low			X		
Within a sector					
potentially high		X			
potentially low	X		X		
Effects on:					
GDP	X		X		
Ecological damages				X	
Unemployment	X		X		
Public budget	X		X		
International trade	X		X		
Emissions	X	X	X	X	
Immission/deposition				X	
Household income	X		X		X

Similarly, the UK Government also carries out an impact assessment during the proposal process of its own policies. But generally, when proposing an initiative, aimed at complying with an EU directive, the different strategies are examined with cost/benefit analyses with the help of relevant economists/experts in area, as well as with different stakeholders.

In all of these cases of policy forecasting, whenever quantitative data is available it is common for governmental analysts to use some sort of econometric model. Such models are useful for establishing the causal relationships between economic variables and using them to make predictions. In the absence of quantitative data, popular judgmental methods include unaided judgment, the Delphi technique, panel groups as well as analogies, the choice of which depending on the availability of the experts. Gordon (2007) presents a tweaked (roundless) version of the Delphi method (which he calls the RT Delphi) for forecasting energy scenarios which he shows to produce the same results as Delphi but in a shorter time span. It remains to be seen if the RT Delphi provides as much information and has a wide a range of applications as the traditional version.

Unfortunately however, in most cases, when expertise is used, it is elicited in an unstructured way, and this, as will be seen later on, is subject to many limitations. A structured approach to the use of expertise could make full use of this domain knowledge whilst minimising its negative effects. Moreover, the procedure used by the EC for eliciting and analysing expert judgment is poorly documented. If a formal procedure exists for doing so, literature relevant to it is nonexistent or inaccessible.

Of particular importance to this paper is the use of expertise for forecasting the governmental initiative adoption rate, as described earlier. The use of analogies for such a task provides an attractive prospect as valuable information can be taken from analogous initiatives (from the past or other circumstances) and applied to the target situation.

3. Structured Analogies

The use of analogies for the purpose of forecasting has been the focus of notable research with fairly positive outcomes. One such study by Duncan et al (2001) explored the use of analogies in the context of time series forecasting, while Nikolopoulos et al (2007) used analogies to forecast TV audience ratings. McIntyre et al (1993) used analogies by buyers to build an expert system to forecast the effects of sales promotions. Although

demonstrating the utility of analogies for forecasting, these studies failed to consider the issues surrounding the use of analogies for the forecaster and the potential difficulties in using them. In other words, they overlooked the need to offer the forecaster support when using analogies.

However, as two recent studies (Lee et al, 2007, and Green & Armstrong, 2007) have recognised, the unstructured use of analogies can be constrained by the various cognitive limitations of the human mind. Lee et al (2007) and Green & Armstrong (2007) claim that a forecaster needs support when using analogies and consequently propose approaches to overcome these problems.

Lee et al (2007) examines the process of using analogies for forecasting and identifies three main stages involved in their use

i) Recall – the need to actually retrieve the past cases

ii) Similarity judgments – the need to determine the suitability of the retrieved cases through assessing their similarity

iii) Adaptation judgments – the need to make adjustments to these past cases to suit the target situation in order to produce the forecasts

The paper recognises the limitations of the human mind and the effect such limitations can have on the use of analogies. It provides evidence of the difficulties faced by the forecaster in each of these three stages when deprived of any support and how providing such aid could be beneficial.

The authors argue that the *recall* of past cases can be hindered by human memory limitations (only a small number of cases may be recalled), incorrect recollection of case details and an erroneous recollection method. Therefore, to this they propose the implementation of a database of past cases which will act as memory support and an aid for the recall process.

In the same way, the paper argues, similarity judgments can be difficult for the forecaster to make due to cognitive limitations and so the authors suggest that this too should be supported. They hypothesise that "providing similarity support in addition to memory support will lead to more accurate forecasts than providing memory support alone" (Lee et al (2007), p.4).

Lastly, the authors argue the need for support for the adaptation judgments and hence further hypothesise that providing support for all three stages will provide more accurate forecasts than had just similarity and memory been supported.

These ideas are the base for a forecasting support system (FSS) developed by the authors to help assess the effects of sales promotions on demand forecasting tasks. The FSS is intended to aid users with similarity and adaptation judgments when drawing up information from the past. Their study showed that such an FSS could substantially improve forecast accuracy under certain conditions (see Lee et al (2007) pp.10-12).

