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Errors in Forecasting Deadlines for the Transition to E-Mobility

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***Abstract*— *During his entire existence on this planet, man has been setting himself temporal benchmarks for all his projects, either personal, or collective, or developed for any activity whatsoever. It is obvious that, for the electric mobility field as well, the factors involved – managers and politicians, display such tendency, temptation or fundamental need, but in their case, the motivation of forecasting and scheduling is of a truly overwhelming magnitude. This is because, while most people seem to have only some inner psychological urges for individual control and progress, whose deadlines may be easily put off several times or even unspecified, decision makers are aware that any changes in the responsible decision factor in the social segment (such as forecasting, planning or programming) may lead to a vital advantage for their organization. Some changes might also lead the system in which the organization is engaged or the entire community, to fatality or bankruptcy. And exactly just how useful, from a macroeconomic, macrosocial and macro-cultural perspective, is the rational determination of several time limits for projects, action plans or collective programs, by government administrations and organizations. The objective of this research is the promotion of a new instrument for analyzing deadlines. Concretely, therefore, the main objective of this study is the question of establishing a specific timeline of forecast error (STEIF) for each anticipatory project.*

The novelty of this article is represented by the introduction of a new layer of complexity in the instrument that is evaluating the forecasting deadlines. This is done by reviewing some instances and methodically entering a specific temporal error index of the forecast (STEIF). The expedience of knowing such error margins would be recaptured, according to our approach, in the precision of conceiving the following forecasts, action plans and programs. On the other hand, the importance of deadlines for the transition to electric propulsion is also highlighted by the trend imposed from the macroeconomic towards the microeconomic level, and such an example is the chaotic reporting that manufacturers show, with regard to the benchmark year of 2020.

Keywords*— *Deadlines, forecast deadlines, forecast error, e-mobility, business models.

I. INTRODUCTION

Deadlines are in a macroeconomic sense temporal limits an intrinsic condition for the content of some private, local, national, regional, union or global strategic projects and / or programs imposed by agencies, administrations, non-governmental organizations, companies multinational or transnational corporations, trusts or holdings or other political or administrative or commercial structures, in order to solve certain desires of private, community or societal interest. In the microeconomic sense, deadlines are time limits set by entrepreneurs or business managers for strategic purposes for some projects, programs or contracts that are either private or personal, either a common or public interest, or both interests. The deadlines included in the company's action plans, projects, or programs are set by contractors and company managers either to be imposed on company staff or on collaborators or business partners to solve a company's own need, a third need, or a community need, or they are set up in the sense of a self-centered economic and financial challenge by a company, for its economic or financial stability for the benefit of society.

Unfortunately for entrepreneurs and initiators, not all start-ups, projects and programs within the field of electric mobility are successful. The decision-makers were not inspired when choosing the Business Model (BM), because they did not properly structure their action plan, and have mistakenly appreciated the importance of the objectives and the means involved (1), (2).

And here is how to deduce from it that the need to tune the forecast error is necessary, with a much more concentrated focus than hitherto, on the time-limit coordinate.

Generally, the scientific literature devoted to prognostic errors does not present a significant ideological representation for the forecasting time component, focusing almost exhaustively on content errors, ignoring the indissoluble relationship of terms with the contents of the forecasts, or assigning the terms a minimalist condition, by itself.

Nor is the importance of time for the vitality of a business model well-honored by research (3).

Concretely, therefore, the main objective of this study is establishing a specific timeline of forecast error index (STEIF) for each anticipatory project. Such an index reflects the status of the mistakes it represents and may be positive, when reality proves to be happier than anticipation and negative, when reality turns out to be below anticipation and zero error or without error, when reality overlaps precisely over anticipation. The latter is the ideal desirable situation for a prognostic developer, because even positive values are all errors.

