Examining the "Forecasting Gap" within Theoretical Classifications of Large-scale Transport Infrastructure

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Abstract

The aim of this paper is to critically review the dominant approaches to explain the forecasting gap and to offer a new classification of the various theoretical perspectives that can be found in the literature on large-scale transport infrastructure.

1. Introduction

Traffic forecasts are an attempt to predict future traffic in a rational and scientifically founded manner, with a view to anticipate optimally the specific needs and expectations of the new infrastructure consumers during the planning stage of the investment projects. The location, the investment and the sum required are determined by the traffic forecasts. Unfortunately, forecasts are often wrong and the "forecasting gap" – the gap between the anticipated level of consumers and the real volume of traffic using the new transport infrastructure in the years following its opening – shows no sign of narrowing with time [20][22]. As Skamris Holm [44, p7] pointed out:

> *"Looking at the development of traffic forecast through the years, to see whether traffic forecasts have become more precise in the course of time, tell us with 99 per cent confidence that forecasts have not improved".*

One of the numerous paradoxes is that, after pointing out for a number of years that forecasters have been wrong, some of the prominent experts in the field [20][22][46] are predicting that it is most likely to remain that way for the years to come. However, making forecasts that would enable major infrastructure promoters to serve consumers, tax-payers and the other stakeholders involved, efficiently and effectively, become increasingly important. It becomes imperative to find out how major infrastructure project promoters and forecasters can use their knowledge of their customers, their operations and the various stakeholders concerned to make decisions that will not only enable them to attract their potential customers but also to serve them better and to retain their clientele, ultimately closing the forecasting gap.

There is a rich heritage from the social sciences that is unfortunately too often overlooked by those attempting to discuss planning and forecasting processes, issues and outcomes. As for so many research instances in the field of decision-making and management, one of the key problems for researchers is that current knowledge about major infrastructure traffic forecasting is fragmented among several disciplines, including psychology, anthropology, sociology, political sciences as well as economics and management sciences. The aim of this paper is to critically review the dominant approaches to close the forecasting gap and to offer a more robust classification of the various theoretical perspectives that can be found in the literature on large-scale transport infrastructure.

that large transport infrastructure projects can be controlled from one centre of authority and that traffic forecasts can be integrated into a single calculative decision to build a major infrastructure. The decision making system is made of unified rational actors with the benefits and risks of building an infrastructure evenly distributed among the stakeholders. They have the same degree of power to influence the process as well as the same appreciation of the risks and benefits involved. Furthermore, forecasting for a Master Plan and forecasting for a Business Plan are two sequential and relatively discrete activities. The former emphasises the specific types of port facilities that should be developed and the order in which these should take place, whereas the latter focuses on how to use the assets to make a profit. As Wignall and Smyth [47, p7] pointed out:

> *"The fundamental difference in how a Master Plan and a Business Plan must view traffic forecasting is the difference between forecasting the overall economic benefit that a development can bring (Master plan requirement) and forecasting the actual revenue a development can secure (Business Plan requirement)".*

Getting the timing of traffic growth right in a Master Plan would be of less importance than getting the principal of the forecast right, as *"a premature port facility in a location with growing traffic will eventually be utilised"* [47,p4]. However, in forecasting for a Business Plan, accuracy in both quantity and timing of traffic growth is essential. In either case seen from the classical approach, accuracy would be the basic criterion on which to evaluate forecasting performance. This is usually done in absolute terms as under this approach conservative traffic forecasts are generally considered as good as accurate ones at least in the short-term. Indeed, because of the indivisibility of the investment in major transport infrastructure projects, most require some short run excess capacity in order to absorb the long-run demand. This undershooting demand forecast is seen as less dramatic in the short run - the outcome resulting from the mismatch between demand and supply, the lack of transport capacity and congestion, will generally not be felt immediately and the financial consequences would be less dramatic as well.