Although the ideas in Lee et al (2007) for supporting the use of analogies for forecasting are valid and the results found positive in the context of accuracy, the development and use of such an FSS will be quite costly and will not be suitable to all situations. Furthermore, such an FSS assumes that past cases will be available for the building of a memory support database, which won't always be the case.

A similar study, by Green and Armstrong (2007) proposes a formal method for using analogies for forecasting to overcome the potential biases associated with the human interface when performing such a task. The authors acknowledge the benefits of using analogies in many forecasting situations but believe that experts will tend to choose easy to recall analogies, which in turn could be the similar cases that confirm their beliefs. In other words, they believe that if analogies are used in an unstructured manner, people are prone to using inferior analogies which will be undoubtedly subject to different biases.

Stemming from evidence of the success of structured use of information as opposed to unstructured use in judgmental forecasting (Armstrong, 1985, Ch. 6), Green and Armstrong (2007) propose that a structured approach to forecasting by analogies (FBA) would encourage experts "to consider more information from the analogies, and to process it in a more effective way" (Green and Armstrong, 2007, p.366) which leads them to hypothesise that the use of analogies would improve forecast accuracy provided they were used objectively and in a structured manner. In order to do so, the paper suggests that the use of analogies should be structured following a five step procedure[2].

- *Description of the target situation*

The administrator (the person responsible for the collection and weighting of the experts' advice) prepares a comprehensive but brief description of the situation by seeking advice either from expected unbiased experts (in the case of EU policy, these can be found in academia for example) or from experts with expected differing biases (again in the case of EU policy, these can be found in the different stakeholder organisations, lobby groups, etc).

- *Selection of experts*

The administrator recruits a set of experts who are likely to know about situations analogous to the target situation. These experts should be chosen on the basis of how much knowledge they have on these analogous situations, the variability in their responses and the importance of obtaining accurate forecasts.

- *The experts each identify and describe analogies*

The experts are asked to describe as many analogous cases as possible (without considering the extent of similarity to the target situation) and to match their analogies' outcomes with the target outcomes.

[2] This information could be obtained through questionnaires, interviews and panel groups with key decision makers.

- *The experts each rate the similarity of the situations*

The experts are asked to list similarities and differences between the analogies and the target situation and then rate the level of this similarity.

- *Derivation of the forecasts*

To promote logical consistency and replicability, the administrator should decide on the rules for deriving a forecast from experts' analogies.

The forecaster then transcribes this information and uses it to forecast. In this way, the knowledge and expertise available from analogous cases can be extracted more efficiently and centred on providing relevant information for the forecasting of the target variable.

Their study, which compares the structured analogies approach with unaided judgment and chance, looks at eight different conflict situations, whose outcome must be predicted. The study reports that when predicting decisions made in eight conflict situations, 46% of structured analogies forecasts were accurate, compared to the 32% accuracy of unaided experts' forecasts, which were little better than chance. They also report that when the experts showed an increased expertise in the domain, the accuracy of the structured analogies forecasts increased further.

Although self proclaimed as "objective" by its developers, the structured analogies approach exhibits the usual problems associated with the use of experts for forecasting. That is to say, that in a few steps in the process, subjectivity cannot be avoided. The fact that the administrator, responsible for selecting, eliciting and analysing the expertise, is different for each task means that the overall process remains essentially subjective in nature. Nevertheless, Green and Armstrong (2007)'s method makes good progress in making a highly subjective process as objective as possible and can hence be seen as considerable advance in the evolutionary line of forecasting by analogies.

Both studies have proposed a way of formalising the use of analogies through structuring the FBA procedure and have found that this leads to improved forecast accuracy, and even more so when the knowledge of the experts increases[3].

Having seen how analogies can be useful in situations which are quite difficult to forecast, such as conflict forecasting or technology forecasting, one would expect FBA to be useful in forecasting tasks associated with policy impact, a similarly difficult situation. Forecasting the impact of a new policy can be treated as a non-periodic special event. More often than not in such cases, data is not available to the forecaster and so recourse to analogies is an attractive prospect. Furthermore, having examined the evidence supporting the structuring of FBA to increase forecast accuracy, forecasting the impact of new policies via structured analogies would be a rational step forward.

