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### **A DYNAMIC PERFORMANCE MANAGEMENT APPROACH TO FOSTER MUNICIPAL POLICE STRATEGIES IN PALERMO TO CONTAIN SPEEDING AND DRUNK DRIVING**

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INDEX.....	p. 2
LIST OF FIGURES.....	p. 4
LIST OF ABBREVIATIONS.....	p. 6
ACKNOWLEDGMENTS.....	p.7
ABSTRACT.....	p. 9

## **CHAPTER ONE**

### **Introduction**

1.1 Problem relevance and formulation.....	p. 12
1.2 Purpose of the study and research questions.....	p.17
1.3 Research methodology.....	p.20
1.4 Thesis structure.....	p. 23

## **CHAPTER TWO**

### **Road safety a multidisciplinary approach**

2.1 Definition of road safety.....	p.26
2.2 Preventing road accidents: the focus on the infrastructure.....	p.34
2.2.1 Preventing road accidents. The focus on the psychological factor.....	p.44

## **CHAPTER THREE**

### **The development of safety culture in Italy: figures of the phenomenon**

3.1 The development of a safety culture in Italy: figures about the phenomenon.....	p.47
--	------

3.2 Road safety in Italy, the legislative framework.....	p.48
3.3 The Municipal Police in Italy.....	p.51
3.3.1 A missing reform for the Municipal Police: some practical implications.....	p.56
3.4 The challenge of technology in furthering (road) safety.....	p.58

## **CHAPTER FOUR**

### **The emergence of performance in the public sector: from measurement to management**

4.1 Introduction.....	p.62
4.2 The rise of ‘New Public management’.....	p.65
4.3 The process of privatization in the Italian Public sector.....	p.69
4.4 Performance Management.....	p.73
4.5 The challenge in measuring performance.....	p.75
4.6 The drawbacks of measuring performance: the case of the Police.....	p.81
4.7 The methodology of System Dynamics.....	p.90
4.7.1 The quantitative modelling approach.....	p.94
4.7.2 The qualitative modelling approach.....	p.95
4.9 The combination of SD with traditional performance methodologies: the case of Performance Management.....	p.97
4.10 the complexities of Police work and the usefulness of (partial) modeling.....	p.106

## **CHAPTER FIVE**

### **Driving misconducts in Palermo and the role of the ‘Mobility Unit of the Municipal Police**

5.1 Introduction.....	p.108
5.2 Traffic congestion in Palermo: an overview of the main causes .....	p.112
5.3 Changes in drinking habits in the population: the phenomenon of ‘movida’ .....	p.118
5.4 The Municipal Police Corps in Palermo: an overlook of their internal organization.....	p.121
5.5 The ‘Mobility Unit (MO.SI.C) and its contribution to tackle speeding and alcohol abuse.....	p.130

## **CHAPTER SIX**

### **The construction of a dynamic performance management model to analyse municipal police strategies in Palermo to tackle speeding and drunk driving**

6.1 Introduction.....	p. 133
6.2 The ‘instrumental view of DPM applied to the MO.SI.C. unit...p.	138
6.3 The ‘feedback perspective’: the Causal Loop Diagram.....	p.145
6.4 The simulation.....	p.148

<b>CONCLUSIONS.....</b>	<b>p.161</b>
-------------------------	--------------

<b>REFERENCES .....</b>	<b>p.173</b>
-------------------------	--------------

Appendix A: Model documentation.....	p. 167
--------------------------------------	--------

## **LIST OF FIGURES:**

Figure 1.1 - Relation between number of fatalities per 100 000 population and number of registered vehicles per 1 000 population for 1938;

Figure 1.2 – relationship between vehicle ownership and fatality rate per population for 2007;

Figure 4.1 – the objective view of performance ;

Figure 4.2 – the instrumental view of performance;

Figure 4.3 – the subjective view of performance;

Figure 4.4 – primary factors leading to dysfunctional behavioral effects of performance management system in the public sector;

Figure 4.5 – graphical representation of a stock;

Figure 4.6 – graphical representation of a driver;

Figure 4.7 – a dynamic performance management view framed through an “instrumental perspective;”

Figure 4.8 – graphical representation of a flow;

Figure 5.1 – structure of the Municipal Police organization in Palermo;

Figure 5.2 – staff in force to the Municipal Police in Palermo;

Figure 5.3 – internal and external staff in force at the Municipal Police in Palermo;

table 5.1 – most recurring infringements of the Highway Code Year 2013;

table 5.2 – staff in force to the MO.SI.C division;

table 6.1 – category of stocks that can increased through financing

table 6.2 – category of stock that accumulates all revenues proceeding from sanctioning activities

table 6.3 – category of stock accumulating revenues from camera-detected offences

table 6.4 – category of stock that be increased/decreased through reshuffling of personnel

Figure 6.1– overview of the main variables characterizing the MO.SI.C. ambit of operation according the DPM perspective;

table 6.1– outline of Performance drivers against end-results;

table 6.2 – outline of strategic resources against end-results;

Figure 6.2 – an instrumental view outline of the MO.SI.C ambit of operation

Figure 6.3 – the CLD diagram

Figure 6.4 – the MO.SI.C model

Graph 6.1 – budget size before increase from fine-generated revenues

Graph 6.2 – speed enforcement devices before implementation of policies

Graph 6.3 – simulation of four alternative scenarios on fines-generated revenues

Graph 6.4 – simulation of four alternative scenarios on road accidents

Graph 6.5 – limits to growth of intra-departmental staff reshuffling

Graph 6.6 – limits to growth of fines issuing and processing

Graph 6.7 – limits to growth of speed enforcement devices

## **LIST OF ABBREVIATIONS**

A.D – *Anno Domini* / Year ;

CIPE – *Comitato Interministeriale Programmazione Economica* / Inter-department Committee for Economic Planning ;

CIT – *Controllo Integrato del Territorio* / Joint-Police Territorial Action;

CLD – Causal Loop Diagram;

CNR – *Centro Nazionale di Ricerca* / National Research Centre

DPM- Dynamic Performance Management;

EU – European Union;

FHWA – Federal Highway Administration;

GDP – Gross National Product;

IHSDM – Interactive Highway Safety Design Model;

MOSIC – *Mobilità e Sicurezza* / Mobility and Safety;

NPM – New Public Management;

OECD – Organization for Economic Cooperation and Development

P&C – Planning and Control;

PNSS – *Piano Nazionale di Sicurezza Stradale* / National plan for road safety

PPAF – Police Performance Assessment Framework;

SD – System Dynamics;

UN – United Nations;

WHO – World Health Organization;

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## **ABSTRACT**

Road related fatalities kill 1,25 million people every year around the world and rank as the ninth cause of death according to some recent statistics by the WHO. Actions to reduce this phenomenon have been taken, at different institutional levels, with promising results, particularly in western societies, where the magnitude of such occurrences has been almost halved in the last decade. Nevertheless the level of attention, with regard to road safety, will have to be kept high if a further reduction of this phenomenon is to be reached. Traditional road safety-related approaches mainly focus on prevention through the constant improvement of vehicles' safety devices and the rationalization of the road infrastructure. Surely such technical improvements have contributed to the reduction of fatalities among drivers but their impact on other categories of road users has proven to be far less effective. To protect pedestrians, cyclists, bikers and drivers themselves, in fact, other measures, focusing on behavioral approaches, are deemed just as necessary. In particular, certain driving conducts, like speeding and drunk driving, are constantly reported to be highly conducive to road accidents and therefore need to be drastically tackled. Consequently the attention should be cast on multiple factors that are believed to be at the root of such phenomena. In particular it is believed that traffic psychology should be relied upon as just as an important element to for road safety initiatives.

Police work, in particular, could be effective in discouraging those behavioral attitudes of widespread disregard for driving rules. In particular, targeting the feeling of likely impunity, that is still high among motorists, could be a strategical move in police action provided that a certain regularity is exercised in the implementation of control activities. But, in Italy, this is unfortunately a difficult goal to achieve given the chronic understaffing that affects Police agencies at all levels and in particular at metropolitan level. Especially at local level, where most of the Highway Code infringements occur, the limitation of staff can be a serious obstacle to exercising regular police controls. Technological solutions have, therefore, been urged as a possible remedy to guarantee a more effective and capillary territorial control to complement the traditional Police work. While acknowledging the added value that speed enforcement tools could mean to the Police some questions remain open as to the best fit of alternative resources that could guarantee durable solutions in terms of sustainability. As it usually happens the true question is not about the value of technology in itself but, rather, it is about the identification of a proper balance between alternative strategies that can guarantee service outcomes to the benefit of the whole community and not to just departmental own targets. Manifestly a need emerges to shift the focus from sectoral targets to more comprehensive approaches where global outcomes become the priority even at the cost of sacrificing some sectoral targets. Police work has rarely embarked on such a course though; their traditional performance metrics are generally calibrated on sectoral output measurement than on service outcomes. A proper methodology should, on the contrary, be adopted to move from a micro analysis of performance to systemic evaluations without neglecting those

dynamic implications so typical of complex systems. Combining traditional P&C solutions with a dynamic approach, in fact, enables decision-makers to detect all those aspects, looking perhaps marginal at first glance but realistically carrying a potential to alter scenarios and impact expectations severely. Dynamic Performance Management (DPM), in this respect, is a methodology that, through simulation, allows a more effective monitoring of wider scenarios while, simultaneously, enabling decision-makers to optimize limited resources in a sustainable way. Therefore, this thesis will propose DPM as a learning tool to guide the Municipal Police in the identification of a balanced combination of preventive and repressive activities and resources that can effectively improve their performance in reducing road accidents while guaranteeing an adequate financial flow from fines-generated revenues to be reinvested in road safety initiatives.

## **Chapter one**

### **INTRODUCTION**

#### **1.1 Problems relevance and formulation**

Road accidents mainly occur as a result of human behaviour. Although several factors may contribute to generate accidents statistics show that wrong driving conducts and poor compliance with norms are responsible

for ninety-five per cent of such occurrences.<sup>1</sup> As it appears from recent studies, not only infrastructural projects but behavioural and psychological factors too need to be duly taken into account if road-related fatalities are to be reduced. Measures to tackle road accidents are twofold in the sense that they imply long and short-term strategies: such activities like improving the road infrastructure, developing new public transportation projects or still increasing public awareness on road-safety issues, all pertain to the long-term scaling. Other initiatives, on the contrary, like streamlining traffic flows, to enhance safety, or working on the repressive side, to discourage certain driving practices, are all examples of the shorter-term time horizon. Road-safety is an ambit where several agencies operate simultaneously exercising different functions: from data collection, to repressive and preventive activities, to engineering solutions or to health programmes, the pattern of governance of this domain displays a level of complexity that immediately stands out. Police work can be situated in the second layer: through the adoption of a proper mix of preventive and repressive measures, in fact, the Police can impact specific contingencies relatively rapidly than other measures that take long to be implemented. Although the number of serious accidents, has been decreasing, throughout the whole country, since 2001, it is the persistence of some specific driving misconducts that have triggered the interest for this research: in particular the attention will be cast on speeding and drunk driving, in the city of Palermo, which recent Police reports indicate as still far too widespread conducts among motorists.<sup>2</sup> In

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<sup>1</sup>M. Dorfer, *Psicologia del traffico e della mobilità*, Mc Graw-Hill Milano 2004, XIII, XIV

<sup>2</sup>Città di Palermo, *Bilancio Sociale 2014*, Comune di Palermo: 462-463

Italian urban areas, the primary responsibility to deal with traffic-related preventive and repressive activities resides with the Municipal Police, a specific Police corps being the expression of the Municipal authority. In their efforts to keep fatalities low the Municipal Police clash with a chronic understaffing that severely impacts their performance. The need, in fact, to dynamically shift to constantly changing service priorities does not always allow that constant focus that speeding and drunk driving would require to achieve sustainable results. The major criticalities are experienced at night, when the capacity of the Municipal Police is even more reduced, due to age restraints in force that forbid the deployment to the streets of the workforce above a certain age range. New recruitments, to make up for the described limitations, are, presently, not an option because of the still persistent nationwide budget-cuts to contain the magnitude of the Italian national debt. For the stated reasons, and in the wake of similar initiatives experienced abroad, more and more voices have been raised to introduce a more substantial recourse to technology to help the Municipal Police to effectively make up for the described state of affairs. Installing cameras is seen by many as an effective preventive solution to discourage illegal behaviour. And speeding, in particular, more than other infringements of the law, appears to lend itself relatively easily to technological monitoring, given the wide array of related devices available on the market. In addition to the wide availability of technological solutions, other considerations would justify a large-scale recourse to video-surveillance applied to infringements of the Highway Code: reformation of rule 208 of the Italian Highway code prescribes, in fact, a compulsory reallocation of revenues proceeding from fines for

road safety initiatives. It is clear that, at times of decreasing financial state- transfers to Municipalities, this opportunity could be seen as a formidable instrument to make up for budgetary restrictions. Undoubtedly technology, to a certain extent, can offer an important contribution in helping the Police ease their daily burden but, at the same time, no deterministic patterns of behaviour, should be associated to this hypothesis either. The equation ‘more technology = less crime,’ however widely shared by public opinion at large and field operators, does not seem to be methodologically or etiologically valid though: when used for prevention and repression, technology alone cannot, in fact, be considered as a sort of panacea to miraculously solve all possible range of problems: rather it should be part of a larger framework where the contribution of human resources is duly taken into account: the use of images for judicial proceedings must withstand, in fact, strict legal challenges before their effective utilisation can be guaranteed. It appears that without the involvement of skilled personnel a huge amounts of the images captured by cameras could not be of effective legal value. Besides the possible legal considerations, massive recourse to technology triggers also a number of sociological and economic considerations which cannot be simplistically dealt with: the key issue, in this respect, is the degree of intrusion, into the citizen’s personal sphere, that the goal of security can allow. But even in the event of absence of specific drawbacks at all technological options still need to be carefully balanced against each other with regard to the desired impact expected on the targeted phenomena. In the specific case of speeding and drunk driving, in fact, the main trade-off is to decide on either to implement speed enforcement solutions

emphasizing the repressive aspect and not excessively straining the workforce or to insist on other alternatives, being more demanding in terms of manpower but expected to foster a higher preventive potential. The issue is definitely complex since, whichever lever the Municipal Police may decide to activate, a number of considerations will have to be faced as to the possible counter-intuitive developments that could be generated by either decision. In particular some trade-offs between the short and the long term. To test the described hypothesis this thesis sets out to inquiry into the present strategies adopted, in Palermo, by the Municipal Police to deal with the mentioned driving misconducts and to simulate possible alternatives that might eventually enhance their performance. This inquiry will be conducted through a dynamic approach integrating Performance Management, a traditional tool for performance measurement, with the potential offered by System Theory. A dynamic analysis, in fact, offers the advantage of monitoring possible delays and counterintuitive effects among concerned variables more productively and consequently of enabling decision-makers a more meaningful understanding of the reality where they operate. The main idea is to offer stakeholders a tool capable of preventing what in literature has been described as ‘an illusion of control’<sup>3</sup> that may arise from strict reliance to the linear approaches of most P&C techniques. In this respect the framework used in this thesis will be Dynamic Performance Management (DPM) as introduced by Bianchi (2012) concurrently with its underlying representation, simulation and testing method System Dynamics (SD).

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<sup>3</sup> c. Bianchi, ‘*Enhancing Performance Management and Sustainable Organizational Growth Through System-Dynamics Modelling*,’ Springer 2012, pp. 158



Through the three analytic elements of this methodology (strategic resource, performance drivers, end-results) it will be attempted to highlight how a different combination of the end-results, i.e. ‘objectives’, might have various impacts on the Municipal Police’s strategic assets, i.e. ‘strategic resources’ which, ultimately, are the factors that guarantee sustainability of action and that must not be dissipated. The methodology is deemed to be relevant since only through a better understanding of the systemic cause-and-effect relationships among concerned variables it will be easier to improve performance by providing decision-makers with a wider perspective of analysis to calibrate policies more effectively with respect to the desired results. While being aware of the fact that the phenomena investigated in this thesis are clearly beyond the reach of Police’s effort alone, given their multiple implications involving road planning, sociology, education, health, law, nevertheless partial modelling can still be useful as a preparatory work for a possible larger mosaic to be designed in the future when more data will be available<sup>4</sup>. The limitation of time, data and resources would have probably made the goal of building a thorough model, incorporating all the possible determinants leading to road accidents, highly unlikely. Nevertheless the better insights which may be obtained from a wider understanding of the cause-and-effects relationships, among the limited variables examined, is still believed to be

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<sup>4</sup> I.M. Newsome, *‘Using system dynamics to model the impact of policing activity on performance’*, Palgrave Macmillan 2008, pp. 170

useful for the Municipal Police to determine the most suitable strategies to be implemented depending on the shifting priorities of their daily routines.