The basic assumption in the classical approach is that transport infrastructures develop as expected through a highly rationalised structure of decision making controlled at the top by a small group of people who have the legitimate right to exercise authority. In other words, the classical approach is grounded in the assumption that planning and forecasting are two technical, non-political activities that proceed in response to the need to secure rationality in decision-making and choices in uncertain situations. As Lovallo and Kahnman [30, p4] indicated:

> *"According to standard economic theory, the high failure rates (of large capital investment projects) are simple to explain: the frequency of poor outcomes is an avoidable result of companies taking rational risks in uncertain situations. Entrepreneurs and managers know and accept the odds because the rewards of success are sufficiently enticing. In the long run, the gains from a few successes will outweigh the losses from many failures."*

This approach provides four major explanations for the forecasting gap. In the first one, emphasis is placed on recognising the variety, the hierarchy and the need for integration between plans as well as on developing ways of improving the soundness of their premises.

> *"Port traffic forecasts are often treated as if they have lives of their own. An economist or a study team prepares a forecast and others (a port authority, an investor or a port planner) use the forecast for their own evaluations. Two concepts tend to get lost in the process: the forecasts contain considerable uncertainty, and there is usually a decision hiding on the forecast"* [45, p11].

The "forecasting gap" would primarily result from planning and forecasting assumptions that are later revealed to be inaccurate. As Flyvbjerg et al [20, p74] pointed out:

> *"When Eurotunnel went public as a company in 1987, investors were told that the project was relatively straightforward … The cost estimate of the prospectus turned out to be a best possible outcome based on the unlikely assumption that everything would go according to plan with no delays, no changes in performance specifications, no management problems, no problem with contractual arrangements or new technologies or geology, no major conflicts, no political promises not kept, and so on."*

Therefore improving the accuracy of traffic forecasting would be intimately related to improving the quality of the forecasting assumptions.

> *"The lesson here must be that forecasters should carefully examine the assumptions underlying any forecasts to determine whether they are based on antiquated data, which is also the conclusion in a report made by Mierzejewski. He also refers to Asher who introduced the term; "assumption drag" which he used to describe the characteristic that, once an assumption becomes embedded in the conventional wisdom, its use continues well beyond the point where it is contradicted by empirical data"* [44, p10].

"The literature is replete with things planner and planning must strive to do, but which they do not. Planning must be open and communicative, but often it is closed. Planning must be participatory and democratic, but often it is an instrument to dominate and control. Planning must be about rationality, but often it is about power" [23, p20].

In fact, it would be dangerous to focus on the normative utility of an approach to the exclusion of its descriptive validity. To say that a forecasting model simplifies reality in useful ways is not the same thing as saying that the forecasting and planning processes should be structured around it. This is a mistake that Strategic Planning analysts and Logistics and Operation Management academics, in particular, are rather prone to make. However the most obvious criticism of the classical approach in explaining the "forecasting gap" concerns the ubiquitous presumption of rationality in forecasting and decision-making behaviours. In this approach, the roles of the decision-makers, promoters, governments and other stakeholders are seen as rational actors using forecasting primarily and essentially to predict, with as much accuracy as possible, the volume of traffic likely to use the facilities in order to maximise revenues and minimize costs and subsidiaries. In order to fully understand and explain the gap that too often exists between the anticipated levels of traffic and the actual traffic levels following the opening of transport infrastructure, additional variables must be incorporated into the stream of research on forecasting inputs, processes and outcomes.

3.2 The Contingency Approach

The contingency approach of forecasting is essentially determinist. It assumes that behaviours and outcomes are determined by exogenous forces and constraints. As opposed to their counterparts from the classical approach, the main contention from the champions of the contingency approach is that there is no "one best way" of forecasting major infrastructure traffic levels. In fact, in his influential paper *"After Rationality: Towards a Contingency Theory of Planning"*, Alexander [1, p45] argues that the contingency approach is the only realistic answer to the various reservations regarding the feasibility of a single general theory of planning.