4. Strength of Combining

Moreover, such a structured use of analogies could provide an ideal compliment to the forecasts produced by the econometric model. There is no evidence to suggest that a combination between quantitative and qualitative methods is currently used by governmental analysts when forecasting policy impact. Several studies have shown the potential benefits of combining quantitative forecasts with expertise in the domain. In a study on the benefits of combining forecasts, Armstrong (2001) uses previous research on the subject to make a valid contribution on the benefits of combining and when such an approach is suitable. Briefly, he concludes that combining offers a means of minimising the weaknesses of each constituent whilst consolidating their strengths. In order to achieve best results, and of particular relevance to this research, he advises to

[3] Forecast accuracy is shown to improve when experts can recall more than one analogy (Green and Armstrong (2007), Lee et al (2007), Hoch and Schkade (1996))

- Combine forecasts derived from substantially differing methods and drawing from difference sources of information

- Adjust the weighting on each forecast depending on the level of confidence in the accuracy of that forecast

He reasons that combining is a recommendable strategy in forecasting; when the situation involves a high degree of uncertainty, when the identification of the most accurate method is not obvious; to avoid large errors (where the three are not necessarily exclusive).

This therefore, seems to be particularly relevant since all of the conditions described above seem to match the characteristics of policy impact forecasting. The combination between the econometric forecast and the structured analogies prediction will undoubtedly draw information from different sources as well as being largely contrasting methods. Hence, a combination between these two methods will provide an approach which consolidates the strengths of both whilst minimising their weaknesses.

The Hybrid Model

The weighting of the forecast from each of the methods will depend on the availability of information/data in each of the cases. A simple illustration showing the nature of the proposed hybrid model for forecasting adoption rate (as a percentage of the target population that has converted to the new eco-friendly technology) would be,

$$\%_{Adoption} = W_1 F_{SA} + W_2 F_{Eco}$$

Where W_1 and W_2 are weights given to the structured analogies forecast, F_{SA}, and the econometric forecast, F_{Eco}, respectively. These two weights can be adjusted depending on the amount of data of that type available. Clearly, if no quantitative data was available for a given policy, the full weight would be on the structured analogies forecast and the approach would be purely judgmental.

A soft systems view of the whole situation of policy development and implementation is depicted in Figure 2, below. The diagram presents the main actors in the situation,

- The European Commission (EC): This organisation is responsible for proposing legislation which is line with EU policies, such as sustainable development. Furthermore, they're responsible for overseeing the implementation of such policies.