## **1.2 Purpose of the study and research questions**

The purpose of the present research is to show how DPM can serve as a learning tool for the Municipal Police to analyse the different dynamic implications deriving from the alternative mix of resources and strategies deployed to tackle such driving misconducts like speeding or drunk driving. In particular the trade-offs generated by reliance on alternative technological solutions to tackle the described phenomena are going to be the main object of this research work. The objective is to identify the proper mix of strategies through which Police performance can be enhanced while simultaneously making sure that their endowment and utilization of strategic resources is properly maintained. Evaluating Municipal Police's performance through some learning scenarios, enabling a dynamic analysis of the different effects generated by alternative policies, is not only an interesting challenge but it is also an innovative approach to the topic: most of the experiences, in the field of police performance analysis, in fact, are mainly limited to the linear thinking of the more traditional and essentially quantitative P&C systems. In addition to that, another innovative aspect of this research is related to the fact that little is known about the effect of legal enforcement and the issuing penalties on driving behaviour and hence on road-safety.<sup>5</sup> While being aware that quantitative analysis do matter it should not be overlooked that a

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<sup>5</sup> Scottish Office Central Research Unit, *'The Deterrent Effect of Enforcement in Road Safety'* - Research Findings, Scottish Office, 1999

greater/lower amount of any output of, say, fines issued to motorists, is, in itself, not necessarily a conclusive indicator of performance: less fines, in fact, could be the mirror of an improved preventive capacity by the Police and not automatically a decline of their repressive action. Conversely, some apparently promising results in one field could, potentially, have been obtained to the detriment of the larger system on the whole with resources being subtracted from other sectors. Mistaking the output for the outcome is a frequently recurring risk<sup>6</sup> in performance evaluation leading to what has been labelled<sup>7</sup> as an ‘illusion of control.’ Dealing with complex environments is, in fact, not easy: cause-and-effects mechanisms between variables are often so tightly interconnected and not immediately detectable that they are likely to expose managerial decisions to a partial, limited, understanding of the full picture. The risk looming ahead is that of unintended consequences caused by a superficial or mechanistic approach in setting performance targets.<sup>8</sup> Therefore the need emerges to adopt an approach that, while minimizing the risk of too narrow a focus, can serve as a learning tool for the Police to assess the impact of their strategies on the larger system. In the case study, in particular, through some learning scenarios, the different effects of specific speed enforcement tools on

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<sup>6</sup>Bianchi C. et al., (2013), ‘*A Dynamic Performance Management Approach to Evaluate and Support SMEs Competitiveness: Evidences from a case study*’, (paper presented at the 31st International Conference of the System Dynamics Society, July 21 – 25 2013), USA: 2

<sup>7</sup> C. Bianchi, ‘*Enhancing Performance Management and Sustainable Organizational Growth Through System-Dynamics Modelling*’, chapter published in *Systemic Management for Intelligent Organizations* 2010: 143-161

<sup>8</sup> C. Bianchi, F. Cosenz, M. Marinkovic, ‘*Designing Dynamic Performance Management Systems to Foster SME Competitiveness according to a Sustainable Development Perspective. Empirical Evidences from a Case-Study*’ *International Journal of Business Performance Management* 01/2015; 16(1):84-108.

prevention and on financial returns will be examined with a view to letting their strengths and weaknesses emerge. With a view these outlined goals this research work will be driven by the following set of macro and sub-research questions:

1) How can a performance management system support municipal police to improve road safety?

- 1.a) What are the strategic resources the Municipal Police can currently rely on to limit such phenomena like speeding and drunk driving ?
- 1.b) What is the optimal combination of end results leading to an effective accumulation and utilization of strategic resources?

2) How can a dynamic approach provide a better decision making tool to design road safety based policies?

- 2.a) On what drivers can the Police rely to tackle the above mentioned misconducts with a view to optimizing the accumulation and utilization of the strategic resources?

2) How to measure the Municipal Police performance according to a systemic view of road safety phenomena?

### **1.3 Research methodology**

The research methodology in this thesis has first focused on a review of the existing literature on the metrics, currently used in major countries, to evaluate performance in the field of policing. An extensive review displayed that, in most of the cases, performance is assessed through quantitative parameters while, only in rare cases, qualitative analysis are performed. Apart from a couple of exceptions relevant literature has displayed that performance is usually assessed against an inputs/outputs relationships aiming at determining whether or not resources have been efficiently used. This is a typically output oriented approach. Further reading led to the conclusion that efficiency-related considerations are more suited for micro-analysis but are unreliable when the purpose of inquiry is widened to global outcomes. For the exposed reasons, and with regard to the topic of this thesis, further analysis were performed to find out if, in the ambit of police work, any attempt had been made to analyse performance from a dynamic perspective. The very specificities of police work, in fact, with effects often unfolding over time and involving multiple variables, are felt to be better dealt with through dynamic evaluations. The studies on Police performance, which the author has come across in relevant literature, has shown that the quantitative perspective is usually adopted for performance measurement purposes: this philosophy departs from the basic assumption that the stronger the repressive action the higher will be the deterrence effect. Nevertheless reliance on purely quantitative analysis may lead to unintended

consequences generated by the lack of a systemic approach.<sup>9</sup> The fact that most of the papers, on the examined topic, were centred on crime fighting, and not on activities to foster road-safety, has not been felt as a limitation by the author in the light of the logical analogies characterizing events requiring a police response. Driving related infringements are, in fact, just like crimes and misdemeanours, phenomena which authorities tackle through similar strategies, often shifting from repression to prevention and vice versa. In the persuasion that complex phenomena cannot be analysed through pre-determined lines of investigation some initial assumptions were formulated concerning to the counter-intuitive effects generated by the use of alternative technological choices to tackle speeding and drunk driving. They were presented as a topic for an interview to field operators to sense their opinions over the implementation of a systemic approach to more effectively deal with the above mentioned traffic offences. Such interviews, in particular, involved some in-depth conversations with high-ranking senior officers in the Municipal Police's Traffic Department which were later evaluated against relevant literature on performance issues. The resulting feedback was a general acknowledgement of the desirability of such an approach. Simulation, in particular, was felt as extremely functional to test alternative strategies. Some of the comments received tended to equate the 'systemic approach' notion with the strategy of reinforcing inter-police cooperation to make up for the corps' chronic understaffing. However desirable this option may appear, some uncertainty emerged as to metrics to be used to assess

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<sup>9</sup> E. Bivona, G.B. Montemaggiore, '*Understanding short- and long-term implications of "myopic" fleet maintenance policies: a system dynamics application to a city bus company*', <<System Dynamic Review>>, (2010) n. 26, pp. 202

individual contributions. Other comments pointed out at the importance of holding regular meetings among concerned stakeholders, within the metropolitan area, so as to guarantee a constant exchange of opinions and feedbacks from one another's experiences; also in this case it was difficult to translate how this enhanced communication would translate in a specific metrics. Therefore the author concluded for the need to limit the simulations to a smaller chunk out of all the possible global strategies available to discourage driving misconducts. The primary object, which simulation would be intended to let emerge, was going to be focused on the different effects generated by speed enforcement tools on drivers' misbehaviour. In particular the need to find a proper balance between the targets to be pursued and the assets available to that effect led the author to resort to Dynamic Performance Management (DPM) to analyse different scenarios generated by different alternatives: in particular the clear fit between the main variables taken into consideration with the DPM logic of strategic resources vs end-results made this choice appear more than appropriate.

#### **1.4 Thesis structure**

This work is divided into five chapters:

**In the first chapter** an introduction over the issue under investigation is presented; departing from an outline of the persistence of certain ill driving conducts, in the city of Palermo, the analysis then focuses on the structural deficiencies affecting the local Municipal Police in tackling such phenomena. Next, an analysis will be conducted as to the importance of

approaching this issue from a systemic perspective in the belief that this can be a fruitful approach to better deal with complexities. This last point will implicitly pave the way to presenting Dynamic Performance Management as a methodology to answer some of the originally formulated research questions. These research questions will serve as guiding thread to cover the whole development of the research throughout the following chapters.

**The second chapter** focuses on the internationally recognized definition of a road accident. Starting from a review of the most relevant literature on the concept of road safety, the chapter will then continue focusing on the measures traditionally undertaken to improve road-safety: next to describing the traditional fields of intervention affecting, for example, the road infrastructure and car-safety devices, particular attention will be then cast on some important streams of thought, particularly advanced in German speaking countries, which consider the psychological factor as a just as an important element to foster preventive action: in this specific field the role that the Police can play is believed to be important provided that personal interactions between officers and offenders are maintained at a satisfactory level.

**The third chapter** will examine the emergence of a road safety culture in Italy in particular through a brief outline of the historical developments which led to its becoming a priority in our country too. An overview of the major legislation on the topic will be given before presenting the main institutional actors with responsibilities in road-safety related aspects. Not only those with responsibilities in infrastructural developments those charged



with repression but also those playing a fundamental role in data collection. Consistently with the object of this work a specific sub-chapter will be obviously devoted to the Municipal Police and their contribution to limit road accidents in urban areas.

**The fourth chapter** will focus on the emergence, in western societies, of the notion of performance as a target to be reached by the public sector to streamline efficiency. After introducing the circumstances in which the Italian public sector embraced this concept, thus far confined mainly to the private sector, a brief outline of the relevant legislation on the topic will be given. After describing the expected advantages deriving from this new approach to efficiency some of the inevitable related downfalls will be highlighted as well: in particular the risk of ‘just producing numbers’ as opposed to the real target of managing efficiency. This risk is potentially affecting all domains where some measurement is to be delivered but the chapter will describe how measurement of police activity, in particular, is liable to distortions if not properly monitored through appropriate indicators and systemic evaluations. This will serve as an introduction to the subsequent and fundamental topic of presenting alternative methodologies to assess performance and based on a systemic approach.

**The fifth chapter** analyses some physical and social peculiarities related to the city of Palermo that are believed to play a role in the persistence of those driving misconducts being the object of this thesis. In particular the phenomenon of speeding will be analysed against the geographical layout of the city as well as against other behavioural considerations that are also

assumed to be among those structural determining factors for traffic congestion in the city. For drunk-driving related misconducts a further analysis will be performed with a focus on some recent socio-economic developments which have led to an increase in alcohol consumption especially within certain age-categories. Both analysis should help identify those ambits of intervention where the action of the Municipal Police is likely to more successful. Finally an overview of the local Municipal Police corps, with particular emphasis on those organizational aspects to deal with driving offences.

**The sixth chapter** will present the case-study through the Dynamic Performance Management perspective. Next to describing the main variables impacting the performance of the Traffic Division, a further classification will enable to distribute them within the typical three-layered framework provided by this methodology and enabling to clearly identify the specific role played by each one of them. Subsequently the dynamic nature inherent to the relations of circularity characterizing some of the concerned variables will be described through the use of Causal loop Diagrams (CLD's) with a view to displaying those reinforcing and balancing mechanisms which need to be constantly monitored to keep the system in a certain equilibrium. Finally the simulation proper will be presented through a system Dynamic model allowing the assessment of a number of possible scenarios deriving from the implementation of alternative or combined policies to tackle speeding and drunk-driving. The fundamental idea of this chapter is to provide decision-makers, within the Municipal Police, with a valid learning-tool that can help through learning scenarios or, wherever possible through

real-data based simulations to effectively evaluate the most realistic policies to be applied to improve their performance.

## **CHAPTER TWO**

### **ROAD SAFETY A MULTIDISCIPLINARY APPROACH**

#### **2.1 Definition of road safety:**

Road safety is a notion that refers to the idea to guarantee users of any road system against potential dangers that could jeopardize their physical as well as their belongings' integrity. The practical implementation of road safety is pursued through a complex and often intertwined set of measures capable of furthering it from several perspectives: from infrastructural improvements to the road network, to organizational solutions to smooth traffic flows, to the necessary law enforcement, guaranteed by police forces, and to educational campaigns the shared goal of all these measures is the reduction of accidents. At international level the definition of road accident arises when serious physical consequences occur to people involved in a crash involving vehicles circulating on the national road network<sup>10</sup>. The traditional approaches to foster road safety focus on the following the priority fields:

1. transport policy;
2. infrastructure;
3. health organization;
4. driving education;

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<sup>10</sup> ISTAT, 'La sicurezza stradale in Sicilia, i numeri dell'incidentalità e gli interventi per la prevenzione,' STEALTH, 2014: 35

5. communication;

6. policing<sup>11</sup>;

As a result of the exponential proliferation of private transport throughout western societies, and recently also in developing countries, the need to enhance road safety has become paramount: all along statistics have shown how road transport has proven to be the most dangerous modality in terms of loss of lives or suffered injuries. This evidence has been confirmed by a number of outstanding studies: The WHO (World Health Organization), for example, indicates that road accidents represent the ninth cause of death among adults but the first among the youth in the age class between fifteen and nineteen.<sup>12</sup> A similar study by the same institution (Global Status Report on Road Safety, 2009) indicates that 1,2 million people perish as a result of road accidents and those who undergo physical damage range between 20 and 50 million. A rough estimation by the European Commission in 2001 indicated that in most OECD countries the financial burden faced by society as a direct or indirect result of accidents amounted to approximately 2% of the GDP.<sup>13</sup> This situation is even worse in developing countries where such an amount can sometimes exceed what these countries are obtaining in terms of financial aid. A fact that has pushed the World Bank, along with other international organizations, to consider road accidents as a priority to be

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<sup>11</sup> I.M. Newsome, *'Using system dynamics to model the impact of policing activity on performance'*, Palgrave Macmillan 2008: 170

<sup>12</sup> ISTAT, *'La sicurezza stradale in Sicilia- i numeri dell'incidentalità e gli interventi per la prevenzione'*, Stealth, 2014, pp. 11

<sup>13</sup> Commission of the European Communities, white paper *'European transport policy for 2010: time to decide'*, Brussels, 12/09/2001, COM (2001) 370; Part 3, "Placing users at the heart of transport policy"; I, "Unsafe roads"

tackled without hesitation.<sup>14</sup> Noteworthy, in this context, is the goal set by UN General Assembly, in 2001 and reconfirmed in 2011, to halve road accidents throughout the world within the decade. At European level a similar target has been pursued by the EU Commission which has supported it with a massive allocation of resources.<sup>15</sup> Although much has been done, in recent years, to foster road safety both in Europe and in Italy, partly as a result of the pressure from public opinion and interested groups, the phenomenon is still considered quite alarming by concerned authorities, especially due to the persistence of certain behaviours that are potentially liable to provoke such events. Despite the impressive decline in the number of accidents the goal was almost hit but not completely so that it was decided to reschedule it for the following decade 2011/2020. The combination of national and European initiatives has, in fact, produced encouraging results with the reduction in fatal events by 48% in the time period 2001-2011 which has encouraged European authorities to re-submit the target along with the following recommendations to member states:

1. investing on vehicles' safety devices;
2. reducing the overall speed;
3. reduce the number of drivers under the effect of alcohol;
4. developing and updating 'hot spot' maps identifying the recurring dangers in the road network with a view to planning appropriate corrective actions;

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<sup>14</sup> ISTAT, *'la sicurezza stradale in Sicilia- i numeri dell'incidentalità e gli interventi per la prevenzione'*, (Stealth 2014): 11

<sup>15</sup> ISTAT, *'La sicurezza stradale in Sicilia'* (Stealth 2014), 14

It is clear that to pursue such ambitious plans it will be necessary to allocate substantial resources to finance the necessary investments on both infrastructure, knowledge about the phenomenon and safety programs. Traditional approaches to the issue of road safety mainly focus on infrastructure and general regulations; nevertheless not all scholars agree on the direct correlation between traffic regulations and safety devices on the one hand and the decrease in fatalities on the other: mortality, for example, even when some technical aspects appear to be the same, varies extensively from country to country for reasons that are not always clear. From what a deeper analysis would , in fact, suggest next to technical elements a safe driving is also influenced by cultural motivations which, in the end, have a huge influence on behaviour. Smeeds, for example, suggests an hypothesis of group psychology and claims that fatalities are determined more by psychological factors than by material circumstances.<sup>16</sup> In other words this author's claim is that safety regulations do not play a substantial role in guaranteeing safety on roads. According to his theory people take advantage of improvements in automobiles or infrastructure to drive ever more recklessly in the interests of speed until deaths rise to a socially unacceptable level, at which point, safety becomes more important, and recklessness less tolerated.<sup>17</sup> Such differences are plausibly attributable to behavioural

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<sup>16</sup> R. J. Smeed (1949). 'Some statistical aspects of road safety research.' "Journal of the Royal Statistical Society," Series A (General), Vol. 112, No. 1) 112 (1): 1–34

<sup>17</sup> G.U. Adams, 'Smeed's law: some further thoughts', (Dept of Geography, University College London 2006)

adjustments in response to perceived increases in the threat of traffic.<sup>18</sup> But the validity of this theory is still a matter of debate. In his famous paper, Smeed had published his formula, for predicting road deaths, as an empirical rule where traffic fatalities were weighed against motor vehicle registrations and population (Smeed 1949). His paper is mostly cited emphasizing that the increase of vehicle ownership leads to a decrease in fatalities per vehicle due to the following driving forces:

- Increase in vehicle ownership rate goes together with an increase in accident exposure;
- Increase in vehicle ownership rate goes together with economic growth and technological development (better infrastructure, better equipped cars, better emergency services etc.);
- Social attitude against road safety changes (evaluation of accident costs, acceptance of restrictions etc.);

The combined impact of the three driving forces leads to three stages of development:

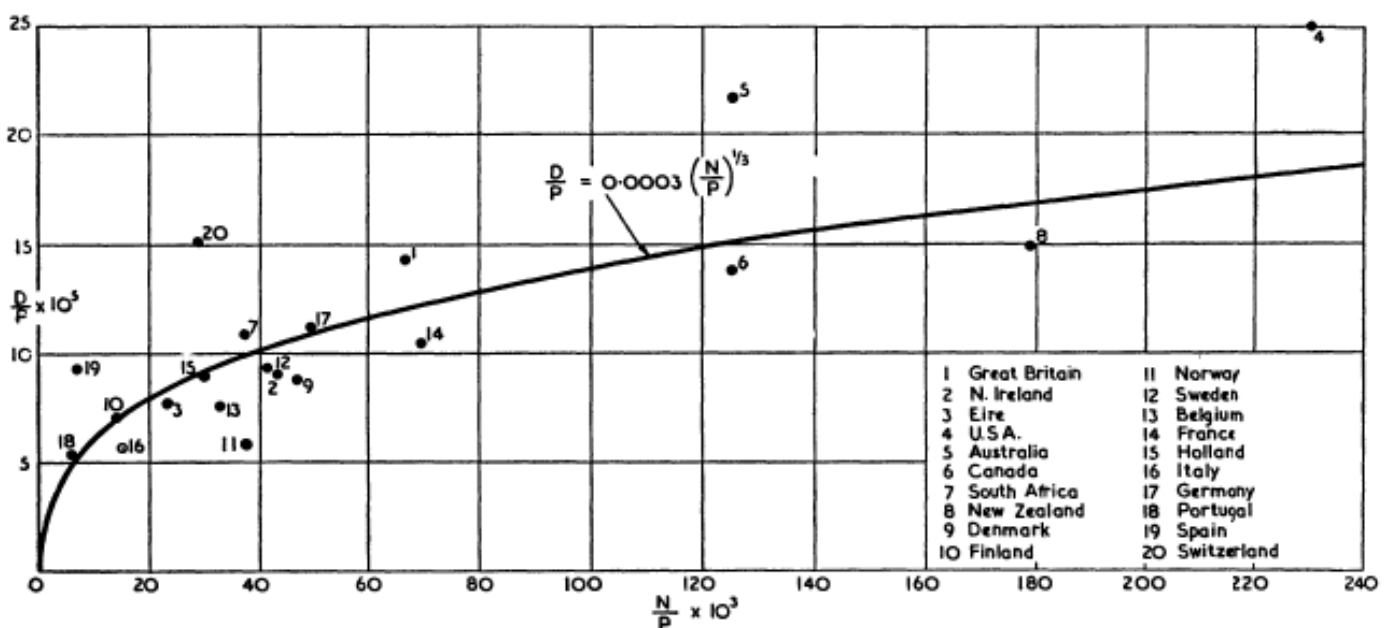
- Declining road safety situation: increasing fatality rate per population dominates due to growing traffic volume and exposure, the economy is weak, and there is no social attention to road safety;

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<sup>18</sup> Adams, J. G. U. *'Risk homeostasis and the purpose of safety regulation'* CEC workshop on Risky Decision-Making in Transport Operation. TNO Institute for Perceptions, ( Soesteberg, The Netherlands, November 1986)

- Turning point: the road safety situation is quite bad; however, the economic performance makes the change possible, if there is adequate social and political will;
- Long-lasting improvement;

however this conclusions lend themselves to criticism because fatalities are only assessed within to the sole variable ‘car-owners’ without considering more indicators. As an overall strategic indicator, in fact, the most widely used variable to describe road safety level of a country is the ratio fatalities per population<sup>19</sup>. From what a wider analysis would suggest, in fact, the increase of vehicle ownership leads to an increase in fatalities per population and in the total number of fatalities (figure 2)

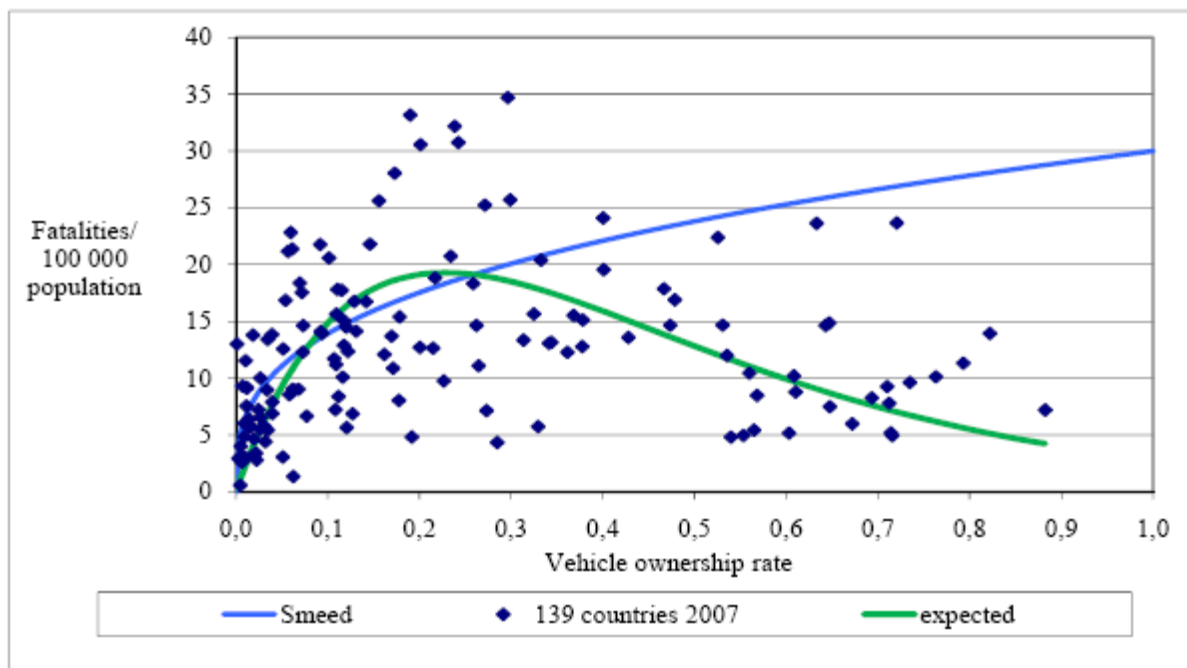


**Fig. 1.1:** Relation between number of fatalities per 100 000 population and number of registered vehicles per 1 000 population for 1938

<sup>19</sup> ‘mortality rate.’ available from ‘geometric design of roads.’ accessed October 28 from [https://en.wikipedia.org/wiki/Geometric\\_design\\_of\\_roads](https://en.wikipedia.org/wiki/Geometric_design_of_roads)



It was found that Smeed's formula is describing reasonably well the changes (increase) in fatalities up to the 0.2-0.3 vehicles/person ownership level, whereas, above this level, the formula is too pessimistic, the fatalities are fortunately tending to decrease in reality<sup>20</sup>. The formula used is appropriate to describe the phenomenon that with low motorization the number of fatalities is increasing. Once reaching a certain threshold, the society will devote and can afford more efforts to turn the previous trends in road safety. The turning point of the fitted curve is about 0.20-0.25 vehicles per person and 20 fatalities per 100 000 population (Figure 6).



**Fig. 1.2:** Relationship between vehicle ownership and fatality rate per population for 2007

On the opposite side Powles (Oxford Textbook of Public Health) notes that the Australian state of Victoria adopted a range of interventions which took it from being a poor performer, in terms of road safety, to one of the best.

<sup>20</sup> WHO, *Road Safety Speed*, WHO, 2004

Deaths fell, in absolute terms, from a peak of 1000 in 1970 to below 300 in 2009, despite strong growth in population and the number of vehicles. Critics observe that, contrary to Smeed's prediction, fatality rates per vehicle are now decreasing faster than the formula would suggest, and that, in many cases, fatality rates per person are also falling. They attribute this improvement to effective safety interventions<sup>21</sup>. However it is believed that Smeed's law still can still be useful to establish general trends since its assumptions still hold for a number of countries<sup>22</sup>

Apparently there are huge differences among countries which can probably be explained with respect to the considerable variations between countries' in terms of geographical features, economic and political background. An example of this stance is given by third world countries where most of the vehicles in use in 1980 were, in fact, manufactured after 1966 yet when driven in certain part of the world these modern vehicles incorporating 80 years of safety technology were achieving kill rates per vehicle higher than those achieved in Britain or the US in the early years of this century with model T Fords<sup>23</sup>.

Other authors correlate the number of fatalities to the gross domestic product: Kopits and Cropper have found that the income level at which traffic fatality risk (F/P) first declines is \$8600 (1985 international prices), regardless of how the time trends are specified.<sup>24</sup> This is the approximate

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<sup>21</sup> S. Oppe (1991). "The development of traffic and traffic safety in six developed countries". *Accident Analysis and Prevention* 23 (5): 401–412.

<sup>22</sup> John Adams, *Risk*. (London: UCL Press 1995)

<sup>23</sup> J. Adams, 'Smeed's law: some further thoughts' (Department of Geography, University of London 1987), 73

<sup>24</sup> Kopits, E., Cropper, M. (2005): 'Traffic fatalities and economic growth, *Accident Analysis and Prevention*, Vol. 37, Issue 1 January 2005, 169-178

income level attained by countries such as Belgium, the United Kingdom, and Austria in the early 1970s, South Korea in 1994, and New Zealand in 1968 (Kopits, Cropper, 2005).

## **2.2 Preventing road accidents: The focus on the infrastructure:**

A road accident is an event involving vehicles, people, places, time and meteorological circumstances and it is in turn influenced by a context where other variables like infrastructure, laws and psychological factors play a role. Out of the major modalities of transport road circulation displays the highest toll in terms of mortality. This has pushed national governments and supra-national institutions to urge the adoption of preventive measures to reduce the number of such occurrences. The EU Commission already in 2001 had, in this respect, identified a number of major guidelines to reduce accidents based on seven strategic targets:

- Improve vehicles' safety devices
- Improve the safety of the road infrastructure
- Encourage the use of intelligent technologies
- Improve educational programs
- Improve the quality of controls
- Reduce the number of injured from road accidents
- Improve the safety for motorcycles

Traditionally road safety has been furthered based on three major approaches, falling within the larger concept of 'active safety' and focusing

mainly on the quality of the infrastructure. Roughly they can be summarized as follows:

1. The first is quite traditional and tends to focus on critical points where the number of accidents occur more frequently (black spot analysis). The validity of this approach is based on empirical evidence (not always accurately tested) according to which interventions on the infrastructural network has an effect on the number of accidents. More likely this strategy is particularly useful when it's necessary to launch traffic calming measures like the introduction of roundabouts or to correct specific criticalities in the road.
  
2. The second approach is utilizes highway engineering to focus on the geometric design of a road and it is concerned with the correct positioning of the physical elements of the roadway according to standards and constraints.<sup>25</sup> Any geometric roadway design needs to take into consideration the three main parts of a road: alignment, profile, and cross-section.
  - i. The alignment is the route of the road, defined as a series of horizontal tangents and curves;

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<sup>25</sup> '*geometric design of roads.*' accessed October 28 ; available from [https://en.wikipedia.org/wiki/Geometric\\_design\\_of\\_roads](https://en.wikipedia.org/wiki/Geometric_design_of_roads)

- ii. The profile is the vertical aspect of the road, including crest and sag curves, and the straight grade lines connecting them;
- iii. The cross section shows the position and number of vehicle and bicycle lanes and sidewalks, along with their cross slope or banking. Cross sections also show drainage features, pavement structure and other items outside the category of geometric design;

The core idea is to meet motorists' expectations<sup>26</sup> with respect to the design and therefore particular attention is devoted to making it as rational as possible with particular attention on the following elements:

- i. Profile
- ii. Sag vertical curves
- iii. Crest vertical curves
- iv. Road drainage

To sum up, when planning and designing a road, apart from combining models and techniques to improve the quality of the infrastructure a golden rule is to make sure that some preliminary studies can be conducted with a view to ascertaining the homogeneity of the road. It has been proven that the more homogeneity the safer can be considered the

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<sup>26</sup> A definition of 'expectation' in a road context has been suggested by Alexander and Lumenfeld: the readiness of a motorist to respond promptly and effectively to an unforeseen situation

road.<sup>27</sup> A road can be considered homogenous when no particular circumstances will alter the motorists' expectations as to the regularity of its profile. Conversely, when a 'surprise element' is introduced, the risks of mistakes by the motorists rise.

3. The third approach is even more innovative than the two previous ones and focuses on prevention by reducing the risk factors including those not necessarily mentioned in specific traffic regulations. In particular three components are central to this approach: quality of the infrastructure, quality of the vehicle and quality of the driver.

In Italy the methodology to assess road safety has been designed by the CNR<sup>28</sup> (National Research Center) in 1998. The approach involves two stages:

1. first roads are analyzed in terms of the number of accidents occurring along them and, depending on the evidences, they are classified as:

✓ mildly dangerous;

✓ relatively dangerous;

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27 Polus A. C. Mattar- Habib, 'New consistency model for rural highways and its relationship to safety'. *"Journal of Transportational Engineering"* 130(3), 2000: 286–293

28. CNR, 'Criteri per la classificazione della rete delle strade esistenti ai sensi dell'art. 13, comma 4 e 5 del N.C. della strada', *Rapporto finale*, CNR, march 1998

- ✓ extremely dangerous;

In ‘extremely dangerous’ cases the analysis tries to discover existing defects and possible defects. A defect is intended as the difference between the observed and the prescribed values.

2. Secondly the analysis focuses more on specific criticalities that may emerge along the specific track.

The ‘National Plan for Road Safety,’ introduced in Italy in 2002, adopts, in this respect, a twofold approach based on short and long term planning:

- In the short term the requirement is to intervene on urgent criticalities through infrastructural and repressive action;
- In the long term the focus falls on organizational as well as infrastructural solutions;

At international level, other methodologies have been developed to objectively assess the performance of a road in terms of safety. Of particular interest are the three Lamm<sup>29</sup> criteria that focus on the reciprocal consistency between the following aspects:

1. technical features of a road;
2. the operational speed;

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29 R. Lamm, B. Psarianos, T. Mailander, ‘*Highway design and traffic safety*’, Engineering Handbook. McGraw-Hill, 1999

### 3. the driving fashion;

Enhancing road safety implies a number of interventions on both the two notions of 'active' and 'passive' safety: 'active safety' as a notion in particular goes well beyond a pure focus on infrastructure but it includes also the following additional requirements:

- Compulsory driving-training and driving licenses;
- Restrictions to car-use when under the effect of alcohol or other substances;
- Removal of fixed elements from roads;
- Replacement of crossroads with roundabouts;

Active safety measures need to be accompanied by 'passive safety' solutions that can be fundamental in minimizing damages to persons and belongings when an accident takes place. These can be summarized as follows so as to include the following items:

- Seat belts;
- Energy management features ;
- Head injury protections;
- Antilock brake systems (ABS);
- Airbags;
- Four-wheel drive;
- Car bodies;



As indicated by the Italian legislator such devices should, within reasonable limits, guarantee acceptable safety conditions when a vehicle is involved in an accident<sup>30</sup>. No infrastructural or technological solution could be effective though without knowledge. An important source to design the appropriate measures is represented by data and these are usually collected by statistics bureaus or agencies. In Italy this task is performed by the National Statistics Bureau (ISTAT). Data do represent a formidable source of knowledge to act effectively in the effort of reducing road accidents but it must be borne in mind that their potential to bear substantial results require also further analysis: when aggregated, in fact, data can be useful only when it comes to the criticalities of the infrastructure (usually identified through black spots) but to identify also factors playing a role in an accident some additional analysis are necessary so as to require further disaggregation. Out of the several techniques available to analyse disaggregated data two in particular are widely used:

- Collision diagrams
- Accident scenarios

In the first case over a three/five year time lapse specific data are collected with particular reference to the time and the date of the accident, the meteorological conditions and the age of the driver.

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<sup>30</sup> Italian Department of Transports, '*technical guidelines update for the design, homologation and use of road barriers*, ' Ministerial Decree 21 june 2004

In the second case, over the same time period, similar cases are clustered in an attempt to define a general archetype for each single kind of accident.

Both attempts aim at evidencing the factors leading to a specific road accidents but do not allow to investigate into possible correlations between traffic flows and frequency of an occurrence. In other words the variation in the frequency of accidents can depend on several factors and this uncertainty makes the analysis difficult and, sometimes, misleading. To make up for such limitations some other methodologies have been developed. Worth mentioning are the following:

- Safety Performance Functions
- Accident Prediction Models
- Crash Prediction Models

Complementary to the notion of homogeneity are the different approaches to measure it but based on different parameters:

- Approaches based on theoretical speed
- Approaches based on operational<sup>31</sup> speed
- Approaches based on a motorist's mental workload

Italy adopts the first approach<sup>32</sup> whereas in the US, Australia or Germany the second one is more relied on. In this respect an interesting contribution is

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31 Operational speed is the highest speed attainable by a motorist in good meteorological conditions and in standard traffic conditions without exceeding the theoretical speed calculated for the specific stretch under consideration.

given by the procedure IHSDM (Interactive Highway Safety Design Model) developed by the FHWA (Federal Highway Administration) in the US which evaluates safety on a standard dual-carriageway road through the use of six different modules:

- Policy Review Module;
- Crash Prediction Module;
- Design Consistency Module;
- Intersection Review Module
- Traffic Analysis Module;
- Driver/Vehicle;

Ultimately another important instrument to be used in the design phase or in the later assessment of a road is the 'Road Safety Audit' in which an independent panel of experts reports on potential risks of accidents of a given road and on its performance in terms of safety. The general target of such an instrument is to offer the best possible level of safety through the achievement of the following targets:

- Identify risks in order to eliminate them;
- Monitor the necessary follow-up on the prescribed measures suggested;
- Reduce the global costs of road infrastructure;
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To conclude this chapter it is useful to remark that in countries like the UK, Australia and New Zealand that have adopted a systematic approach to the analysis of roads' safety the number of fatalities has substantially decreased even though the number of circulating vehicles has increased. The described measures are believed to contribute substantially to fostering safety. Although no compulsory adoption has been required by norms it is likely that that will be the case in the near future: a recent Directive by the European Parliament, in fact, provides that within the next two years all roads belonging to the intra-European road network and also those financed with European funds will have to meet the following criteria:

- Display a regular statistics of the most dangerous stretches of a given road;
- That these evaluations are performed by panels of experts at regular intervals;
- That specific warnings are displayed on specific tracks that can jeopardize security;
- That the governing body of each road compulsorily reports on each single fatal accident;
- That, prior to the approval of any new project, an evaluation of its impact on safety is duly rendered;

### **2.2.1 Preventing road accidents. The focus on the psychological factor:**

A quick glance at the measures suggested in the previous chapter displays that most of the efforts to prevent road accidents are still focused on the traditional approaches on vehicles' safety devices and on roads. Yet

according to statistics 95,5% of the accidents is to be attributed to the human factor therefore it is felt that the psychological element needs to be addressed further to reduce the occurrence of certain events.<sup>33</sup> Driving is, in fact, a complex activity that has stimulated a variety of interesting studies in the related literature exploring processes, hierarchies and different phases of behaviour. Outstanding, among the different contributions, is the work by Keskinen<sup>34</sup> (1996) who identifies four conditions influencing driving:

- Driving skills
- Skills in dealing with unexpected situations
- Driving motivations (leisure, work)
- Personal attitudes (self-esteem, self-control)

Other conclusions, about factors influencing the driving behaviour, attribute the social context a major role in misleading drivers about other drivers' intentions. This biased perceptions can potentially trigger reactions consistent with the misunderstanding: *“that guy is not going to give me priority therefore I need to speed up to pass first.”* The individual's ability to comply with norms is another aspect influencing driving behaviour. This is influenced according to Dorfer (2004) by qualities like education, intelligence, social skills. These elements are not necessarily in a linear relationship with each other; in fact it may well happen that individuals with a high IQ may consider themselves to be exempted from respecting the set of

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33 NCHRP, Report 600. 'Human Factors Guidelines for Road Systems', Second Edition, TRB, 2012.