"Given these cogent reservations about the feasibility of a general theory of planning, it is clear that a most modest approach is indicated. Consequently, a contingency framework is suggested here as a way of addressing the problems the planning theoreticians face today".

To the question - what is the best way to forecast future traffic levels, the contingency theory's answer is: it depends - effective thinking in some situations may not be successful in others. In this approach situational, structural and environmental factors determine the performance of a major infrastructure project and therefore the size of the traffic forecasting gap. Thus traffic forecasts are seen as resulting from functional adaptation to the contingency factors. Indeed, there are no forecasts that can withstand structural shocks such as war, trade embargoes, natural disasters, and the like. Nonetheless, the search is for statistical patterns of key associations between the infrastructure projects and their vital situational variables such as the industrial structure and GDP. Researchers attempt to discover the degree of empirical variation in traffic forecasts and to establish the conditions of such variation. For instance, Smyth [45, p6] indicated:

"There is a general relationship between industrial structure and per capita GDP. Industry's share of GDP tends to peak around 45% of total output at per capita incomes in the $3,000 to $5,000 range, and manufacturing peaks around 30% of per capita income in the $2,000 to $4,000 range. While the relationships are quite loose, they indicate that one needs to consider limits to manufacturing growth and to expect that high container growth rate will taper off in the future".

The contingency approach provides two major explanations for the forecasting gap. In the first one - namely the contingency perspective - the key to filling the "forecasting gap" is to design infrastructure projects that are best adapted to the features of the forecasting task, the characteristics of the impending change in its external environment and the features of its internal context.

"The relative effectiveness of any approach is influenced by the time-span of the forecast (long term versus short-term prognoses), the base years and possible unexpected structural changes in the underlying (macro-economic) explanatory variables [45, p22]".

Therefore the emphasis is placed on assessing the various attributes of the infrastructure project, tasks as well as their environment and adjusting the forecast accordingly. Indeed unpredictability in key input variables as well as unforseen events and change in the environment also contribute to the traffic forecasting gap.

"It is clear that uncertainties exist with regard with future demand. Incalculable and unpredictable events will shape the future in ways we cannot hope to anticipate, and even if travel mode were perfect, uncertainties in the input variables are large and to a great extent unpredictable." [44, p10]

Major unpredictable national, regional, and international crises add to the list of environmental factors that can have a significant impact on infrastructure performance and therefore on the size of the traffic forecasting gap. As Smyth [44, p11] pointed out:

"They postulate that organizations are located at the ends of underlying conceptual continua with the middle ranges of the continua being mainly empty … The stark bi-modal world of organizations clustered at the end of continua is a myth". [8, p162]

Moreover the contingency approach fails to pay due attention to the agency of choice by the promoters and the decision-makers, as well as dealing with the problems of obtaining accurate information. In addition, it does not consider either the human sources of inaccuracy in traffic forecasting or the lack of political considerations in the classical approach.

3.3 The Behavioural Approach

There are limits to what can be done to make forecasts more accurate by increasing rationality in decision making, integrating plans, improving the soundness of the premises, creating the perfect conditions for accuracy, and matching forecasts to contingencies: human behaviour must also be considered. The behavioural approach is firmly grounded in the assumption that there are significant individual sources of inaccuracy in traffic forecasting. As Naess et al [38, p538] indicated:

"Model computations are influenced by the individuals who construct and calibrate the models and carry out the analysis, and the background, knowledge, and attitudes of these people."

The features that matter most are those affecting individual judgment in purposeful future oriented decision-making [25]. That literature has been summarized by Durand [11, p821]:

"First, cognitive biases impair decision-makers' abilities to select optimal choice (Barnes, 1984; Schwenk, 1984; Clapham and Schwenk, 1991). Second, routines as programmed sequences of behaviour short-circuit individuals' autonomous judgments (Nelson and Winter, 1982; Teece et al, 1997). Third dominating logic orients individuals' vision, resulting in blind spots and escalation of commitment (Prahalad and Bettis, 1986; Staw and Ross, 1987). Individuals' intrinsic limitations may cause individuals and hence the organisations they work for to commit forecast errors; i.e., may undermine a firm's forecasting ability."