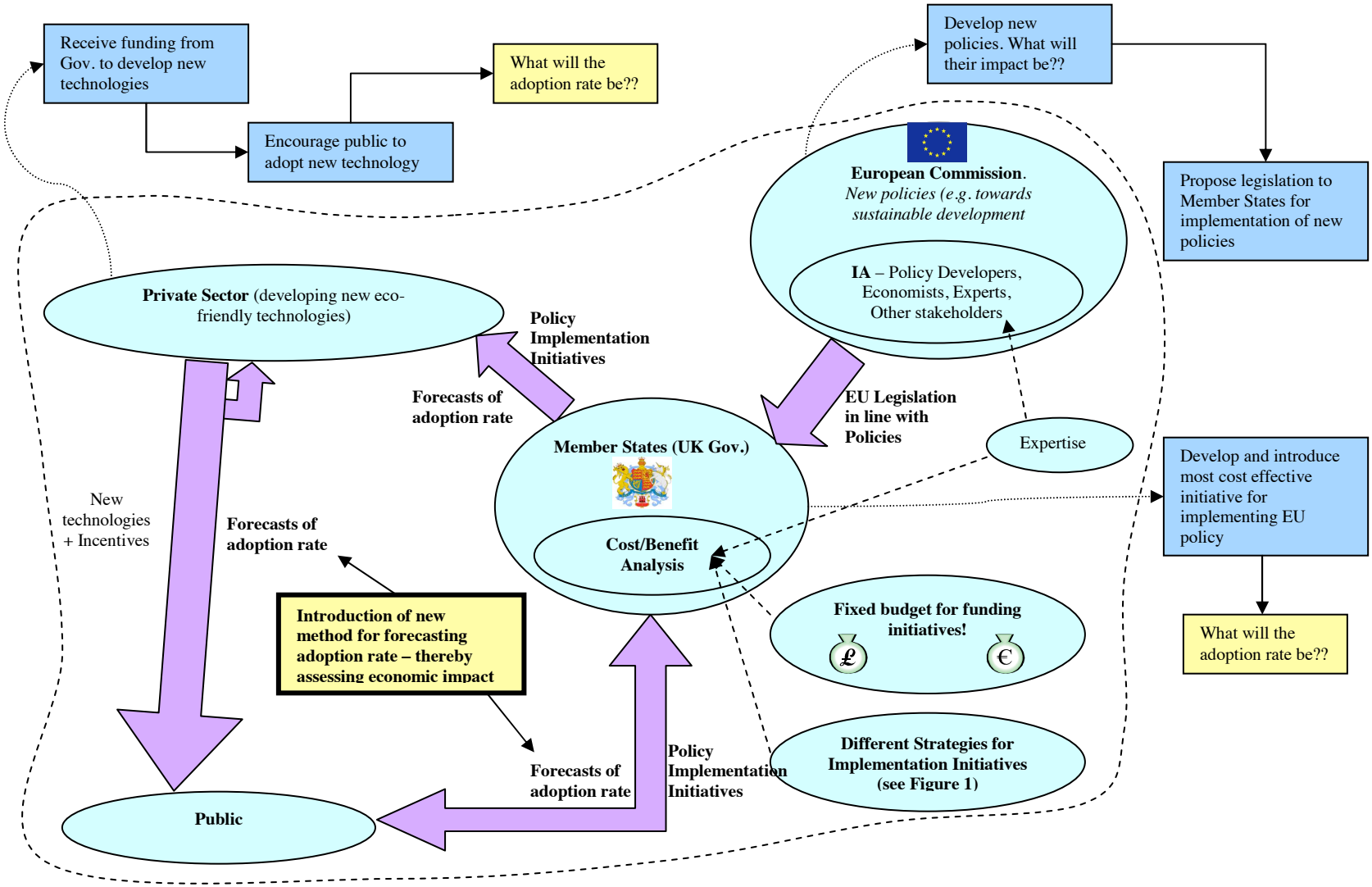
- The governments of the Member States (The UK Gov.): The principle of subsidiarity says that it is the Member States that are responsible for the implementation of the EU policies and how they do it is up to them. If a new eco-friendly technology can play a part in such an implementation, these governments will develop policy implementation strategies, or initiatives, aimed at promoting the use of such technologies (in the private sector and the public) through incentives (subsidised prices, compensation schemes, etc) to promote the change over. There will be a fixed budget for investment into these initiatives so such governments will need to forecast the adoption rate of each short listed strategy so as to have an idea of the economic impact of each alternative. This will provide an indication as to the effectiveness of each and will hence allow identifying the most cost effective option.

- The private sector: This will include the companies responsible for developing the new technologies to be promoted by the governance structures. They will have business targets/objectives so they'll want to forecast the rate at which their technology is being adopted (which can be viewed as a measure of performance). They will also include private companies that offer their employees benefits for adopting the new technologies.

The public: this will be the main target group of the policies, at which the new technology is aimed.

In the centre of the diagram sits the approach for forecasting adoption rate, and thereby the economic impact of the initiative promoting it. Similarly, the proposed approach can be used for producing the adoption rate forecasts required by the companies.

Figure 2: Soft systems view of environmental policy impact



5. Evaluating the New Methodology

In order to develop and test the proposed approach against current methods, data is required. In an attempt to attain such data, two prominent sources stood out as sensible starting points; the European Commission (EC) and the UK Government. The aim was to obtain as many cases where three conditions held;