34 R. Denis, *Traffic & Transport Psychology: Proceedings of the ICTTP* – Talib Rothengatter & Huguenin, 2000

norms globally recognized. Social norms as well can influence driving behaviour. Excessive alcohol consumption, for example, can be induced by the social context where there may exist no social stigma for its consumption as it would, on the contrary, happen with drugs or related substances. Worse even, alcohol is not only perfectly legal but it is often even encouraged by society at large with the risk of inducing a person prone to drinking to minimizing the risks of associating alcohol and driving. Psychologic considerations about motorists' behaviour are part of a field of study usually referred to as 'traffic psychology.' In this discipline the analysis tries to highlight the relationship between the driver, the vehicle and the environment. The application of this discipline has been a consolidated practice in German speaking countries since the seventies all norms concerning traffic regulation need preliminarily to be scrutinized against the theoretical and practical framework of it. Traffic psychology's general implications go well beyond generic educational programs to embrace the most recurring features of human behaviour. In more specific terms the major contribution of 'traffic psychology' focuses on the main risk factors related to accidents and namely: alcohol abuse, drugs, fatigue, use of medicines but also the police control activity and the effectiveness of norms and regulations. The instruments to achieve this are: observation, description, recording of the behaviour, analysis of attitudes and motivations as well as the identification of differences among individuals facing similar situations. Driving requires more than just the ability to respond to external inputs, it's not, in fact, about purely individual skills either; driving, in fact, is unfortunately determined by some negative features capable of setting the stage leading to accidents. Conducts like aggressiveness, cynicism,

arrogance, in fact, are intrinsically rooted in human behaviour to such an extent that they are considered inevitable. According to Dorfer they appear to be the price to pay for human flexibility (Dorfer, 2004). As stated by Dorfer (2004) the possibility to really influence conducts to adhere with rules is necessarily depending on a real comprehension of motorists' inner behaviour.

## **Chapter three**

### **3.1 THE DEVELOPMENT OF A SAFETY CULTURE IN ITALY. FIGURES OF THE PHENOMENON:**

#### **Introduction**

Since the beginning of the sixties the need for widespread mobility has increased substantially in our country as a result of the economic boom and the resulting industrialization characterizing those years. The increasing demand for transportation was met through an increase in the production of vehicles for private use to a much larger extent than what had been allocated for public transport. As a result most of public transport companies were dismantled, almost all over the country, especially at local level. Cars were seen as symbols of freedom and personal self-realisation and that translated into an increase in production: from 1966 to 1990 the number of vehicles has risen impressively rising from 10.740.386 units in 1966 to 44.654.487 in 1999, of which over 36.000.000 units were cars. What fell behind, with respect to this huge figures, was an equivalent development of the road network which will determine a substantial gap between the available

infrastructure and vehicles using it. What strikes the eye is the disproportion between the degree of development of the two phenomena since cars have undergone a fourfold multiplication as opposed to the doubling of the road network. Such a distortion is considered one of the main causes<sup>35</sup> for road accidents and Italy is the European country scoring the lowest when it comes to statistics over mortality or number of injured. Nowadays an opposite trend seems to be developing with the reintroduction of large scale mobility projects to make up for traffic related problems like congestion, environmental damage and safety but of course the relatively long time requirements to complete such infrastructures will require parallel measures to tackle the problem in the meantime.

### **3.2 Road safety in Italy, the legislative framework**

The proliferation of private transport, as described in the preceding chapter, has led to increasing pressure from public opinion and international institutions to put road safety as one of Italy's hottest topic in the political agenda. At the beginning of the year 2000 it was estimated that victims of road accidents amounted to such alarming figures: 6410 fatal events and 301559 injured. In an attempt to make up for this situation a number of laws and initiatives were passed as from 1999. The most relevant were:

- 1999: design of the first national plan for road safety;
- 2003: introduction of a penalty point system for the driving licences;

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<sup>35</sup> ISTAT, *'la sicurezza stradale in Sicilia- i numeri dell'incidentalità e gli interventi per la prevenzione,'* Stealth, 2014,



- 2007: important modifications to the highway code;
- 2008: launching of an auditing system to evaluate road safety and the quality of inspections;

Through law 144/1999, and in the wake of the ‘European Action Program for Road Safety 2011/2020,’ a ‘national plan for road safety’ (*Piano Nazionale per la Sicurezza Stradale PNSS*) was adopted in our country as a global strategy to tackle the phenomenon of road accidents: the plan represents the first legislative initiative to foster road-safety in Italy. It is to be implemented through yearly programmes to be defined by the Ministry of Transport and to be approved by the CIPE. The third phase of the plan, activated in 2007, and still in force at present, sets out to reduce road accidents and proposes two major action lines to that effect aiming at:

- Tackle with no delay already identified criticalities;
- Implementing strategic actions aiming at improving the management and governing of road-safety;

Complementary to the national plan for road safety - whose practical implementation is to be defined by yearly projects, proposed by the Department of Transport - is the contribution of local territorial bodies, like the regions, that are required to lay out articulated programs to effectively profile the major criticalities requiring intervention in their territories. The measures introduced can be quickly sketched as follows:

i. The penalty point system.

Introduced, in Italy, by legislative decree 151/2003 it aims at penalizing traffic offenders while, at the same time, streamlining the legal process and so ease the Courts' burden. Germany introduced a demerit point system, in 1974, and a similar one was introduced in New York at about that time. Its practical implications imply that upon committing a driving infringement points are subtracted from the initial score each driver is entitled to; after a defined time period, if no additional infringements are committed, the penalty is cancelled; if the total of the penalty issued exceeds the initial score each driver is entitled revoking of the licence ensues and the offender is required to retake the whole exam for a new driving licence. In Italy the system provides for each holder of a driving licence to rely on an initial score of twenty points. In case of an infringements to the traffic code points' subtraction is calculated depending on the gravity of the infringements. Young drivers usual between 18-20, on the assumption that their driving conduct requires extra monitoring than an experienced driver, are penalized more severely and they are also subjected to more stringent rules. The speeding penalty system has been designed in such a way to be proportional to the gravity of the infraction and it can be summarized as follows:

- points for speeding over 10 kph and less than 40 kph;
- 6 points for speeding over 40 kph and less than 60 kph;
- 10 points for speeding over 60 kph or for cases of alcohol abuse;

- ii. The auditing system launched in 2008 and known as ‘road safety audit’ is a methodology applicable to existing roads as well as new projects. The system aims at identifying inherent potential dangers as well as a road’s performance in terms of safety. In addition to these two major goals a need has emerged to reduce global costs related to infrastructures as well as to make sure that specific action is taken once a criticality has been identified.

On the whole the combination of European, national and local measures has produced encouraging effects: from 2001 to 2011 there has been a reduction of road accidents by 48%. An indeed promising result although slightly lower than the target that had been set by international institutions for that specific decade.

### **3.3 The Municipal Police in Italy**

The Municipal Police in Italy are a local police corps with responsibilities to apply national and regional laws as well as municipal regulations exclusively within the territorial perimeter of the municipality. Article 18 of Presidential decree 616/77, on the decentralization of some state functions to the local authorities, states in fact:

*‘administrative functions related to urban and rural police and to be applied within the municipal boundaries are exercised by the Municipal Police with the exception of specific tasks having been attributed to other police forces’*

The Municipal Police is the direct expression of the municipal authority which can decide, conform legislative Decree 267/2000, whether to exercise police functions independently or in association with other municipalities. Historically the very origin of urban police in Italy can be traced back in roman times when in 29 a.d. Emperor Caesar Augustus introduced two distinct units (*cohortes*), one for furthering public order and peaceful cohabitation inside the city and another one responsible for protecting the walls. After their dismissal by emperor Constantine in 312 a.d. these local police units will follow different organizational patterns peculiar to the different areas concerned. It will only be towards the end of the 19<sup>th</sup> century that a structured development of ‘municipal guards,’ under the direct supervision of mayors, will spread across Italy as a result of the wide discretion that had been attributed to municipalities by the then shaping new Italian state. The status and the role of the Municipal Police are hinted at in article 117 of the Italian Constitution which admits the existence of local Police Corps charged with territorial responsibilities. A more detailed specification of their competences are laid out in Law 65/1986 which is, still to date, the main legislative framework specifying the functions, the competences and the limitations the Municipal Police is subjected to, especially in comparison to national police forces. The functions, in particular, can be broken conform the following listing:

- Traffic police function
- Judicial Police function
- Administrative police function;

- Urban security
- Local taxation function
- Rural police function
- Judicial functions;
- Health function

The following is a more detailed listing of the main functions pertaining to the Municipal Police:

**The Traffic department** further to rule 137 presidential Decree 393/59 this department monitors primarily the compliance of motorists with the highway code with a view to fostering road safety. This function is mainly pursued through a mix of repressive and preventive activities carried out directly by officers on duty and indirectly through video surveillance equipment stationed at fixed places or moved depending on the circumstances. Complementary tasks carried out by the Traffic department, with respect to safety, are the educational activities, focusing on prevention and involving students from different grades. The related programs tailored depending on the age of the participants;

**The Criminal function** is regulated by rule 55 of the Code of Criminal Procedure which describes the responsibilities of the criminal police. The department of Judicial Police, within the Municipal Police, is charged with criminal law enforcement, within the municipal boundaries, with the exclusion of those specific competences attributed by the law to other police

forces. To this effect officers are responsible for detecting crimes, for preventing them to be further developed, for securing evidences to be used against offenders. Such initiatives can be carried out autonomously or be delegated by Judicial authorities conform the prescriptions of rule 370 of the Code of Criminal Procedure;

**The Administrative function**, further to art 17 of Presidential Decree 616/77 on the police functions delegated to local authorities, involves a wide range of duties in all those activities normally requiring a permit or an authorization. Notably commercial activities, no parking areas, building activities, local taxation, enforcement of ordinances and regulations;

**The function of urban security** is a recently recognized specific competence of the Municipal Police pursuant Ministerial Decree 5 august 2008. The notion of urban security includes such aspects as: peaceful cohabitation, urban livability and social cohesion<sup>36</sup>. Such goals are furthered by the Municipal Police directly but often in coordination also with other police forces or through some *ad hoc* projects. Distinct to the notion of urban security is that of ‘public security’ which is laid out in article 117 of the Constitution and in article 1 of the TULPS (*Testo Unico delle Leggi di Pubblica Sicurezza*). Both sources identify the State Police as main authority in security related issues. However the Municipal Police may be required to assist as it has been increasingly the case in recent years especially within the

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<sup>36</sup> Regione Piemonte, ‘*Sicurezza urbana, le competenze degli Enti locali, quelle dello stato e la cooperazione tra enti*’, -manuale a dispense sulla sicurezza urbana, Regione Piemonte, 2012

framework of joint-police action falling under the acronym CIT (*Controllo Integrato del Territorio*);

Despite the wide range of responsibilities, as it appears from the above description, it is quite remarkable that a proper recognition of a full-police status has not been granted yet to the Municipal Police, despite the attempts to this effect made throughout the last thirty years.<sup>37</sup>

Law 65/86, further to specifying the functions exercised by the Municipal Police, describes more the organizational aspects concerning the recruitment and the training of the officers, the characteristics of the uniforms, the equipment which the officers are allowed to use for their activities. From an organizational perspective the Municipal Police can be organized as a ‘corps,’ or a ‘service,’ depending on the number of personnel in force. The main authorities exercising hierarchical control over the Municipal Police are the Mayor and the Commander of the corps: consistently with law 142/90, (over the separation between political powers and technical competencies) the Mayor exercises not a direct authority but is entitled to issue binding guidelines as to the smooth-running of the service or the organizational aspects of the corps while the commander is the technical authority who decides how the municipal targets must be met. Additional responsibilities attributed to the commander involve the monitoring of discipline requirements of the personnel under his/her command. Other institutional figures, to whom the Municipal Police may be expected to respond, are the representative of government authority at provincial level (*Prefetto*) and the

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<sup>37</sup> F. Carrer, ‘la Polizia di Stato a trent’anni dalla legge di riforma,’ Franco Angeli, 2014: 224-226

members of the Judiciary. These different authorities are, each, responsible for a specific segment of law enforcement and prevail over the Mayor's authority; therefore, when depending on either of the two, the Municipal Police are expected to consider them as their direct superiors. The *Prefetto*, for example, takes over whenever issues concerning public order or security are at stake. Judges, conversely, steer the activities of the Municipal Police whenever a judicial investigation is carried out. What strikes, with respect to the described functions and number of authorities involved is the potential level of complexity characterizing the work of a police corps that still too many tend to underestimate especially in comparison to other national enforcement agencies.

### **3.3.1 A missing reform for the Municipal Police: some practical implications**

Despite the huge set of responsibilities falling upon the Municipal Police a debate has been going on for years over the legal obstacles preventing the Municipal Police to express their full potential. Differently from what is allowed to other major national police bodies, in fact, the present legal framework excludes the Municipal Police from the same legal competencies enjoyed by the former. Similar limitations apply to the operational instruments to carry out routine activities. Ministerial Decree 145/87 clearly states these limitations: first of all some important legal competences to carry out certain activities like the right to conduct any personal inspections of suspects. In addition the geographical limitation of their competences, being confined to the municipal boundaries, does not allow effective action when,



for operational purposes, this perimeter needs to be crossed. Particularly striking is the limitation of their police status only when on-duty. In other words off-duty, municipal police officers, unlike their counterparts in other police forces, are equivalent to mere citizens. This can represent a formidable obstacle to enforcing the law if a particular situation arises under such circumstances. Further restrictions involve the technical equipment or the weaponry allowed to them: these are, in fact, often unsuited to the nature of the tasks the Municipal Police may be required to carry out. The described situation arises out of the fact that, so far, the Municipal Police has never been considered a full status police force; the issue is complicated, it touches upon such Constitutional aspects over the repartition of competences between the State and local authorities which cannot be bypassed unless Constitutional reform is decided upon. Rule 117 of the Italian Constitution, in fact, specifically attributes such notions as ‘public security’ and ‘public order’ only to national police authorities. This kind of limitation, which could be justified in the past, does not appear, nowadays, to be in line with the increasing demand for security coming from society. Many bills have been proposed to Parliament with a view to increasing the competences and the operational reach of the Municipal Police but so far, due to political rigidity and probably to some resistance opposed by other police forces, the proposed reform has never seen light. As a result the above mentioned legal and operational limitations persist with clear consequences in terms of support to emergencies that affect society at large. Recent developments have tried to make up for the missing reform by introducing elements of synergic cooperation between the major police forces and the Municipal Police. Clearly these are attempts to obtain more from the Municipal Police

without, conversely, formally enhancing their status. Through the notion of inter-institutional cooperation the Municipal Police may be required to perform some tasks traditionally belonging to the National Police but only in a framework of auxiliary support and still being deprived of the operational ‘weaponry’ enjoyed by their national counterparts. In particular Ministerial Decree 92/2008 attributes the Municipal Police competences in the ambit of urban security, making this police corps clearly accountable for a number of recent phenomena spreading concerns among the population, but, again, no fundamental modification to their status is granted. This last development has translated into an increase of the burden of tasks and responsibilities for the Municipal Police but with almost no provision with respect to staff increase. This, impossibility to hire additional staff, limits the Municipal Police’s performance and also causes a negative return in terms of perceived image by the community. Citizens are, in fact, puzzled; when approaching the ‘uniform,’ hoping to find some solutions to their problems, are often let down by the inability of the Municipal Police to promptly and effectively find a solution to their problems.<sup>38</sup>

### **3.4 The challenge of technology in furthering (road) safety**

The persistence of phenomena affecting road safety and urban security coupled with the chronic understaffing of those bodies responsible for furthering security and exercising controls have led to an increasing interest by authorities and public opinion in technological solutions to guarantee a more capillary control of territories. Video-surveillance systems in particular

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<sup>38</sup> Regione Piemonte, “*La Gestione dei conflitti*” – Corso dell’Assessorato alla Polizia Locale della Regione Piemonte – Torino, novembre 2001-gennaio 2002

have been widely advocated as an effective solution to optimize costs while guaranteeing a more capillary control of critical areas. Attitudes with respect to such instruments have been quite diverging: next to enthusiast supporters some critical voices have questioned the effective performance of these devices mainly on legal considerations: concerns, in particular, are addressed to the effective legal utilization of the captured images and to the threat that these solutions would pose to privacy. The debate has been going on for years in major western societies where opinions have often been influenced by the emergence of specific fears. In the US, after the terrorist attacks on 11 September, public opinion seemed more ready to accept strict limitations to their right to privacy in return for a stronger feeling of security that remote-surveillance was promising to deliver. In Britain the rise of huge waves of criminality, at the beginning of the nineties, had led authorities to launch a massive program to invest on video-surveillance solutions. In ten years the Home Office had invested approximately 300 million euro in a program aiming at reducing crime.<sup>39</sup> At the end of the ten-year period roughly 500 video surveillance systems had been installed throughout the country with a number of cameras exceeding forty thousand. Probably the success of such a program was possible due to the specific circumstances that country was experiencing at the time: citizens were supporting action against criminality even at the cost of accepting a potentially massive in their private sphere. A rough glance at statistics seemed to credit cameras for the constantly decreasing crime rate; further analysis will reveal though that criminality at the time was decreasing (and not only in England) purely as a result of a

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<sup>39</sup> C. Phillips, *'a review of CCTV evaluations: crime reduction effects and attitudes towards its use'* Crime Prevention Studies, n 10: 123-155

general trend and not as a consequence of cameras. This is a phenomenon commonly known as ‘regression of the mean’ where a linear association is made between a given input and its corresponding output but its apparent implications are etiologically and methodologically not valid although it lends itself to easy speculation and manipulation<sup>40</sup>. The only ambit where cameras seem to be really effective is the prevention of theft in parking lots or the monitoring of accesses in restricted traffic areas. Later years will show that despite the presence of cameras criminality tends to rise again with a growth rate of 8,4% per year and a turnover 74 billion dollars. Probably three questions would need to be answered before embarking in complicated debates as to the pro and the cons of such devices:

1. Do cameras actually prevent crime?
2. Are the inherent costs for setting up video-surveillance systems sustainable?
3. What can the role of authorities be in making the use of such devices fruitful?