The behavioural approach encompasses the following two perspectives: (1) the Individual characteristic perspective; (2) the Decision/Information-processing perspective. In the first perspective - the individual characteristics perspective – the accuracy in traffic forecasts is determined by one main set of factors: the personal variables which characterise the people involved in the process of making the forecasts. The search is for the factors and features that influence the firm's forecasting ability. This perspective stems from the psychological literature on attitudes, cognitive styles, and behaviour. As Skamris Holm [44, p288] indicated:

"Psychological explanations attempt to explain biases in forecasts by a bias in the mental makeup of project promoters and forecasters. Politicians may have a monument complex, engineers like to build things, and local transportation officials sometimes have the mentality of empire builders".

The proponents of this perspective postulate the existence of a deterministic relationship between individual characteristics and behaviour. Personality traits, attitudes and values are presumed to influence forecasting accuracy. This view of forecasting is rather inadequate: it is not dynamic, it does not examine the process of forecasting, and it is far removed from organisational reality. The direction of influence between changes in individual variables and improvement in forecasting accuracy remained highly debatable. Furthermore as Makadok and Walker [32, p862] indicated the evidence suggests that the proponents of the individual characteristic perspective are not looking at the right place:

"Two separate analyses provide unequivocal evidence that, in the vast majority of cases, forecasting ability is an organizational not an individual-level competence".

In the second behavioural perspective, namely the decision-making and information processing perspective the promoters and forecasters' optimism is seen as the key reason for the forecasting gap. Optimism bias is the term used to describe the demonstrated, systematic tendency for project appraisers to be overly optimistic about project costs, duration and benefits. As Flyvbjerg et al [22, p5] indicated, there are good reasons to question the validity of such an explanation for the forecasting gap:

"Appraisal optimism would be an important and credible explanation of underestimated costs if estimates were produced by inexperienced promoters and forecasters, i.e., people who are estimating costs for the first or second time and who are not drawing on the knowledge and skills of more experienced colleagues … But given the fact that the human mind is distinguished by a significant ability to learn from experience, it seems unlikely that promoters and forecasters would continue to make the same mistakes decade after decade instead of learning from their actions. It seems even more unlikely that a whole profession for forecasters and promoters would collectively be subject to such a

debates and technical analyses. Here, prognoses and estimates produced by project promoters would be even more suspicious.

> *"Estimates of future traffic produced by the project promoter may be even more prone to bias than estimates produced by consultants since the promoter often has an obvious interest in presenting the project in as a favourable a much as possible and be under less pressure than consultant to enforce professional standards"* [22].

Because of the expertise of the consultants and forecasters with their specialized technical jargon, that by definition, excludes those without professional training, the complexity of quantitative simulations and disaggregated demand models and other sophisticated computer modelling techniques, it would be difficult for any layperson to monitor or control their actions and performance or contest their claims.

The main strength of this first political explanation for the "forecasting gap" has been to identify the existence and source of power through professional expertise, autonomy and language. However, the explanation tends to acknowledge the technical skill and knowledge of the forecasters and consultants while overlooking the sources of power and expertise of other stakeholders. Furthermore, that explanation for the "forecasting gap" has confined itself to the behaviour of planners and promoters neglecting the wider context that determines the power base wielded by them.

The second explanation of the political approach suggests that major transport infrastructure projects can only be developed through the joint actions of a set of actors from a number of groups, each with their own agenda. As Trujillo et al [46, p3] pointed out:

> *"In practice, at least four groups of actors are involved: consumers, operators, the government and the regulator and it is important to understand how their concerns differ … In discussing demand forecast key actors are often more advocates of their agenda than scientists"*.