II. LITERATURE REVIEW

Predicting is the projection or anticipation of processes and phenomena of a more or less distant future, regardless of their nature or the domain for which they are designed, specifying the main objectives of a project or program, such as and the resources and main means necessary to achieve them. Among other things, and depending on their horizon (the deadline to

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which the forecast is included), the forecasts are differentiated into three main categories: forecasts, plans and programs. Starting with the publication of the Club Report in Rome and the conduct of the Stockholm Conference on Environment - both events taking place in 1972-, almost all international political and scientific forum have developed projects and programs, safeguarding the environment and sustainable development based on rigorous forecasts. In the field of mobility, in particular, rules have been established on the reduction of harmful emissions and the increase of absorption rates on the electric car market. (4)

Practice, however, has shown that certain forecasts have not been satisfied by reality, which means the recording of lamentable errors. But reducing greenhouse gas emissions can only be remarkable if a massive adoption of electric cars occurs - which implies long-term commitments only if access to the electricity refueling infrastructure improves (5).

An ex-ante responsible prognosis must be based on an ex-post statistic and a competent analysis by methods such as Delphi, simulation, correlation analysis, etc.

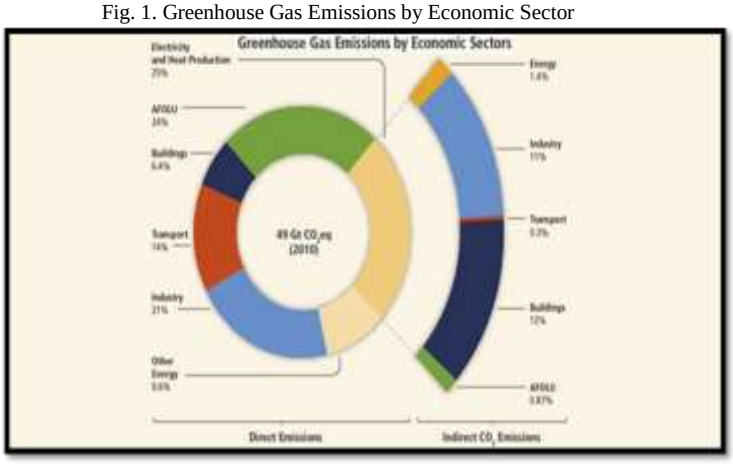
Forecasts and programs are used for the previsioning of the implementation of some future social and economic phenomena and processes, particularly featuring concrete numeric value expressions. Other concepts not as advanced in many cases, or even more generic or vague are used in a more ambiguous manner.

Therefore, by its resolution concerning the European road safety for the period 2011-2020 (6), the European Parliament requests the European Commission to set, as a long-term objective, the prevention of all deaths caused by road accidents, without, however, imposing results materialized as numeric values at the end of the contemplated decade or in stages. It is interesting, though, how ten years earlier, i.e. in 2001, the European Commission launched a white book thereby setting the agenda of European policies in the field of transportation, until 2010, and which proposed, as one of the objectives, to half of the number of road accident victims until the end of the period. But in 2010, the results of the aforementioned objective were far from expectations, even though there had been significant progress in the field.

Things are quite similar when it comes to reducing greenhouse gases emitted in the atmosphere, as shown in fig. 1, by means of transport; some progress was noticed, but not as initially forecasted. Even though energy efficiency has increased – thanks to some restrictive measures having proven as efficient, the global effect was counteracted by the increase in transportation activities – following an increase in the number of transportation means and the overall travel. In this instance, forecasting and scheduling were, again, imprecise, and the results turned out to be completely insufficient.

The importance of a project or program deadline is, mainly, similar in magnitude to its content. Even if the deadline may be seen sometimes as a secondary objective implicit or adjacent to the content, for many people. The temporal limit is however, intrinsic and indissoluble to an economic forecast or an economic program.

Fig. 1. Greenhouse Gas Emissions by Economic Sector



Source: (3) Abegglen, 2014

Although a forecast is different from a program by that the former is purely informational, while the latter is imperative, the program concept is indissolubly based on the forecast concept. Furthermore, whenever a manager or a politician develops a project or a program, they also take into consideration, within such undertaking, certain recognized perspectives, forecasts and predictions, which are often only paradigmatically drafted, of some personalities who are publicly acknowledged for their power and accuracy of forecasts.