To answer these questions it would be useful to start by mentioning the examples of the terrorist attacks to the underground in London in June 2005. Cameras were there and they were useful to reconstruct the different steps of the event but they could not prevent it. The same doubts arise with regard to the frequent manipulations of ATM machines: also in this case the presence of cameras does not seem sufficient to reduce the phenomenon. It would

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<sup>40</sup> C. Phillips, *‘a review of CCTV evaluations: crime reduction effects and attitudes towards its use’* Crime Prevention Studies, n 10: 123-155

seem that statements that cameras are an effective way to reduce crime is equivalent to saying that through pencils analphabetism can be tackled. In England five criticalities were identified with respect to the use of cameras:

1. subjects could not be clearly identified;
2. images are not clear and details could not be fixed;
3. light is often not sufficient to make the image clear;
4. the presence of obstacles (leaves) made it impossible to identify the subject clearly;
5. Recording supports are often so much reutilized that the quality of the images is poor;

So, probably, the answer is that cameras to be effective need to be positioned depending on the environmental circumstances and to be operated by personnel having the necessary experience to use them effectively. The devices need to be serviced regularly, staff must be trained to use them effectively and protocols need to be established to give clear instructions to the operator when a crime is detected. Only in this way cameras are believed to be an effective instruments of prevention. An impersonal use of such devices, in fact, would probably produce some result in the very short period but once offenders learn how to spot them beforehand their preventive and reassuring effect would be lost. The goal is not to collect photos but to operate such devices to foster a change in behavior.<sup>41</sup> In conclusion cameras do offer authorities the undeniable advantage of delivering an immediate

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<sup>41</sup> Regione Piemonte 'L'occhio (ed il) vigile' - Atti del convegno – Torino 2005

solution to a problem but questions arise in a longer run, namely when the effects of such instruments are to be evaluated.<sup>42</sup> Apart from the technical criticalities cameras are also to be evaluated from a perspective of social sustainability: the question is if their use can be made compatible with the equally fundamental right to privacy. From a juridical point of view the Italian authority for the protection of privacy and personal information clearly identified four milestones in the use of images to guide authorities in a correct utilization of video-surveillance systems:

1. Use of images allowed only for legal purposes;
2. Use of images allowed only for the strictly necessary goals;
3. Use of images must be inspired to the principle of proportionality;
4. Use of images allowed for goals considered by the law;

These principles need to be always applied within these specific guidelines when images are captured since otherwise the Italian legal requirements would not allow their use in Court's proceedings.

## **Chapter four**

# **THE EMERGENCE OF PERFORMANCE REQUIREMENTS IN THE PUBLIC SECTOR: FROM MEASUREMENT TO MANAGEMENT**

## **4.1 Introduction**

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<sup>42</sup> S. Cannepele *'impatto e sostenibilità della videosorveglianza: il ruolo dell'ente locale tra domanda e offerta'* – Atti del Convegno – Torino 2005

The eighties and the nineties have witnessed a period of reform in the public sector dictated by the need to optimize resources and make the action of the public administration more efficient. From a traditional bureaucratic approach, where compliance with norms and regulations was the primary obligation, this new course has implied a mental shift towards a managerial perspective based on performance. The adoption of a result-oriented culture, inspired by the private sector, and expected to be absorbed by public agencies too, has forced a thorough reorganization of long-standing mental models which, despite some progresses is still in its development stage. Results, efficiency, quality of service and effectiveness are the fundamental targets to pursue through such keywords as ‘service quality’ and ‘customer satisfaction’ which have, ultimately, entered the regular jargon of public bodies. The source of inspiration for this new trend can be associated to the emergence of the New Public Management (NPM) philosophy; this ideological movement, first appeared in Anglo-Saxon countries, lays the emphasis on applying management principles derived from the private sector to public institutions. A core guideline of this philosophy is the principle of accountability holding administrators directly and personally responsible for the results delivered. At first the promised efficiency, that this new approach was expected to foster, was received by a widespread enthusiasm by citizens and major stakeholders: for the first time, in fact, the Public Administration was ceasing to be a closed, auto-referential body and managers would, at last, be held directly responsible for the efficiency of their action. However promising this new course may sound, some drawbacks could stain its reputation: the inherent pressure for results, in fact, coupled with the accountability principle could open the way to possible systemic distortions

dictated by the need to produce ‘numbers:’ the so called ‘tragedy of the commons,’ (Hardin (1968), in fact, displays very well how the reward system associated to the deliverance of results, could push individuals to act in their own interest and on the maximization of their own individual targets to the detriment of global goals. In extreme, yet not unlikely, cases it could even lead to data misuse, as widely described by literature. The whole question seems to be turning around the notion of performance and the way it has to be intended and measured: efficiency, in fact, should not and cannot be limited to an arithmetical sum of single maximized outputs. Rather it should, preferably, be the outcome of concerted strategies capable of looking at the full picture, even to the partial detriment of some individual results. As clarified by system thinkers to reach global efficiency problems should not be dealt with not as isolated or random events but rather as sets of antecedent conditions that can be predicted and controlled provided an holistic approach is maintained (Miller 2007). Unfortunately traditional P&C systems do not appear particularly suited to guarantee such a comprehensive approach since they usually focus on sectoral parameters, mainly of financial nature, that do not encourage that wider approach suggested by system thinkers. The implicit risk of too narrow a focus, when assessing performance, would open the way to what in related literature has been described as an ‘inversion of means with ends’<sup>43</sup> implying a misperception that might cause administrators to mistake intermediate results for final goals with the obvious risk of missing the global mission that public action should guarantee. Complex

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<sup>43</sup> C. Bianchi, D.W. Williams, ‘*Applying System Dynamics Modeling to Foster a Cause-and-Effect Perspective in Dealing with Behavioral Distortions Associated to City’s Performance Measurement Programs*’ Paper submitted at the 9th Transatlantic Dialogue, Baltimore, 12;15 June,&2013



environments, in fact, require administrators the ability to identify factors affecting results, to evaluate outcomes, to detect those inertial signals likely to impact resources, to be aware of possible delays and non-linear relationships among variables. A limited formal understanding of the connection between performance variables, in fact, would open the way to a temptation to make over-simple direct linkage between cause and effect in performance management and target setting. With regard to the exposed risks this chapter will consequently focus on the limitations of traditional P&C mechanisms and describe the advantages of integrating them with a dynamic methodology capable of detecting all those factors that arise in a dynamic environment and that would not be captured by a traditional performance tool. In particular, special attention will be devoted to an analysis of DPM (Dynamic Performance Management), combining the criteria of a traditional tool with a dynamic perspective, as a way to offer decision makers an effective way to monitor performance in complex environments.

## **4.2 The rise of ‘New Public Management’ (NPM)**

New Public Management (NPM) is a philosophy that is intended to apply ideas and strategies, typical of the private sector, into the management of public services (Haynes 2003). According to Shamsul Haque, “one of the most influential factors leading to the emergence of NPM, in advanced capitalistic nations, has been, since the late 1970s, the historical shift of State ideology towards a neo-liberal framework which rejects the Welfare State,

questions government capacity, blames public bureaucracy, believes in private sector superiority and emphasizes market competition in service delivery.<sup>44</sup>” The popular acceptance of various NPM reform initiative, derives in good part from the unchallenged rhetoric<sup>45</sup> according to which “*greater accountability will lead to improved performance.*” Some even went further to defining NPM as a new paradigm (1976 Kuhn). Following the influence of Drucker, the whole idea about accountability is centered on results. Otley considers this principle “as the cornerstone of performance management systems. During the last two decades many definitions of New Public Management have been suggested by various authors among which that considering it as “an administrative revolution or post-bureaucratic paradigm.<sup>46</sup>” Its actual relevance is emphasized by Stiglitz, Sen and Fitoussi in 2009: “*Our societies have become more performance-oriented. We expect results, whether from our managers, our workers, or our politicians. Individual rewards are typically based on performance, and incentive systems have to be based on metrics. What we measure affect what we do. And what we are individually or collectively aiming at affects what we measure. There is an intricate relationship between objectives, measures and actions.*” One of the main consequences of the general acceptance of New Public Management has been the emphasis placed on performance measurement. Most of the reforms, that in recent years have interested the public sector in different countries, display similar conceptual schemes

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<sup>44</sup> M. Shamsul Haque, (1995) *New Public Management: Origins, Dimensions and critical implications*, in *Public Administration and Public Policy*, vol. 1, pp. 209 – 229.

<sup>45</sup> Shamsul Haque M., (1995) *New Public Management: Origins, Dimensions and critical implications*, in *Public Administration and Public Policy*, vol. 1, pp. 209 – 229.

<sup>46</sup> Shamsul Haque M., (1995) *New Public Management: Origins, Dimensions and critical implications*, in *Public Administration and Public Policy*, vol. 1, pp. 209 – 229.

typical of NPM. The theoretical background behind NPM is partly related to the Public-Choice-Theory, i.e. neoclassical economics applied to the public sector, as well as to the Principal-Agent-Theory seeking to find a new institutional economic approach to make up for the failures of the State. Chris Wood, one of the main scholars who has greatly contributed to the development of this NPM, describes the essential elements characterizing it:<sup>47</sup>

1. greater responsibility of decision makers in the management of public resources;
2. appropriate selection of performance indicators to clearly define the objectives that have to be pursued effectively and efficiently;
3. decentralization of production to replace the complex state machinery with smaller and more flexible peripheral units;
4. introduction of competitive mechanisms aimed at reducing costs and increasing the levels of service quality;
5. simplification of administrative processes and greater emphasis on the concept of performance expressed in terms of both outcome and output;

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<sup>47</sup> Hood C. 1991, 'A Public Management for all seasons?' *Public Administration Review*, Vol. 68: 44-45

6. Through the adoption of this approach it is believed to embark public action in a new approach capable of allowing efficiency through a set of challenges;
7. greater transparency and openness in a world threatened by the powerful forces of hierarchy and bureaucratization (the promise of democracy) (O'Donnell, 1998; Schedler, Diamond, & Plattner, 1999);
8. access to impartial arenas where abuses of authority can be challenged and judged (the promise of justice) (Ambos, 2000; Borneman, 1997; Elster, 2004);
9. improvements in the quality of government services (the promise of performance);

What appears from the above points is that among the key-features of NPM such recurring principles can be traced as 'economic sustainability', 'effectiveness,' 'efficiency' 'decentralization,' 'subsidiarity' 'separation of politics from administration' accountability and 'performance measurement.' According to Poister, "*performance measurement is intended to produce objective, relevant information on programs in general or organizational performance, that can be used to strengthen the role of management and help decision-makers achieve better results through an improvement of their*

*overall performance.*<sup>48</sup>” Out of the above mentioned specifications of the principle of accountability, in particular, is the one having undergone a thorough change: Back in history such concept would only be limited to the responsibility of elected officials for the overall results in their constituencies, to be later extended to civil servants, stripping them of their cover, for the first time, and holding them more directly responsible for the performance of their unit.<sup>49</sup> In the period of ‘Taylorism’ the same principle would come down to the accountability of the ‘foreman,’ for the output of the unit under his supervision; more recently it would evolve to the obligation of delivering regular reports.<sup>50</sup>” The stream of thought aiming at improving the efficiency of public bodies next to NPM has also produced that other philosophy known as ‘Public Governance.’ The core principles of this alternative theory focus on the ability of public agencies to constantly develop new institutional arrangements with a view to fostering cooperation to be seen as the main instrument to get a wider acceptance of public policies. This would require a shift in perspective, moving from single-agency performance to more global approaches, where outcomes are to be evaluated with respect to the whole socio-economic system. Public

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<sup>48</sup> Poister T.H., J. Bass, *‘Measuring Performance in Public and Non Profit Organizations’*, , San Francisco, 2003: 4; about the concept of organizational control check: Flamholtz E. G., Das T. K., (1985), *‘Toward an Integrative Framework of Organizational Control, in Accounting, Organizations and Society’*, Vol. 10, No 1, pp. 35-50; Flamholtz E., (1996), *‘Effective Organizational Control: A Framework, Applications and Implications’*, in *European Management Journal*, Vol. 14, No 6, pp. 596-611.

<sup>49</sup> P. Barberis, *‘The New Public Management And A New Accountability’*, *Public Administration* Volume 76, Issue 3, 1998: 451–470

<sup>50</sup> Further to the ‘Tetlock alternative’ a previous model based on paper and relationships has to give way to an accountability of the individual based on expectations

Governance is not to be seen as antithetic to NPM though but, rather, it represent its natural evolution.

### **4.3 The process of privatization in the Italian Public Sector**

In Italy the process of ‘privatization of the public sector’ has seen the light in the beginning of the nineties: the recent challenges posed by globalization to national systems could not allow any longer a Public Administration, seen by many as an auto referential body, considered too distant from the citizens and often too focused on bureaucratic procedures than on being an instrument to enhance the competitiveness of the private sector. With the coming into force of law 142/90 and subsequent law 241/90 the way was paved to get the Public Administration on a total new track where such notions as ‘effectiveness,’ ‘transparency’ ‘financial soundness,’ ‘adequacy’ and ‘simplification’ would become the inspiring guidelines of a renewed public action. A fundamental instrument introduced by these legislative reforms, and intended to secure the new envisaged public structure, was ‘management control;’ through management control public managers were expected to rely on a new tool to plan their targets more productively, to define their strategies more accurately and to allocate resources efficiently. Management control has not only become a legal requirement but also an instrument to optimize scarce resources.

The path of reform to pursue efficiency in the Public sector continued throughout the following years and culminated with Legislative Decree 150/2009 which introduced some additional principles such as ‘performance

measurement’, ‘goal-orientation’ and ‘accountability.’ In particular, performance measurement and managerial accountability will be seen as the main organizational tools to foster efficiency. As stated by Borgonovi, *“Performance measurement is an essential aspect of performance management.”*<sup>51</sup> It comes down to the capability of a public administration to respond to the needs of society and of its internal workers. Quoting Bianchi: *“Improving performance and fostering accountability in the public sector requires, among other, an understanding of the impact of back office units on delivered services.”*<sup>52</sup> Further to Miller’s (2007) wording:

*“Everyone talks about performance but usually with multiple meanings. It is measured in many ways such as: rankings, scores, data, beliefs and perception. It looks, in turn, objective and subjective, dictated by numbers on the one hand and feelings on the other. Senior administrators think about it in terms of growth and academic quality. To outsiders in government issues or business practices, it is about outcomes, accountability, completion, cost benefits and more”.*

Despite the promised expectations that this new course has triggered some further challenges still lay ahead for a full implementation of it: in particular a solid shift in mentality is still required enabling public officials to look at these reforms not only as a pure legal obligation but as a daily discipline to be applied to their daily activities.

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<sup>51</sup> Borgonovi E., Fattore G., Longo F., (2009), *Management delle Istituzioni Pubbliche*, Egea, Milano; Borgonovi E., (2005), *Principi e Sistemi Aziendali per le Amministrazioni Pubbliche*, V edizione, Egea, Milano

<sup>52</sup> Bianchi C., *Sistemi di Programmazione e Controllo per l’Azienda “Regione”*, Giuffr , Milano.

There exist numerous factors though that slow down this envisaged course: According to many authors the current use of performance measurement is still surprisingly limited (Behn, 2002, 2003; de Lancer Julnes, 2008; de Lancer Julnes & Holtzer, 2001). At local level, in particular, authorities do not have a long-standing tradition of detailed target setting. Elected officials, in fact, prefer to avoid committing themselves to complex goals since failure to reach them could be detrimental to their chances of reelection. Political hierarchies, in fact, focus more on the promises made to constituents without worrying too much for the need to calibrate resources to the strategic goals. Managers, on the contrary, need clear targets on which to base their subsequent actions. This mismatch can tend to encourage a sectoral and departmental view of public action and induce the Administration to pursue unrealistic targets. As outlined by Niven (2007) targets identified by local authorities are often a generic listing of good intentions rather than clear, attainable and measurable goals. Internal administrative processes are often poorly structured and unclear as to the mission to pursue and to the steps through which to accomplish it. Not surprisingly electoral programs focus more on evoking vague scenarios but they rarely contain clear and measurable targets for the constituents to scrutinize. What seems to be missing is a target-oriented approach, a clear rationalization of decisional processes, a detailed design of a proper set of indicators to measure performance. Even when some measurement system has been implemented indicators are, in fact, far too often, focused on pure quantitative outputs. This has often to do with a traditional view of performance, focused on the need to pursue a financial equilibrium through a financial balance between expenditures and revenues collection. Notoriously this can be a limitation



since the evaluation of performance, in the public domain, requires a focus on different perspectives too than just the financial one (Chenhall & Langfield-Smith, 2007) . The performance of lucrative entities is evaluated in terms of profits, sales, market share, productivity, debt ratio and stock prices. But in the public sphere the evaluation of performance is more difficult. The purpose of a non-profit institute is, in fact, directed at improving the circumstances of individuals, organizations, communities, and society as a whole (Epstein and McFarlan, 2011) and this requires new approaches to performance screening that conventional P&C systems cannot guarantee. In addition to their excessive focus on financial parameters traditional P&C system are also unsuited to deal with the dynamic complexities public management has to deal with. The term “dynamic”, is here used to identify a method to support decision-makers in an organization to better understand and learn about cause-and-effect relationships between relevant factors affecting organizational outputs and outcomes over time. Such factors as intangibles, time-delays, linkages between short-and long-term<sup>53</sup> are the characterizing attributes of a dynamic view of performance management.