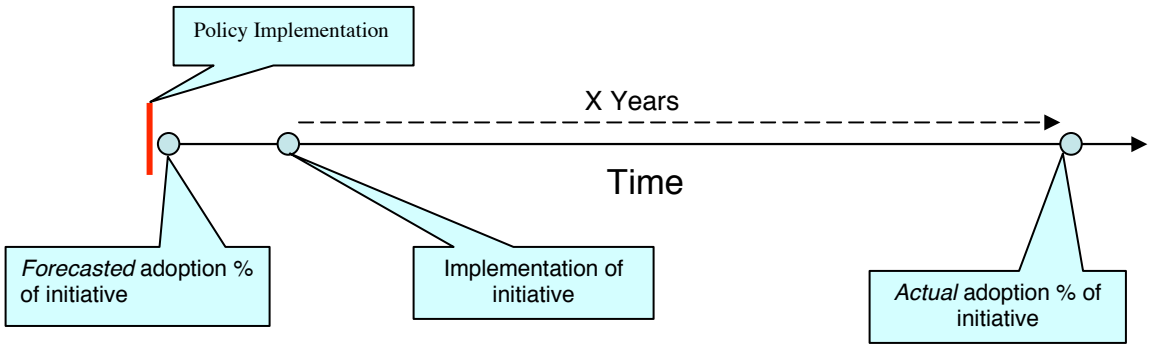
1) the policy proposed led to the development and implementation of a governmental initiative aimed at hitting a policy target

2) a *forecast* of the adoption rate of this initiative was produced during the ex-ante cost/benefit analysis (or other)

3) a follow up study was conducted to determine the *actual* adoption rate

As illustrated by the diagram in figure 3, below

Figure 3 Typical requirements for cases needed



With this research proposing a tool that could potentially benefit and facilitate regulation, it was natural to approach the *Better Regulation* directorates of both governments in search of the cases described above.

As a starting point, a meeting was held with officials of the Secretariat General (which has better regulation as one of its key responsibilities) of the European Commission in Brussels, Belgium (4th December 2007). Having presented the main ideas of the research, the main conclusion drawn was that the EC was not sure what data was actually available. Being a transparent organisation, the EC publishes all past IA reports along with their policy proposal documents. However, the EC emphasised that follow up studies (as in condition 3 above) are only carried out for "big money" projects. Hence, we are left in the situation of conducting an exhaustive search of the EC's database to find possible cases with which to test our approach.

Organised in a different structure to the EC, the task of better regulation falls to the Department for Business, Enterprise and Regulatory Reform (BERR). This time, a conference call was held with an official responsible for the impact assessment (IA) template used in UK policy development. Very much like the EC meeting, the main conclusion was that the UK wasn't exactly sure what was available in terms of data and that it was simply the case of conducting an exhaustive search through their database (also published online), which although larger (dating back to 1998), was far less organised (several broken links).

Other possible sources of data yet to be contacted are the Department for Environment, Food and Rural Affairs (DEFRA) of the UK Gov. and the European Environmental Agency (EEA).

6. Conclusions and Further Research

Hence, there seems to be no formal procedure in place at EU or UK policy level for producing implementation strategy adoption rate forecasts. If there is indeed one, it has been poorly documented and access to it remains complicated.

Nonetheless, the need for such forecasts is great; not only for budgeting reasons but also for long range planning and strategy. Such forecasts will be an indication of the expected effectiveness of the strategy and will consequently serve as an important criterion for the decision of which strategy to finally opt for and execute.

Similarly, there exists little or no literature documenting any empirical work done on forecasting policy implementation strategy adoption rates. With no past research on this specific application of policy impact forecasting, it will be difficult to compare the quality of the proposed model's forecasts with those produced by any other.

What's more, there is no system in place at these governance structures to control the quality of the forecasts being produced. It is often the case that follow up studies are not carried out to verify the quality of any of the ex-ante forecasts produced. As a consequence, the absence of such a system makes it difficult to truly progress along the right line to ensure the improvement of such policy impact forecasts. Such a documentation would put healthy pressure on decision makers to analyse the situation properly and would propel the need for better forecasting approaches.

Moreover, access to the required cases for testing the forecasting ability of the proposed model, as documented in section 5, is proving difficult. Such cases are not readily available and it will be an important challenge in this research to obtain and use them to test the proposed approach.

Policy implementation strategies exist not only in the Public sector but also in the Private, in the shape of corporate policies. Many firms around the world are in the process of becoming "greener" and as a result, are implementing corporate policies in line with this (e.g. encouraging employees to change to Hybrid cars by offering them several

incentives). Similarly, the proposed approach could be used to forecast technology adoption rate (without the use of incentives) as this is also an area which suffers from the use of expertise in an unstructured way. The nature of the model means that it is flexible enough to be applied to areas like the ones just mentioned.

Finally, it must be said that all of the ideas presented in this paper could just as easily be explored in a non-European context. This research could be carried out in an American or Asian context very easily, using local data.

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