Setting a certain deadline for a project or a program, as rationally and as morally possible, is certainly no plain calendar drafting, randomly set similarly to some entertainment-like milestone. Although abstract due its anticipative nature, the deadline must be something more than an esthetic dimensioning pursuant to natural rhythms, such as: a week, a month, a year, perhaps twenty years, and it must represent more than a random, as well as an absurd fantasy of the manager or the issuing agency.

Thus, setting a deadline presumes a rational control of the actions and activities included in the project or the program, a prudent estimation that would not cause false expectations throughout, or delusions, in the end. However, the accuracy of deadlines, in conjunction with the content of the forecast or program, proportionally depends on the quality of immediate and statistical data entered in the algorithm pursued. In the event that such data is mostly erroneous, projections may be perceived as true shocks. And if this is also supplemented by events connected to the chameleonic nature of the economy and the materialization of some unpredicted needs, the forecast or program may indeed be set to fail. Moreover, there is another element of time planning, as a factor of the forecast or program strategy. It mainly concerns the deliberate setting of a deadline which may be too tight or, in other words, a content overbid compared to a given deadline – for the psychological purpose of stimulating or speeding up the actions of the entrepreneurs of the project or program promoted. This apparent underestimation of the necessary time or the overestimation of the objectives of the project or program would only therefore act as a means for a certain achievement of some satisfactions forecasted ever since the

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beginning, in a realistic manner, by the person drafting the items.

This is why, for instance, we may not know whether or not the initiators of the famous ZEV program of the CARB Californian council somehow premeditated the too-tight initial restrictions imposed on the toxic emissions of vehicles, since in the meantime they reconsidered such emissions and eased them. Similarly, we cannot determine whether or not they underwent a forecast error. Whatever this may be the case, when talking about solutions of policies pertaining to the number of electric vehicles adopted in California, we cannot ignore the presence of the zero-emission vehicle (ZEV). The ZEV purpose, adopted in 1990 as part of the Low-Emission Vehicle (LEV) Program, is one of the most important measures adopted by state governments for approaching the air quality issues and encouraging the adoption of electric battery vehicles (7).

The above invocation emphasizes, besides the importance of establishing a term as appropriate as possible to the content of a proposed project or program, and the socio-economic utility stemming from the very idea of animating a desirable system through the most challenging projects and programs.

III. Approach and Methodology

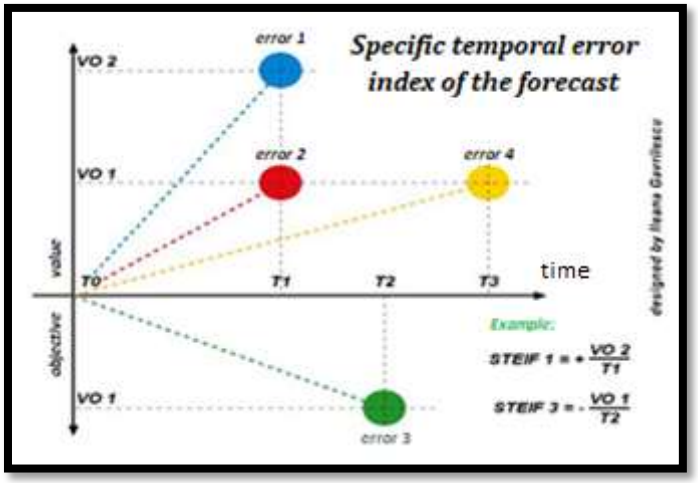
The method proposed in the present research is the comparison of some values of errors - determined by us by a novel formula, first developed theoretically and then applied in a demonstrative manner on a case of reality.

$$STEIF_n = \frac{VO_n}{T_n}$$

where
n = index of the error considered,
VO = objective value of the error (physical dimension of the forecast object)
T = final moment of the forecast (deadline)