Few public agencies, unfortunately rely on such comprehensive measurement systems but it is clear that to reach global achievements new methodologies and new metrics will have to be adopted. The importance of proper measurement systems was also confirmed by recommendation 89/2010, “*guidelines for the measurement and evaluation of performance,*” through which the ‘National Consultative Body for Performance Control and

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<sup>53</sup> R.S. Kaplan, ‘*the conceptual foundation of the balanced Scorecard*’, Working Paper, Harvard Business School, 2010

Transparency in the Public Sector' (*Commissione per la Valutazione, la Trasparenza e l'Integrità delle Amministrazioni Pubbliche*), stressed the need to design systems capable of going beyond pure financial analysis. The conspicuous number of stakeholders and decision-makers is, in itself, an example of a wide arena that would require *ad hoc* instruments to coordinate efforts and monitor global performance. In the public sphere, in fact, outcomes do not fall , in most of the cases, under the specific authority of single agencies but rather the contrary.

#### **4.4 Performance Management**

As clarified by Cosenz (2011)<sup>54</sup> a proper methodology for analyzing complex environments should be able to combine the short and long term perspective as well as reveal those counter-intuitive relations and time delays which, especially in the Public sector, are likely to occur as a result of the slower decisional process generated by the legal requirements that bind public decision-making. Performance management can be an ideal solution to that effect. Several are the performance management systems available that can be used to foster efficiency: from critical success factors, to key performance indicators, to the Balanced scorecard each one of them can serve some specific purposes. Through PM systems monitoring is not limited to just final results but it encompasses also the means used for their achievement (Fitzgerald 191). According to van der Waal among the main advantages of PM systems the following are worth-mentioning:

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54 F. Cosenz, *'Sistemi di governo e di valutazione della performance per l'azienda <<Università>>*, Giuffrè, 2011

1. Greater accountability of decision-makers
2. Greater coordination between different organizational units
3. Greater focus on target achievement
4. Greater involvement of staff in managerial processes and achievement of results
5. Greater motivation

On the other hand some inconveniences posed by this methodology can be summarized as follows:

1. Excessive focus on financial and economic parameters
2. Limited selectivity in the choice of indicators
3. Uneasiness with dynamic complexities characterized by non-linearities and time-delays

To face such kind of limitations, the Balanced Scorecard (BSC) methodology developed by Robert Kaplan and David Norton in the early 1990s, has been used as an approach to frame an organization's performance, organizational assessment and operational alignment.<sup>55</sup> The Balanced Scorecard is based on the following main concepts:

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<sup>55</sup> Weinstein L., Bukovinsky D. 'Use of the Balanced Scorecard and Performance Metrics to Achieve Operational and Strategic Alignment in Arts and Culture Not for Profits', in International Journal of Arts Management, vol. 11, No. 2 2009, p. 42,; R. Kaplan, D. Norton, 'The Balanced Scorecard-Measures that Drive Performance', in Harvard Business Review, 1992, pp. 71 – 79; R. Kaplan, D. Norton, 'The Balanced Scorecard: Translating Strategy into Action', Harvard Business School Press, Boston, 1996

1. Organizational performance cannot be managed by only focusing on end – results, rather it is important to understand how these end-results are generated and those factors affecting them;

2. Performance cannot be measured solely in financial terms. As a matter of fact, a “customer”, a “ process” and “learning and growth” perspectives are also essential

Nevertheless, according to Bianchi,<sup>56</sup> even the Balanced scorecard presents some limitations. Notably, “it does not support an understanding of how end-results can be affected by performance drivers, how performance drivers can, in turn, be affected by the use of policy levers aimed at influencing strategic resources accumulation and depletion processes, and how the flows of strategic assets are affected by end-results<sup>57</sup>” Following paragraphs will consequently set out to outline a possible alternative methodology allowing the integration of traditional performance measurement systems with a dynamic analysis. Dynamic Performance Management will be therefore presented as a tool that combines a dynamic approach as offered by System Dynamics and the measurement metrics of Performance Management.

#### **4.5 The challenge in measuring performance**

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<sup>56</sup> C. Bianchi, G. Montemaggiore, *‘Enhancing strategy design and planning in public utilities through “dynamic” balanced scorecards: insights from a project in a city water company’*. System Dynamics Review, 2008, Vol. 24 (2): 175–213.

<sup>57</sup> C. Bianchi , W. C. Rivenbark, *‘Using System Dynamics to Enhance Performance Management in Local Government: An application to Residential Refuse Collection’*, Paper presented at the 2012 APPAM Fall Research Conference, November 8-10, Baltimore (USA), 2012: 9

“Performance measurement is becoming the hottest topic in government today<sup>58</sup>” So was writing, in 1996, Terrell Blodgett of the University of Texas and Gerald Newfarmer of Management Partners, Inc., in this way reflecting a general trend that, since recently, has been increasingly involving public agencies. Every organization faces the common challenge of continuously improving its performance. But if this has been a long-standing practice in private organizations the same cannot be said about the public sphere where this phenomenon is relatively new. Given the specificity of their tasks and duties the most controversial question for public bodies is how and what to measure though: Quoting R. Behn in fact “*different purposes require different measures*” and different organizations rely on different measurement systems<sup>59</sup> since their respective goals may be diverging. Moreover, different people have different purposes: legislators’ priorities do not necessarily coincide with those of journalists,’ citizens’ expectations differ from those of administrators.’ This means that there is not one and only one ‘magic solution’ for all purposes:<sup>60</sup> For some enterprises the focus will probably be centered on profit’s maximization, making any sort of measuring in principle easier, whereas public actors will, more likely, be concerned by their ability to deliver a service. One could wonder why measuring performance has become such a ‘hot’ topic nowadays. Or, similarly, what do people expect to achieve with those measures? Probably the answer to these questions lies in the widely shared innuendo that

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58 Blodgett, Terrell, and Gerald Newfarmer, ‘*Performance Measurement: (Arguably) The Hottest Topic in Government Today*,’ Public Management, January, 6, 1996

59 R. Behn, ‘*Why measure performance? Different purposes require different measures*,’ Public Administration Review, September/October 2003, Vol. 63, No. 5

60 R. Behn, ‘*Why measure performance? Different purposes require different measures*,’ Public Administration Review, September/October 2003, Vol. 63, No. 5

measuring performance is good. Business firms have always been measuring their performance and their level of efficiency has always been perceived as much better than the public sector's. Unfortunately, the kinds of financial ratios mainly adopted within private corporations are not particularly revealing when resorted to describe the complexities of the public sphere where, next to financial soundness, a very important element of scrutinized by the community is about the level of service rendered. Performance in the public field, in fact, touches upon several factors that are, not necessarily, of economic nature. So questions arises as to:

- the specific kind of performance that public agencies should then measure;
- the way they should measure it;
- the purposes that these measurements should serve;

Municipalities, notes Mary Kopczynski of the Urban Institute and Michael Lombardo of the International City/County management Association (1999, 133), can use comparative performance data in five ways:

- to recognize good performance and to identify areas for improvement;
- to use benchmarks of higher-performing jurisdictions as improvement targets by jurisdictions that fall short of the top marks;
- to compare performance among a subset of jurisdictions believed to be similar in some way (for example, in size, service delivery practice, geography, etc);

- to inform stakeholders outside of the local government sector (such as citizens or business groups);
- to solicit joint cooperation in improving future outcomes in respective communities”

Wholey and the Urban Institute’s Harry Hatry note that “performance monitoring systems are beginning to be used in budget formulation and resource allocation, employee motivation, performance contracting, improving government services and improving communications between citizens and government”(1992, 604), as well as for “external accountability purposes”(609). From these and other similar comments it would appear that to properly screen the performance of any given public institution it is necessary to build calibrated measurement systems that can provide appropriate metrics on the multifaceted nature of their action and indicate whether or not strategic objectives are being reached, both in the internally and externally. It should be recognized that public services are complex human activity systems that are not likely to be managed with too rigid methods. Measuring performance, in fact, is not an end in itself; the end is to know what to do with that performance information and this requires a systems capable of defining appropriate indicators displaying how effectively the organization is pursuing its goals both in terms of the results achieved and the efficiency of internal processes. When decisions are to be taken on performance improvements it is necessary to have a clear preliminary idea about the mission of the agency; and of its weaknesses in performance too. We have seen, in the preceding paragraph, how far, in Italy, public administrations still are from this sort of awareness; this is

clearly a weakness that will have to be corrected if a far-reaching level of performance is to be reached. A correct definition of objectives, activities and results appears a fundamental preliminary step to define a satisfactory planning and control system based on strategic learning. This is particularly true when resources are scarce since the very limitation of what can be deployed to the arena requires a preliminary identification of realistic targets. Defining objectives goes beyond a pure identification of a set of activities to be carried out; the objectives are not to be confused with the activities themselves, rather they are the results of such them. Therefore the preliminary step to be carried out is to identify the tangible resources actually available and to assess the way they can be productively deployed to perform those activities. Be that staff, technological equipment or intangible resources such as image, quality of services and customer satisfaction the important thing is to start from the available resources and then inquiry into the objectives that can realistically be pursued. This would provide a clear ambit liable to measurement. Ideally a good performance management system, apart from focusing on the above mentioned causal links should also avoid focusing on single aspects/units. On the contrary it should provide information both on the organization's internal processes and external activities since a final objective is always depending on the combination of the two. According to Bianchi, in fact, combining an "external" view (which is primarily outcome-oriented) with an "internal" one (which is primarily output-oriented) is a pre-requisite to assess performance effectively.<sup>61</sup> In

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<sup>61</sup> C. Bianchi, *Improving Performance and Fostering Accountability in the Public Sector through System Dynamics Modelling: From an 'External' to an 'Internal' Perspective*, John Wiley & Sons, Ltd, 2010



other words such an approach should, on the one hand, provide administrators with full information, on which they can base their decisions, the action of public institutions. Failure to do that might lead to a misrepresentation of reality and generate what has been labeled as a ‘performance paradox’ to indicate a phenomenon where too narrow performance indicators lead to the misperception between outputs and outcomes.<sup>62</sup> The perception of such mismatches is fundamental to avoid a ritual and superficial adoption of budgeting and partial performance indicators, leading to an ‘illusion of control’ and opportunistic behavior.<sup>63</sup> Cognitive limitations, in fact, coupled with conflicting interests, missing objectives and shifting ideas are all aspects that cannot be dealt with by too narrow measurement systems. We notice that similar concepts are often stressed in relevant literature (Hopwood,<sup>64</sup> Hirst,<sup>65</sup> Vakkuri and Meklin<sup>66</sup>) The common thread in the different works available emphasizes the underlying idea of a need to go beyond the limitations arising from ‘bounded rationality:’ a concept introduced, by Simon and March in the early fifties<sup>67</sup> and proving that decision makers are likely to miss a systemic

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<sup>62</sup> S. Van Thiel, F. L. Leeuw, *The performance paradox in the public sector*, in *Performance Management Review*, 2002, vol 25, N. 3: 267-281

<sup>63</sup> J. Dermer, R. Lucas, *The Illusion of Managerial Control. Accounting, Organizations and Society*, 1986, vol 11, 6: 471-482.

<sup>64</sup> A. Hopwood (1972). *An Empirical Study of the Role of Accounting Data in Performance Evaluation*, *Journal of Accounting Research*, 10, 156-182.

<sup>65</sup> M. Hirst, *Reliance on Accounting Performance Measures. Task Uncertainty, and Dysfunctional Behavior: Some Extensions*, *Journal of Accounting Research*, 1983, 21, 2, 596-605

<sup>66</sup> J. Vakkuri, P. Meklin, *Ambiguity in Performance Measurement: a Theoretical Approach to Organizational Performance Measurement*, *Financial Accountability & Management*, August 2006

<sup>67</sup> H. Simon, *A Behavioral Model of Rational Choice*, *Quarterly Journal of Economics*, 1955, vol 69: 99-118.

vision<sup>68</sup> because of their being anchored to their mental models. In conclusion, broadening the observed system's boundaries, as previously described, can support a shift of focus from measurement to management, from data collection to systematic use of information, from an input or output to an outcome view of organizational results (Matheson et al, 1997; Moynihan, 2008).

#### **4.6 The drawbacks of measuring in performance: the case of police**

Police agencies, just like any public agency, need to capture the necessary data elements to assess their performance. Police forces and Police Authorities are required to set performance improvement targets for a range of key performance indicators, some of which are prescribed nationally and others reflect additional local aspirations. Various approaches are employed in different force areas to agree on appropriate targets, but they are most commonly (but not exclusively) related to:

- \* past performance trends;
- \* performance of an appropriate benchmark, such as equivalent police forces;
- \* contribution to a share of a national target;

Many statistic data are collected but they are often of little relevance to understand performance. Policing, in fact, is complex in nature and is not

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<sup>68</sup> H. Simon, '*Bounded rationality and organizational learning*'. Organization Science, 1991, Vol. 2, pag. 125-138

easy to separate into discrete, mutually exclusive activities. As the Home Office Minister for Policing John Denham articulated “*You cannot measure the performance of a police force through one or two statistics.*” whereas mapping the relationships of the main variables in police work, even if only at qualitative level, would provide a better picture to perform this ambit more effectively. The ‘illusion of control’ mentioned by Bianchi<sup>69</sup> “can be avoided if a non-mechanistic perspective is adopted, based on dynamic evaluations and a strategic learning-oriented perspective.” The same author asserts that the “introduction of formal performance management systems, into the public sector, has generated various unintended effects, such as an increase of bureaucratization, a lacking definition of goals, weak connection between the political and the managerial level and consequent poor alignment of activities that should instead be coordinated.”<sup>70</sup> Police effectiveness, for example, is often assessed with respect to their time reaction to calls, amounts of crimes solved, number of accidents reduced. Unfortunately in most of the cases such indicators can be useful to monitor outputs but are rather ineffective when trying to evaluate global outcomes. The identification of the best mix of resources and activities to achieve the desired outcomes is becoming increasingly complex and since police forces are required to manage a growing range of service performance outcomes as a whole rather than as a topical sub-set it becomes imperative to rely on proper tools to

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Bianchi C. (2010), *Improving Performance and Fostering Accountability in the Public Sector through System Dynamics Modelling: From an „External to an „Internal perspective*, in *System Research and Behavioural Science*, 27: p.364.

<sup>70</sup> Bianchi C. (2010), *Improving Performance and Fostering Accountability in the Public Sector through System Dynamics Modelling: From an „External to an „Internal perspective*, in *System Research and Behavioural Science*, 27, p. 364

enable the Police to hold a firm control over the multiple tasks they are required to carry out. It would be, in fact, misleading to learn that the Police has optimized their capacity to answer calls if, simultaneously, not enough patrols are available to be sent to the required crime scene. In the case of crime detection, for example, if the emphasis were only to be focused on diminishing the amount of undetected crimes this action would, in fact, be affecting the edge of the crime pyramid, by removing some criminals from the streets without saying much over the overall performance in solving the determinants of crime (outcome measure). As stated by Bianchi, an increasing pattern of detected crimes by the police might indeed signal efficiency in using staff and means but some questions would remain as to the accomplishment of the global outcome to reduce the determinants of criminality. Extreme efficiency in arresting people could, in fact, hide the Police's concentration on easy-to solve cases with no real benefit on major issues affecting society and the side effect of increasing the burden on an already strained jail system.<sup>71</sup> In the case of sanctions for infringements to the Highway code, for example, the Municipal Police could squeeze to the maximum their capacity to issue fines by installing speed enforcement equipment at every corner of a city. The output of fines issued would clearly be maximized but questions would still remain unanswered as to the effectiveness of this instrument with respect to the desired outcome of general prevention: an excessive recourse on remote sanctioning would, in

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71 C. Bianchi, D.W. Williams,' *Applying System Dynamics Modeling To Foster a Cause-and-Effect Perspective in Dealing with Behavioral Distortions Associated with a City's Performance Measurement Programs*' article published in *Public Performance & Management Review*, 2015, volume 38, issue 3

fact, increase the revenues for the municipality the consequent missing interaction between offenders and officers would not let emerge other possible infringements that remote sanctioning cannot of course detect. Furthermore an excessive focus on improving financial ratios would exacerbate the divide between the community and the police and so obliterate the element of mutual respect which is necessary to plant the seeds of a fruitful cooperation. The case would be even worse if the increased global amount of sanctions was obtained through a specific focus on easy-to-solve infringements without paying the necessary attention to those conducts displaying a higher potential to generate serious accidents. Consistently with what has been described above it appears that focusing on pure quantitative indicators can be a major limitation when assessing the effective performance of public institutions in delivering a service to their stakeholders. This limitation is particularly felt in certain sectors of public intervention characterized by a higher chance of data's being willingly manipulated. This appears to be particularly the case in sectors like education and policing.<sup>72</sup> This is not unfortunately an unlikely scenario since experience shows that indicators can be squeezed to serve individual purposes having little to do with the common good. According to Zink (2004), this pressure for results "has degenerated into a situation where the police leadership presses subordinates to keep numbers low by any means necessary" Manipulating or 'fudging' crime data has been mentioned as a recurring practice adopted by the police to generate the expected numbers to report; for instance: "misclassify crimes from felonies

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<sup>72</sup> R. Behn, *'Why Measure Performance? Different Purposes Require Different Measures'*, Public Administration Review, 2003, 63, 5, 586-606.

to misdemeanors, under-value the property lost to crime so that the deed would not be considered a felony”. (Eterno & Silverman, 2012, p. 27). The phenomenon of messing with data can be explained through several examples: from the need for managers to loosen pressure for results, to career-related considerations. De Lancer and Julnes (2006), for example, identify three of them:

‘attribution,’ ‘representation of quality,’ and ‘goal displacement.’