This explanation focuses on the nature of interactions taking place among multiple participating actors and agencies as well as on their interests, relative autonomy, as well as their strategic and tactical use of power to retain or obtain control over the project. As Trujillo et al [46, p5] pointed out:

> *"It is not easy to achieve convergence on the views of what a good demand forecast should be because both firms and government have some interest in playing strategically with the demand forecast"*.

This explanation stresses the complexity and ambiguity of both the large transport infrastructure and the negotiation processes involved in getting the project approved. The projects themselves are simply a point of departure for bargaining among stakeholders involved. The development of transport infrastructure projects often takes place in the absence of clearly defined goals and without clear focus of power to deal with risk and resolve conflicting issues. The final set of forecasts is simply a convenient temporary agreement reflecting no overall agreement on purpose but bringing stakeholder expectations into momentary convergence and taking negotiation to temporary closure until the construction of the infrastructure begins. As Trujillo et al [46, p5] indicated:

> *"Politicians will want to look good during their tenure … the eventual renegotiation of the deal is left to their successors since they generally imply political costs. But it is clear that private operators happily play in this game. For many of the best deals, their main concern is to get the contract signed by the government, knowing quite well that there is generally significant room for renegotiation. Patience in this field is often rewarded once the contract is won"*.

The major contribution of this explanation has been to stress that players have a strong incentive to play strategically, and to highlight the complexity and ambiguity of transport mega-projects. However, this perspective has come under fire for being long on description and short on prescription and for relying on "soft" methodologies, leaving open the questions of causal inference and generalisation [22, pp71-72].

> *"Existing studies of costs, benefits and uncertainties in transport infrastructure development are few. Where such studies exist they are typically small-N research, i.e. they are single-case studies or they cover a sample of infrastructure projects too small or too uneven to allow systematic, statistical analyses… Moreover, because of the small and uneven samples used, different studies reach very different conclusions"*.

A view of traffic forecasting that emphasises complexity such as this one requires further work towards the specification of its elements.

The third explanation from the political approach builds onto the theory of resource dependence championed in the late 1970s by Pfeffer & Salancik [43]. The theory argues that the organisational behaviour becomes externally constrained because an organisation must attend to the demands of those in its environment that provide essential resources to attain its objectives. Therefore forecasters and promoters would make sure that political desires and wishes of those who control the key resources are reflected in the traffic prognosis.

be listen to. Analysis may therefore also be used to convey a message that is purely symbolic – to impress others within or outside the organisation or to hide another less laudable motive".

According to Skamris Holm [44, p10] using forecasting in such a way could be counterproductive:

> *"It is an obstacle for more reliable forecasts if it, in reality, already has been decided that a project should be implemented and that the initial investigations are made only to support this decision, and to help getting the project adopted"*.

Plans and forecasts are made to satisfy some party pressure or awkward interest group. But builders, promoters as well as government officials know that they need not strain themselves too hard to reach forecasted costs and traffic forecasts.

> *"One of the most important issues within the last decades has been the increasing focus on environmental issues when discussing problems of transport. This political dilemma has lead to misleading traffic forecasts and especially to overestimate rail traffic and to huge variation in road traffic. By making these estimation failures it looks as if the environmental goals set out in the various environmental declarations are about to be fulfilled"* [44, p11].

This explanation offers a somewhat Machiavellian account of the forecasting and planning processes that, nevertheless, could strike a cord [16][20][22]. From an essentially symbolic standpoint, the study of the "forecasting gap" would not be of much interest, except to demonstrate how promoters could easily dupe people.

> *"If we now define a lie in the conventional fashion as making a statement intended to deceive others we see that deliberate cost underestimation is lying; and we arrive at one of the most basic explanations of lying that exists: lying pays off, or at least economic agents believe it does."* [21, p288]

Aside from limited anecdotal accounts - in particular the stories of the Channel Tunnel (the longest underwater rail tunnel in Europe), the Oresund bridge between Denmark and Sweden (one of the largest cross-national infrastructure projects in Europe), and the Great Belt link connecting East Denmark with continental Europe (the longest suspension bridge and the second longest underwater rail tunnel) [20] - there are no extensive empirical studies widely supportive of this view.