Thanks to the fractional formula, the error of a temporal prognosis is even greater as the period for which the estimation of an objective value is made is smaller. Therefore, the objective value of the error $(VO)_n$, must be related to the length of time T_n for which the forecast has been predicted, and this is practically the way of calculating a specific index. The absolute value of temporal key errors cannot negative. In economy, however, it becomes important if deviation is fortunate or, on the contrary, unfortunate. Positive errors, that are fortunate, in which reality proves to be favorable in relation to anticipation, will enjoy a positive index whilst negative errors, those in which reality proves to be below anticipation, will be denoted by a negative index, so that successful prognoses are considered neutral. In order to determine the sign of the STEIF - specific temporal error index, we make use of the trigonometric circle, as shown in fig. 2, assuming that positive errors are placed in the first quadrant, while the negative ones, the more expressive, are found in the fourth quadrant. The value of each error is given by the ratio between the error size and the period for which the prediction was made. Thus, for Error 1, the value ratio is between VO2 and T1, for Error 2 the ratio is between VO1 and T1. It is understood that Error 1 was determined by a lower "inspiration".

Fig. 2. STEIF – Specific temporal error index of the forecast
Source: Author's own calculations



This index may relate to any of the issues related to electric mobility – number of vehicles, price of cars, autonomy, price of kW/hr., number of charging stations etc., but what is even more interesting and more important is that the index may be attributed to the forecast issuer, acting as a reflection on their capacity to forecast, as accurately as possible, the progress of a phenomenon. It is understood that the review of temporal errors of forecasts apply to "closed" cases. It would resemble the skill score of the rating, survey or estimation agencies' classification. To this end, contractors shall consider such index specific to each forecast issuer within their orientations and planning.

IV. Results

For our review, the most interesting case seems to be the one related to the deadlines set forth by Elon Musk – the majority shareholder of the famous car manufacturer, Tesla, considered by many to be the most exemplary entrepreneur from Steve Jobs onwards. Deadlines related to the launch and pace of delivering the machine make it be the most popular electric model: The Tesla Model 3. The appearance that the data for this case is retrieved from multiple journalistic sources is totally irrelevant to our application, even though these data coincide for several of such sources. Our application, unwilling to demonstrate only the possibility of calculating the temporal error index, uses these only as a pretext.

Up to the time of its official launch, since July, 28, 2017, the waiting list recorded around 500,000 customers, with a deposit of $1,000 each. All of them hoped they would receive the ordered car by the end of 2017. On a different occasion, Musk claimed that in 2017, Tesla would sell over 2,500 Model 3 units. In July, 2017, Tesla delivered the first 30 Model 3

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units, while for the month of August, Elon Musk would promise to deliver 100 pieces, and in September, he would be able to deliver to the owners the keys for another 1,000 cars. When, at the time of the launch, the head of Tesla announced that, for those having already paid the deposit, the waiting time for the car would be at least one year, 63,000 customers instantly cancelled the purchased and asked for a refund. Of the 1,500 deliveries promised for the third quarter of 2017, a maximum of one third was barely met. On the verge of the fourth quarter of 2017, Elon Musk would renew his promise, thereby stating that he would speed up production and would be able to manufacture 3,000 new units of the Model 3. Except that, during the last quarter of the year, of the 3,000 cars promised, he could only deliver 1,550 new vehicles. In an interview of CNBC, Bob Lutz, formerly the head of BMW, Chrysler, Ford and General Motors mentioned that at this rate Tesla would be gone by 2019.