- attribution is about attributing the wrong causal connection between outputs and outcomes. This can alter the accountability principle;
- representation of quality when measuring actions and results is about the usual dilemma whether to focus on a single performance measure or on many. The trade off is about poor causation versus poor selectivity (Van Dooren et al, 2010, p. 160);
- goal displacement occurs when certain goals are pursued at the expense of other goals;

Flamholtz<sup>73</sup> proposes instead the following phenomena that may lead to goal displacement are: *sub-optimization, selective attention, inversion of means and ends*.

- sub optimization occurs when targets are achieved at the expense of other units;
- selective attention focuses only on certain targets;

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<sup>73</sup> E. Flamholtz, ‘Effective Organizational Control: A Framework, Applications, and Implications’, *European Management Journal*, 1996 14, 6: 596-611

- inversion of means and ends occurs when people are induced to focus on certain intermediate results while losing sight of the whole picture;

The last two phenomena have also been defined as “Tunnel vision” and “Myopia”, respectively (Smith, 1993, 1995).

But the police performance can be affected by other pathologies like ‘gaming’ often deriving by an excessive pressure on police managers to deliver results.

Bohte and Meier (2000) highlight instead such phenomena as: ‘cutting corners’, ‘lying’ and ‘biasing samples’.

- cutting corners is about pursuing quantity instead of quality;
- lying is about taking advantages in the information asymmetries between themselves and their evaluators;
- biasing samples is about reporting only the cases leading to most positive evaluation like solving the easy cases in police matters and neglecting the more complicated ones;

Patrick (2009) identifies some additional practices <sup>74</sup>in ‘stitching’, ‘cuffing,’ ‘skewing’ and ‘nodding:’

- stitching: a way to obtain of evidence against suspects by unlawful means the unjustified suppression of recorded crime;
- cuffing: a practice to declassifying, not recording;

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<sup>74</sup>R. Patrick, *‘Performance management, gaming and police practice. A study of changing police behaviour in England and Wales during the era of New Public Management’*, in Institute of Local Government Studies (INLOGOV) University of Birmingham, 2009

- skewing: the act of skewing of resources toward measurable outcomes;
- nodding: the practice of conspiring with offenders to obtain detections by unethical means;

Van Thiel & Leeuw<sup>75</sup> (2002, p. 271) provide an interesting example of gaming by discussing the case of the Dutch police: in this example the decline in the number of arrests made by the police does not necessarily indicate a deterioration in the work of the police but rather the contrary if we assume that arrests diminish because of the reduction in the number of perpetrators<sup>76</sup>. In this case, focusing on a single performance indicator – and in such a static manner – might generate unintended consequences. In particular the need of getting the police to keep the number of solved crimes stable – regardless the reduction in the stock of perpetrators – might give rise to gaming phenomena (i.e. perverse learning). In fact, the police might be inclined to increase (even beyond the socially tolerable levels) the pressure on the community in the search of a number of crimes to deal with and to report, with a clear focus not on quality but on quantity. In New York, during Giuliani’s period of office “success in crime fighting was being equated with the number of arrests made. A police officer would be regarded productive if he/she made a lot of arrests. A police commander in a precinct would be regarded as a really good police commander if his/her arrests were up this year. This wasn’t necessarily the only measure of success but it was

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<sup>75</sup> S. Van Thiel, F. L. Leeuw, ‘*the performance paradox in the public sector,*’ in *Performance Management Review*, 2002, vol 25, N. 3: 271

<sup>76</sup> Bianchi, Williams, ‘*Applying System Dynamics Modeling to Foster a Cause-and-Effect Perspective in Dealing with Behavioral Distortions Associated to City’s Performance Measurement Programs,*’, Baltimore, Transatlantic dialogue, 2013: 13



the predominant one. Eterno and Silverman (2012) emphasize how the focus on the short-run to the detriment of a longer time framework is an effect of the commented phenomena. They report as follows: “False arrests have been identified as the result of arrest quotas”. They also remark how “arrest quotas may encourage police to focus on less difficult and important arrests at the expense of more significant and arduous arrests.” Such practices and trends represent the drawbacks can indeed be considered as a reverse side of the medal about the whole philosophy behind the principle of individual accountability. When the latter is, in fact, anchored to too narrow performance indicators the risks of messing with data arises. The UK Government’s adoption of the Police Performance Assessment Framework (PPAF) appeared to recognize the problems inherent in the diversity of the policing function. As the Home Office Minister for Policing John Denham articulated *“You cannot measure the performance of a police force through one or two statistics ”so we are trying to have a performance framework that captures the whole breath of policing activity. Statistics are useful to make comparison with respect to the past but they do not really allow to understand which component has a more relevant impact on phenomena*”. Bearing in mind the aphorism stating that often “what gets measured gets done<sup>77</sup>” it is therefore a challenge for measurement systems’ designers to identify proper and sufficient indicators to avoid any risk of manipulation.

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<sup>77</sup> Peters and Waterman (1982, 268) attribute it to Mason Haire. But the origin of thye statement is up for debate.

By quoting Campbell (1976), Behn<sup>78</sup> remarks how “the more quantitative social indicators are used for social decision-making, the more subject they will be to corruption pressures and the more apt they will be to distort and corrupt the social pressures it is intended to monitor.” Instead of focusing then on just one quantitative indicator it would be advisable to identify some additional metrics to mirror efforts also on the preventive side, with an eye on qualitative considerations too. For example when assessing the effectiveness of Police action in a given area the focus should not only be fixed on the number of arrests made but also to such additional indicators as: ‘citizens’ utilization of public space’, ‘presence of commercial activity,’ ‘number of community problems solved.’ This would help reduce the distortions that are likely to arise by too a narrow set of indicators designed to assess a complex scenario.

#### **4.7 The methodology of System Dynamics (SD)**

System Dynamics (SD) is a methodology to understand the behaviour of complex systems over time. Through conceptual charts the methodology allows the graphical representation of the relevant variables of a system so allowing a useful mapping of the relevant structure of a system. If quantifiable data are available to initialize the variables, SD allows, through a set of equations, to simulate possible system’s behaviors over time so as to allow observers to monitor such mechanisms as accumulation, feedback

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<sup>78</sup> B. Behn, ‘*performance leadership Report, an occasional (and maybe even insightful) examination of the issues, dilemmas, challenges, and opportunities for improving performance and producing real results in public agencies*’, 2011, vol. 10,

loops and non-linear effects. These mechanisms do exist in the reality of complex systems but whose implications are not captured by traditional P&C systems which tend to limit the provided information on the economic and financial performance of the organization. In addition to that SD can help offset certain cognitive limitations affecting an average observer: human rationality, in fact, tends to focus on static or linear phenomena and, even in those cases when the concept of feedback loop is present in the observer's mind, it is very unlikely that he/she will be able to follow the simultaneous effects of multiple loops. Furthermore, from a circular perspective of movement, this system of measurement should be able to allow identifying possible levers of intervention that decision makers can use to drive the system towards the desired state. More in particular, through the use of system dynamics simulation models, policy makers have the opportunity to test the effects of policies and therefore to know in advance all the potential effects, both of long and short-term, which may arise from the implementation of these. Through simulation SD allows to:

- detect those, at first sight, imperceptible weak signals which over time, through accumulation, can seriously impact relevant variables;
- take counterintuitive dynamics into account which the cognitive limitations of the decision makers and the scarcity of information available would not make it easy to detect;
- monitor possible delays occurring in the cause/effect relationships between variables;

- test intervention policies with a view to selecting the most appropriate with regard to the functioning of the system;

SD is suitable to analyze different settings from economic, to social to biological ones and many more. SD is still useful even when quantitative data are not available since it allows qualitative analysis through the possibility to rely on causal loops diagrams (CLD). A CLD enables to highlight the relationships among variables, their interdependencies with the only limitation of allowing no simulation. The major contribution of the SD methodology to users and decision makers is not identification about the suggestion of policies but, rather, in the understanding of the relevant components of the system and of the dynamics they may display over time. The methodology of System Dynamics was founded in the late fifties at the Massachusetts Institute of Technology by J.W. Forrester.<sup>79</sup> According to Bianchi, System Dynamics differs from traditional methods of analysis because, on the basis of the comparison made between the simulation models and the reality, *“it allows decision makers to continuously review the assumptions previously made and so extrapolate keys of interpretation that allow to understand and deal suitably with the complexity of the phenomenon observed”* (Bianchi, 2009). The steps through which the SD methodology allows an analysis have been summarized by Moxnes (2009) and can be traced in the acronym P’HAPI<sup>80</sup> proposed by the same author. Each letter stands for the following set of passages:

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<sup>79</sup> J. W. Forrester, *‘Industrial Dynamics’* MIT, Cambridge, Massachusetts, 1961

<sup>80</sup> E. Moxnes, Presidential address: *‘Diffusion of System Dynamics’* System Dynamics Society. Proceedings of the 27th International Conference of the System Dynamics Society, Albuquerque, 2009

- Identification of a problem;
- Hypothesis over the possible causes of the problem;
- Analysis. If the hypothesis previously formulated can be reproduced in the system, a conclusion is drawn as to its rejecting or confirming it;
- Testing of the alternative policies designed to alleviate the problem through simulation in the model; Since the feedback structure of a system determine its dynamics, selected policies try to modify the dominant feedback loops by redesigning the structure of the system;
- Implementation of the optimal solution;

System dynamics models are developed through structures made up of causal circuits between the variables of the system under investigation. The basic elements, determining the dynamic structures, are precisely the feedback loops. Roughly, a feedback circuit can be defined as “*a chain of two or more variables that affect each other.*” These different causalities allow to understand the mechanisms behind a given phenomenon, highlighting the drivers and levers of intervention that can be used to influence the state of the system. More in particular, the relationships between the variables that form these causal circuits can be distinguished in:

- Direct relations. In this type of relationships, graphically indicated by the symbol “+”, to an increase / decrease of a variable corresponds to an analogous increase / decrease of the linked variable;

- Indirect relations. In this type of relationship, graphically indicated by the symbol “-“, the relation is opposite: to an increase / decrease of a variable corresponds decrease / increase of the linked variable;

To determine the polarity of the loop we look at the symbols: if a loop just shows “+” symbols the polarity will clearly be a “+” sign, i.e. “increasing”. But in case there appear some “-“ then the way to proceed is to perform an arithmetical sum of all the “-“ symbols and see if this comes down to an even/ uneven number. An even number of “-“ correspond to a positive polarity (i.e.: two minus are a plus, four minus are a plus, six minus are a plus.... etc. etc.) Conversely an uneven amount of “-“ will be equivalent to a decreasing dominance of the loop. The combination of “+” with “-“ is to be treated according to the algebraic rule that states that when a “+” and a “-“ are multiplied the ensuing relationship will be considered dominated by the “-“.

Depending on the polarity of the loop, resulting from the steps described above, it is possible to distinguish between:

- 1) Reinforcing loops. In this case the combination of the variables displays a “+” dominance which means that their interactions causes the observed phenomenon to show a trend of exponential growth or exponential decay;
- 2) Balancing loops. In this case the combination of the variables displays a “-” dominance which means that their interactions eventually causes the observed phenomenon to show a trend of gradually balancing dynamic till an equilibrium point at a certain time is reached.

### **4.7.1. The quantitative modeling approach**

In the System Dynamics methodology the quantitative analysis is performed by using a type of model called 'Stock and Flow diagram' (from now SFD). More specifically quantitative models allow, through a specifically designed software to obtain a graphical simulation of the dynamics that characterizes the system under analysis along a simulated time-horizon. This requires a preliminary initialization of the variables involved. The variables that are used to draw a quantitative simulation model can be classified into:

1. Stocks. They express the level of accumulation of a given variable;
2. Flows. Flow variables increase / deplete the accumulation in a stock;
3. Auxiliaries. Such variables allow to add significant elements to the mechanisms of the stocks and the flows. Be that time or ratios they are significant elements of the model which allow certain calculations to be performed;
4. Constant variables. Sharp values are inserted in these variables, i.e. no calculation is performed;

### **4.7.2. The qualitative modeling approach**

The qualitative option in SD is an approach oriented to the identification of the systemic relationships of a given phenomenon to shed some light to

the functioning of the system. Several authors consider that the qualitative approach is deprived of scientific character because simulation is then not possible. As claimed by Gherardi and Turner, the data generated in a qualitative analysis, “are unsuitable for statistical analysis and can be defined as soft data.”<sup>81</sup> On the other side, other authors, conversely, insist on the qualitative analysis’ being just as important as quantitative analysis. Coyle says that when dealing with a high level of uncertainty qualitative analysis can be “*useful not less than a full scale quantitative modeling approach.*” In such a situation an inference diagram can be enough to provide useful suggestions and insights to decision makers.<sup>82</sup> That is, to use a non-simulation System Dynamics approach in which, “*inferring is preferred to calculating.*” Sticking to Forrester’s opinion: “*There are cases where uncertainties in concepts, make it difficult to build a quantitative model based on observed data and structured interactions with clients. In such cases it might be preferable to restrict the analysis to a qualitative level using such indicators as ordinal parameters, intervals, ratio scales and quantitative scales.*”<sup>83</sup> In System Dynamics the qualitative analysis is realized through the elaboration of a specific type of model called Causal Loop diagram (CLD’s). CLD’s are graphical maps showing the causal structure of a system. In particular, a CLD allows to map explicitly the causal relations between the variables and to identify which feedback mechanisms are produced by the dynamic behavior of the variables of

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<sup>81</sup> S. Gherardi, B. Turner, ‘*Real men don’t collect soft data,*’ Dipartimento di politica sociale dell’università di Trento, 1987 Quaderno n. 13: 6- 34.

<sup>82</sup> G. Coyle, ‘*Qualitative and quantitative modeling in System Dynamics: some research questions.*’ System Dynamics Review, 2000 Vol. 16: 225-244

<sup>83</sup> J. Forrester, ‘*Counterintuitive behaviour of social systems*’ Technology Review, 1971 Vol.73: 3 -24



system under investigation. Bagheri and Hjorth (2007) called viability loops those being critical in providing the balancing mechanisms to prevent exponential growth or decline caused by reinforcing loops.<sup>84</sup> CLD's have proven to be extremely effective instruments since they:

- 1) Provide a graphical description of the problem investigated;
- 2) Allow to represent, in a straight and effective way, the assumptions over the dynamics of an investigated phenomenon;
- 3) Highlight the fundamental feedback mechanisms among the variables related to the investigated phenomenon;
- 4) Allow to bring to the surface mental models of the decision-makers involved;
- 5) Facilitate the process of communication and knowledge-sharing between all actors involved;

Since no simulation occurs when using CLD's their use is just useful to understand the cause-effect relationships as well as the feedback loops in the observed system. CLD's may be constructed also by using the same symbols of "Stock and Flows" diagrams as a way to combine increase the understanding of the contribution of each variable in the system under analysis.

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<sup>84</sup> A. Bagheri, P. Hjorth, '*Planning for sustainable development: a paradigm shift towards a process-based approach*', Sustainable Development, 2007 15, 2: 83-96

#### **4.9 The combination of SD with traditional performance methodologies: the case of Dynamic Performance Management**

Following what has been exposed so far it must have become clear that the SD methodology can offer a dynamic solution to the limitations arising from the use of the more traditional tools in P&C analysis whose narrow focus has been widely described in previous paragraphs. SD should not to be considered an alternative to them but, rather, a complement to make up for the rigidity they are often characterized by. Complex systems in fact are characterized by dynamic relationships among variables subject to uncertainty and unpredictability. Therefore there is a need to find a methodology able to describe non-linear relationships, time delays between cause and effects and that enables to find a balance between the short and the long term (Cosenz 2011). Combining SD with other tools traditionally used for P&C purposes it will be possible to provide decision makers with a more integrated vision of the system being investigated and therefore enable them to focus on the policies deemed to be the most effective to achieve their strategic objectives. This paragraph inquiries into the combination of Performance Management and SD whose integration generates the methodology of Dynamic Performance Management (DPM), which can help key-players a useful tool to screen performance in dynamic environments and improve their understanding through the simulations made possible by it. Supplementing P&C systems with SD allows to govern the dynamic complexities of complex environments that are a typical consequence of uncertainty and unpredictability in the relationships among

variables.<sup>85</sup> Dynamic Performance Management (DPM), combining the advantages of PM with SD, enables to counteract the behavioral distortions associated to performance measurement through a shift from a static to a dynamic picture of organizational processes and results. Through this integration the measurement techniques of PM are put in the broader context of analysis. This perspective is defined “external”(Bianchi 2010) to distinguish it from the ‘internal’ perspective where the vision is the one of each single observer. As pointed out by Bianchi, “the design of a dynamic performance management system can be done through three different approaches: the ‘objective view,’ the ‘instrumental view’ and the ‘subjective view.