The second explanation of the fourth political approach - the symbolic action, extends the previous one and thereby provides a view that is of much use in studying large transport infrastructure forecasting processes. This perspective emphasises the role of political language and symbols in decision-making. As Pfeffer [42, p211] pointed out more than twenty years ago:

> *"Political language and symbolic action can have consequences for mobilization and motivation of support, for cooling off or placating opposition either inside or outside the organisation"*.

This explanation combines ideas about sources, uses, and outcomes of power together with ideas concerning the role of symbolism, language, beliefs, and myths. The argument goes that considerations of power and influence are relevant for predicting resource allocation and decisions, whilst consideration of language and symbolism are critical to understanding the process designed to create legitimacy for these outcomes of power. Pettigrew has championed this unified view of political and cultural analysis for studying change [40]. In brief, he suggested that the various actors attempt to develop and convince others of the dominating legitimacy of their actions, ideas, and demands. These actions and decisions become legitimate when the various actors accept them because they believe that they are sufficiently just and right for willing compliance.

> *"If outcomes can be legitimised to the point where they are not questioned, even by potential opponents, actors have succeeded in obtaining their desired outcomes by using their power to prevent conflict from arising ... This aspect of power has been termed unobtrusive (Hardy, 1985), not so much because power is used unobstrusively but because of the circumstances in which it is used and the objective of its use. Overt power is employed in situation of overt confrontation, with the aim of defeating opposition. Unobstrusive power is used before overt confrontation occurs, with the explicit aim of preventing it."* [40, p135]

The key element to successfully achieving a multibillion-dollar mega infrastructure project would be the use of language, symbols, beliefs, and myths in presenting the project so that a social consensus around them emerges. Yet, political language and symbolic activity take place in a polarised competitive environment. As Flyvbjerg, Bruzelius and Rothengatter [20, p89] indicated:

> *"It is here we find that the familiar idiosyncrasies associated with the conventional approach to the development of major infrastructure projects: politics and the public debate are polarised"*.

Both sides of the political contest seek to manage the process by which actions and events are given meaning. One way of achieving this is the use what is commonly know as "salami tactics" [21, p281].

sciences, the empirical findings and theoretical developments in the field of planning and forecasting are method-bound. As Flyvbjerg et al [19] pointed out:

> *"And for small-sample studies, which are typical of this research field, technical explanations have gained credence because samples have been too small to allow tests by statistical methods".*

Thus far, the research findings lack generalisability and provide little advice to decision-makers on how to predict and solve forecasting problems as well as on how to improve forecasting processes therefore closing the "forecasting gap". The advocates of the political approach [12][13][14][16][18][19][20][21][22][48] have made a very strong case for the proposition that power and politics cannot be ignored in large transport infrastructure planning. However, they have not yet investigated in detail the complex interplay between rationality, human needs and politics. To say that multibillion-dollar mega infrastructure projects are political and that traffic estimates used in their decision-making are highly, systematically and significantly misleading is true but too simplistic. More differentiated propositions regarding the variables influencing political processes in such major infrastructure projects are needed. As Langley [29, p693] pointed out:

> *"Research that concludes simply that everything is complex or that simple normative models do not work is limited in its appeal. As Van de Ven (1992) notes, process theorization needs to go beyond surface description to penetrate the logic behind observed temporal progressions whether simple or complex".*

4. Discussion and Conclusion

Our review of the alternative explanations for the "forecasting gap" shows that they cluster into four main categories: (1) the Classical Approach; (2) the Contingency Approach, (3) the Behavioural Approach; and (4) the Political Approach. In the Classical Approach the roles of the decision-makers, promoters, governments and other stakeholders are those of rational actors using forecasting to predict, with as much accuracy as possible, the traffic volumes likely to use the facilities in order to maximise revenue and minimize cost and subsidies. The Contingency Approach is essentially determinist: situational or contextual factors and features determine the outcome and therefore the size of the forecasting gap. The Behavioural Approach is grounded in the belief that there are some significant individual sources of inaccuracy in forecasting and planning. The Political Approach to explaining the "forecasting gap" addresses the body of theoretical material that represents the dark side of planning theory – the domain of power.