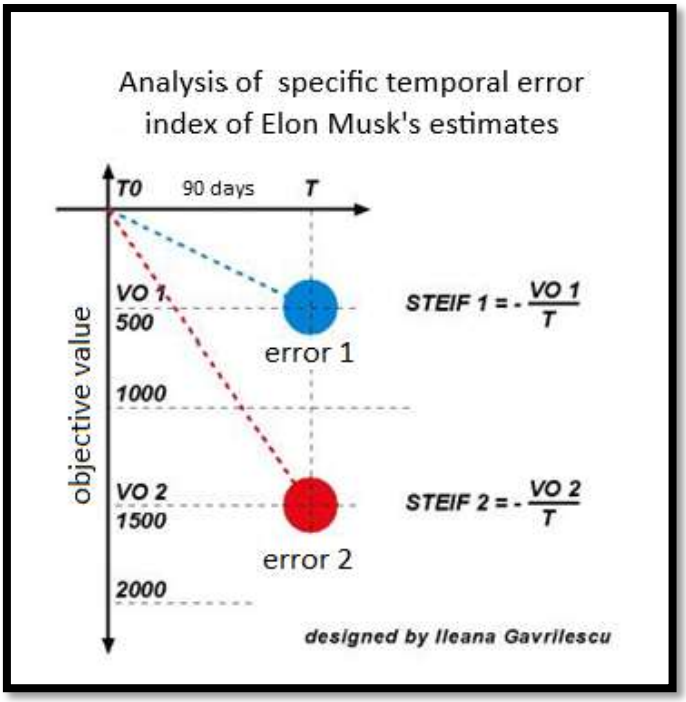
Therefore, for the third quarter of 2017 – i.e. for 90 days, Elon Musk recorded an objective error computed as difference between what he promised and what he actually achieved, namely 950 units. And because such error was negative, it shall be recorded as "-950", which will impose the same status on the index, as well. Reporting the objective value to the number of days, we shall obtain "- 10.55".

TABLE 1. Comparison of STEIF data

Date	Objective Value	STEIF
3rd quarter 2017	- 950	-10.55
4th quarter 2017	-1450	-16.11

Source: Author's own research

Fig. 3. Specific temporary error forecast error index for the prediction of Elon Musk



For the fourth quarter – namely, for another 90 days, Musk's error flagged 1,450 units. By doing the calculations, we will obtain a specific temporal error index of the forecast of –16.11, which is proportionally higher or more serious than the previous index because it refers to a higher objective value and, therefore, a higher error value, for the same forecast term. This data is summarized in table 1 and detailed in fig. 3. That is how Elon Musk goes from a guru of estimates to being at bottom of the list. Not only did he, momentarily, lose credibility before customers, but he will surely be avoided by any potential partners.

Another example comes in support of the fact that, although, throughout its development, a program flagged negative temporal indices, it may still be deemed as no error or zero error, as described in the methodology, until the actual deadline. A scenario concerning the growth of the electric vehicle market in Germany, drawn up in 2013 by the ISI Fraunhofer Institute states that under conditions favorable for electric vehicles, the joint objective of the Federal Government and the National Platform for electric vehicles (NPE), namely, to register one million electric vehicles, may be reached until 2020 without promoting the purchase (8).

But already in October, the signatories of an article related to the German electric vehicle market would trigger an alarm about the fact that the German Government aims at increasing the shares of electric vehicles in Germany o 1 million cars by 2020, but at the time of the study in 2012 only had 4,500 battery electric vehicles and 47,600 hybrid vehicles (9)

Other sources, then, point to the fact that, in the summer of 2016, Germany recorded a number of 155,000 electric vehicles (full electric + hybrid), but that, during the following four years, another 800,000 units may potentially be registered. This would lead to a real figure of around 1 million electric plug-in cars in 2020, meaning that the forecast conceived in 2010 would indeed become reality.

V. Discussion and Conclusions

The design of programs and drafting of forecasts accurately must consider previous experience whenever deadlines are set. Specific time-error indices may be set not only in relation to some issuing factors – either individuals or groups, but also for a problematic related to electric mobility: number of vehicles, price of cars, autonomy, price of kW/hr., number of charging points etc.

The inflexion year 2020 connects many projects, programs and forecasts specifically by their related deadlines. This stands as a good opportunity to subject for review all anticipations so far, to assess which, how many and to what extent they will have become true. Other projects, with deadlines in other key moments are already running, but this does not mean that we cannot set, at this point, an anticipative error level, at least by assessing their stages.

At this time, of all energy alternatives related to mobility, electricity receives the most recognition, as far as transportation for passengers and goods are concerned.

That is why we believe to be understood that specialized research must at least take a look towards the entire research enclosure and take over, even from the areas traditionally considered as auxiliary or even incongruent, the most diverse perspectives or previsions, forecasts and other anticipative

data. For all of these, it must apply a distinguishing and segregation filter for reliable estimates of daunting fantasies.

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