There are a number of important points derived from the preceding summary of the various explanations for the "forecasting gap". The first one concerns the pluralism of the literature on forecasting and planning. There is an interdisciplinary diversity of the literature on recent works on traffic forecasting for large transport infrastructure investments. One obvious yet important question arises: Why has such a diversity of explanations occurred? As is the case for the "implementation gap" [9], the traditional answer suggests that these different approaches represent a trend towards increasing sophistication in the history of practice and thinking in the area, revealing a progressive shift away from the classical approach. As Harris [24, p24] pointed out:

> *"These changes allied with a range of other developments in planning theory during the past twenty years, reflect broader "crisis" in planning theory related to the decline of the classic rational planning model."*

The existing diversity of explanations results from their perceived failures and limitations, leading towards the development of more refined alternative explanations.

There are a number of problems with this attempt to explain the diversity. Firstly, the building up process of increasing sophistication should logically direct us towards one single best and, therefore, generally accepted explanation for the "forecasting gap". An essential conclusion of the previous pages is that, as yet, there is no such analytical consensus among academics and practitioners; either on the most meaningful way of examining the "forecasting gap" or on what factors are most important one to consider in planning a large transport infrastructure.

Secondly, such an explanation implies that there is a rough chronological trend in the development of the various explanations. However, it was only during the 1970s that the "forecasting gap" was finally recognised as an important issue [25, p122].

> *"In the sixties forecasting errors tended to be positive (i.e. actual values exceeded forecasts). Thus, even if plans proved to be "wrong" few complained of the direction of the errors. However, this did not occur in the seventies when forecasting was on occasion grossly in error in the opposite direction".*

This paper portrays a concurrent, as opposed to a sequential linear, development of explanations. Thirdly, the evolutionary thesis implies that there should be diminishing support for the explanations classed under the umbrella of the classical approach. This paper does not indicate a decline in the popularity of the classical

catching reality in flight; and in studying long-term processes in their contexts, a return to embeddedness as a principal of method." [41, p3]

Although the analytical separation of the three clusters of factors may make them appear to be structural entities, the contextualist model is designed to be understood as one composed of dynamic processes with mutually contingent inter-relationships over time. No one single component of the model is expected to account for the accuracy of the forecasts. Focusing on one or other of these three categories of factors as the key to understanding traffic forecasting is bound to promote neglect of the other levels that are equally vital influences on the outcomes.

Contextualism offers at least two major theoretical and methodological advances [10] important in the study of traffic forecasting. First, it allows simultaneous consideration of the many key factors likely to influence the various forecasting processes and outcomes. Causation is neither linear nor singular. The forecasting gap has multiple causes and can be explained by the convergent interactions and interconnected loops between factors and features over time. The result is a holistic account in which content and context are repeatedly reviewed alongside process variables. Second, contextualism provides an approach capable of drawing on concepts from a variety of disciplines. It has been suggested above that there are multiple processes concurrently at work in the forecasting and building of a major transport infrastructure involving rational, structural, behavioural, and political dimensions. The forecasting gap is a complex phenomenon which could benefit from holistic treatment allowing distinct paradigmatic approaches to co-exist and contribute to the analysis of what is happening. As the world becomes smaller and expectations for new transport infrastructure continue to rise, making research that would enable promoters to serve their customers and other stakeholders more efficiently and effectively becomes increasingly important.

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