- the objective view: this approach is focused on the identification of the core object of the whole process carried out by a given public institution in order to provide a service/product. More specifically, the adoption of the objective view allow to underline the contribution of each department towards the value chain leading to the delivery of an end product to internal and external clients. This requires a thorough mapping of the chain from beginning to end. It also requires that such factors as the underlying processes, the responsibility areas, the assigned resources, and the policy levers involved in delivering the final result are made explicit;

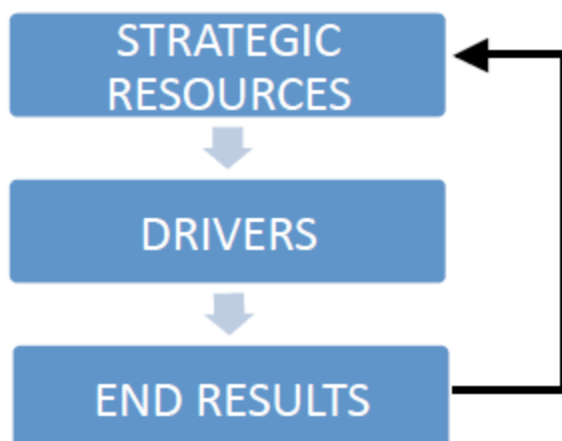
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<sup>85</sup> Cosenz F., “Sistemi di governo e di valutazione della performance per l’azienda università”. Giuffrè, Milano (2011)



**Fig. 4.1:** The objective view of performance (Bianchi 2012)

- The instrumental view. This approach seeks to define the relevant performance indicators related to the links (drivers) in the circular relation between strategic resources and end-results and The drivers represent the levers of intervention (policies) that allow to influence the expected results; This view is defined instrumental since it identifies a set of levers of intervention (the drivers/policies) connected to the critical success factors that can be directly influenced by the decision makers (Cosenz,2011).

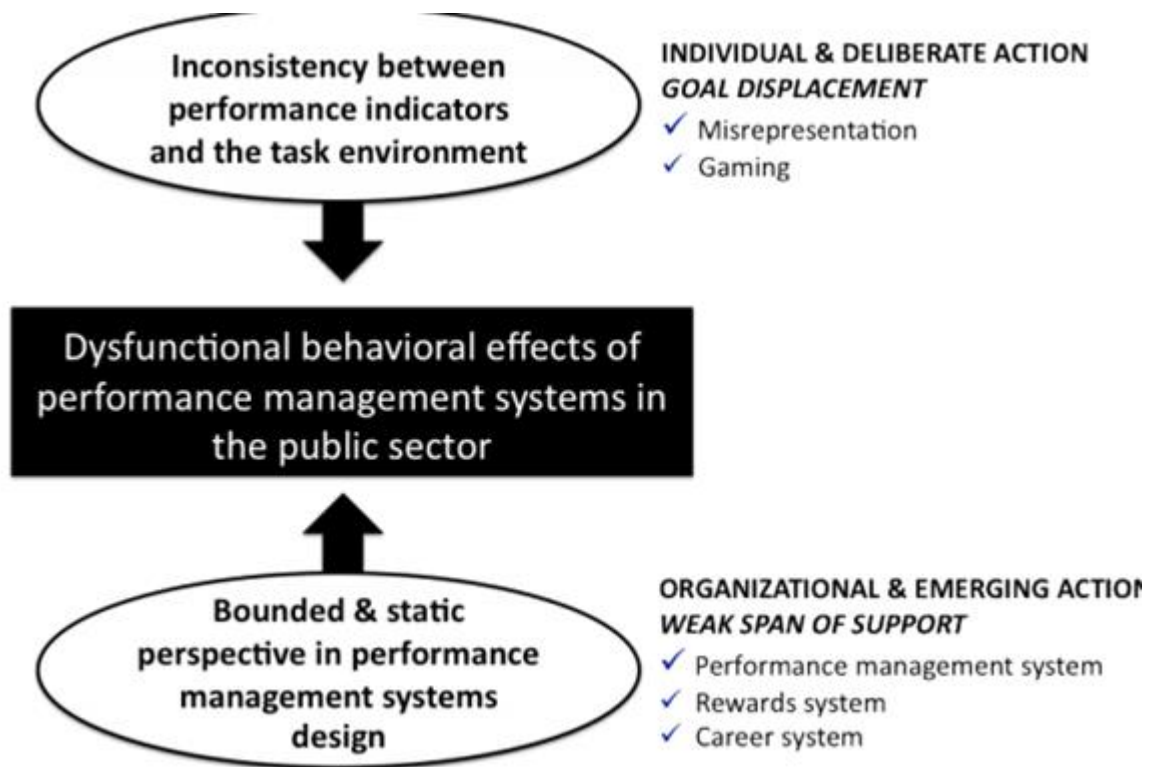


**Fig. 4.2:** The instrumental view of performance (Bianchi 2012)

- The subjective view. This is a synthesis of the previous two views since it makes explicit, for each decision area, those factors that need to be included in plans and budgets; in particular: the activities that need to be undertaken, the processes involved, the intermediate results and the final objectives;



**Fig. 4.3:** The subjective view of performance (Bianchi 2012)



**Fig. 4.4:** primary factors leading to dysfunctional behavioral effects of performance management system in the public sector

To productively apply SD to performance management the most suitable approach is the so-called “instrumental” view of performance (Bianchi 2012, p. 153-155). The instrumental view implies that the means for improving performance must be made explicit. In this regard, in a system it is necessary to identify:

- end-results
- their respective drivers
- the strategic resources

Before analyzing the relationships among these categories the preliminary step is to make explicit what performance must be; in other words what the realistic objectives need to be with respect the available resources (strategic).

After identifying the objectives, intermediate and final results must be identified. In other words, the final results are equivalent to the goals achieved by an organization with respect to its environment, its products and services. The final results can be:

- economical/financial (i.e. the change in cash flow);
- competitive;
- social results (i.e. the improved image of the organization);<sup>86</sup>

Starting from the end-results there is a need to identify the drivers (policies) influencing the former. Drivers are crucial for an organization since they generate the final results. Therefore, in order to understand and clarify their contribution to the achievement of global and sectoral results, it is fundamental to define appropriate performance indicators referring to such drivers (Ewell,1999). The drivers, in turn, are affected by the strategic resources. These three concepts need to be seen in a loop relationships. Strategic resources are modeled as stocks whose graphical representation is the following:



**Fig. 4.5:** graphical representation of a stock

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<sup>86</sup> Cosenz F. (2011), *'Sistemi di Governo e di Valutazione della Performance per l'Università'*, Giuffrè, Milano 2011: 78

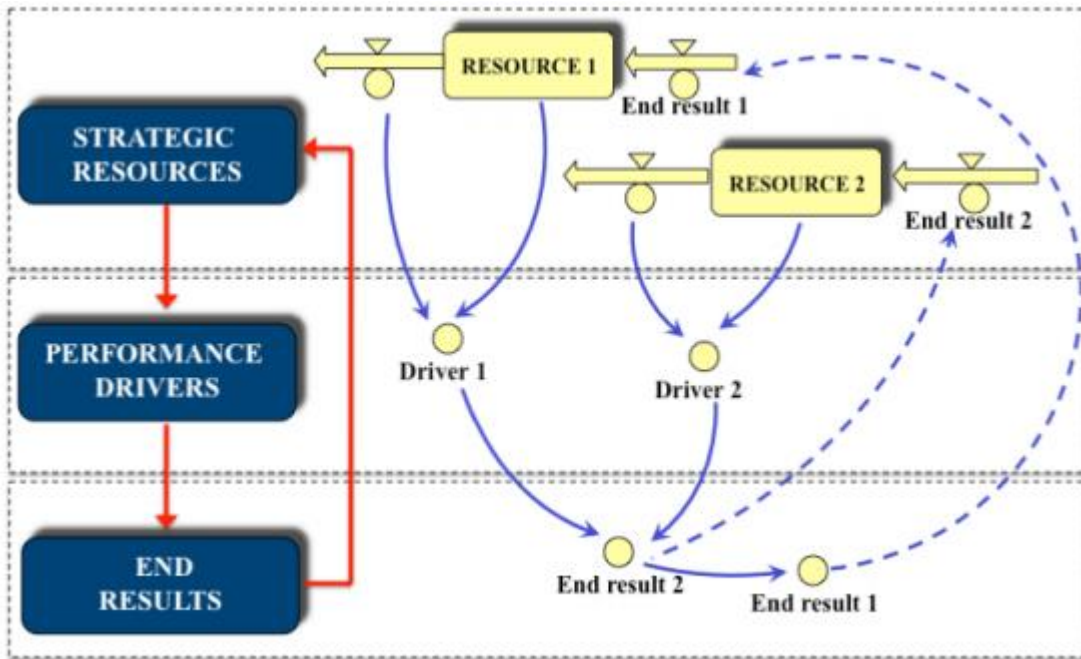
Stock represent the set of available factors, tangible or intangible, over period a given time. They respond to the logic of a ‘bath-tub’ where resources can accumulate or just be depleted. It’s the content of stocks that can be deployed to influence the related drivers which allow to affect the end-results. Drivers can be measured in relative terms, i.e. as a ratio between actual performance and a benchmark or whatever possible alternative ratio that seems more suitable to serve the purpose of the model. Their graphical representation is the following:



**Fig. 4.6:** graphical representation of a driver

The endowment of strategic resources needs to be substantial to be able to impact drivers effectively therefore the maintenance of an appropriate balance between strategic resources is the key to sustainable development.



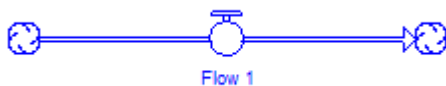


**Fig. 4.7:** a dynamic performance management view framed through an “instrumental perspective”

Understanding the loop mechanism between strategic resources, drivers and end-results and *vice versa* is a crucial aspect of DPM. This implies that each decision-maker must be careful not to deplete the mix of strategic resources available to the detriment of other possible players who might need to rely on them. And it’s this kind of complexity that fits the dynamic nature of SD with the Performance Management approach. Operationally this is usually done by identifying both the relevant reinforcing and balancing loops on which to intervene to keep a proper balance between the need to deplete and replenish resources (Richardson 1986; 1995). As stated by Bianchi<sup>87</sup>, if the underlying principle in SD is that process structure determines the system’s

<sup>87</sup> C. Bianchi, D. Navarra, ‘Enhancing Performance Management and Sustainable Development through e-government policies in Urban Areas A System Dynamics Approach’ Paper presented at the 2013 ASPA Conference - New Orleans, March 15 – 19, 2013

behaviour and system's behaviour determines performance then, acknowledging the relationship between processes and behaviors is the key to developing sustainable strategies, through a correct managing of the leverage points in the investigated system. The processes of accumulation/depletion of strategic resources depend on the value of corresponding inflows and outflows. These flows affecting the resources are basically the end-results proper which essentially measure the overall organizational performance of decision-makers. End-results can be graphically represented as follows:



**Fig. 4.8:** graphical representation of a flow

Such flows are modeled as “valves” which decision-makers can regulate through their policies (Bianchi, 2010). Flows operate over time therefore, understanding the effect on delays on the accumulation / depletion of strategic resources is another key-issue to managing performance in dynamic complex systems. To sum up the “must” for decision-makers using DPM can be summarized into the following three:

- identifying those strategic resources that most determine success in the environment where an organization or different organizations operate;
- ensuring that the endowment of such resources is satisfactory over time;

- keeping a proper balance between the different strategic resources;

#### **4.10 the complexities of police work and the usefulness of (partial) modeling**

From an overview of preceding chapters it will now be clear that SD is a fundamental tool to foster a better comprehension of complex systems thanks to its specific attitude to focus on the dynamic developments of the different variables involved. Road safety, in particular, is a complex phenomenon since it depends simultaneously on different causes ranging from demographic phenomena, to social conditions, to economic considerations, to education, to infrastructure, to psychological factors, to organizational aspects of the Police, to the efficiency of the judiciary system and to the quality of legislation. But using System Dynamics to investigate the global impact of all these aspects simultaneously on road safety does not seem to be an easy task. Modeling such a large system seems unfeasible due, principally, to the lack of available data. The amount of information needed for such a purpose would be of extreme magnitude and the observation period would realistically have to be extended over a relatively long period of observation which would, given the limitation of time and data be unlikely for this research work. Even with this data limitation, the resultant model was able to test the validity of some assumptions, such as the impact of re-profiling the mix of policing resources. Besides relevant literature supports the validity of for partial modeling; the contribution of SD however limited

to crunches of larger systems, in fact, has not been denied since the initial understanding of the cause and effects relationships among variables is still considered useful.<sup>88</sup> Several studies would seem to confirm this assumption: in the study by I.M. Newsome (2008), for example: the efforts of the West-Yorkshire Police in guaranteeing a satisfactory level of service, despite a limitation of resources, are investigated, in both the response and reassuring activities. The analysis over the effects of shifting resources from response to prevention (reducing crime or reassuring the community) clearly revealed that one improvement in one option would be obtained to the detriment of the other unless some additional resources were found. Joined-up police efforts were seen as a possible solution but the difficulty in building a reliable data sets capable measuring different contributions from individual players did not lead to satisfactory conclusions. The inability to measure individual contribution is a major hurdle, in fact, when it comes to assessing the advantages of joint-police efforts.<sup>89</sup> Despite the limitation of data the methodology was still proven useful as a valid learning tool to gain a better understanding of some of the interactions and how they might change over time. Given the complexity of the cause-effect interaction between these variables it is very difficult to establish a clear and holistic model of System dynamics but the advantages of partial modeling seem to be related to the possibility of extending the analysis when more data become available.

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<sup>88</sup> I.M. Newsome, *'Using system dynamics to model the impact of Police activity on performance'*, Palgrave Mc Millan, 2014 pag. 169

<sup>89</sup> I. M. Newsome, *'Using system dynamics to model the impact of Police activity on performance'* The Journal of the Operational Research Society, Vol. 59, No. 2, Operational Research in Government (Feb., 2008), pp. 164-67

## Chapter five

# DRIVING MISCONDUCTS IN PALERMO AND THE ROLE OF THE TRAFFIC DIVISION OF THE MUNICIPAL POLICE

## 5.1 Introduction

Over the last ten years fatalities deriving from road accidents have been displaying, both in Italy and in the rest of Europe, a decreasing trend as a result of the different measures undertaken at national and European level to tackle the phenomenon. However promising this result can be, the efforts to improve road safety are probably far from being over: the persistence, in fact, and sometimes the increase, of potentially dangerous driving misconducts, is a source of concern among authorities and public opinion. The yearly report issued by the City of Palermo, covering the developments of the different municipal services (*Bilancio Sociale*), in the section dedicated to the Municipal Police, seems to confirm these concerns: dangerous practices like speeding and alcohol abuse among drivers have been maintaining too high a level, if not a growing trend, as it would appear by the number of fines issued to offenders.<sup>90</sup> Reasons for the recrudescence of such phenomena cannot be attributed to one single factor but to a mix of aspects where behavioural patterns and psychological considerations play a role. As indicated in previous chapters, relevant literature, focusing on the stream of traffic psychology, advises not to underestimate these aspects if this trend is ever to be reversed. Clearly the different nature of the multiple areas of intervention to foster road-safety require, each, different solutions

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<sup>90</sup> Comune di Palermo, '*Bilancio Sociale. Sintesi*', 2014

and different time-lapses to produce tangible results. The Municipal Police cannot, evidently, intervene on infrastructural developments or replace the competences of psychologists but they could effectively contribute to counteract certain behavioural patterns through a mix of preventive and repressive measures. While not eradicating the root of the problem, their constant activity could still have an impact to foster road safety by reversing the widespread perception, among offenders, of the unlikelihood to be sanctioned. In addition to that, the role of the Municipal Police, through a constant interaction with the population, could help clarify a certain degree of confusion over the extent of tolerance permitted by authorities with respect to certain infringements. This aspect is also very important since lack of certainty, over what is tolerated and what is not, could bring a number of drivers to unwittingly offend.<sup>91</sup> Speeding and drunk driving are behavioural phenomena, each with its underlying causes, but, in Palermo, they fall into that unfortunately widespread attitude of general disregard for basic rules and minimization of own misconducts.<sup>92</sup> Such a state of affairs appears to be determined by a very peculiar and local combination of perceptions and attitudes that are particularly rooted in the population but which, arguably, need to be eradicated if this illegal course is to be reversed: on the one hand, the widely shared belief that infringements are quite unlikely to be sanctioned induces a certain relaxation in the population with regard to compliance with norms and regulations; the underlying idea is that, whatever the infringement, the chances to get away with it are high. This is not

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<sup>91</sup> D. Wilkinson, S. Hope , *'the deterrent effect of enforcement in Road-safety – research findings, Association for European Transport, 1999*

<sup>92</sup> D. Gambino, M. Peritore, *'il traffico: 5 cose da sapere sul senso civico dei palermitani, svelati da uno studio svedese,' Cose da fare in Sicilia, 24 giu 2015*

surprising since the general perception is that speeding is common-place and, to an extent, tolerated. This assumption is strengthened by the awareness about the understaffing which limit the action of the Municipal Police and which, notoriously, is claimed to be one of the major obstacles to the implementation of effective controls. On the other hand, poor compliance with rules, seems curiously to be encouraged by a peculiar psychological attitude towards duties and individual responsibilities, often dismissed as a marginal issues, in an environment characterized by widespread anarchic behaviour<sup>93</sup>. This assumption appears to be in line with the what was described in chapter two about the influence of a ‘context mentality,’ describing the influence of specific environments on individual’s behavioural responses. The risks inherent to this state of affairs are related to a potential ‘imitation effect;’ triggering a reinforcing circle which, if not tackled, can further sediment and make it even more difficult to reverse the trend. With such a potential scenario in the background, future road safety policies will have to be calibrated not only on traditional priorities like improving the infrastructure and developing better performing safety devices for vehicles but they should also focus on the findings of ‘traffic psychology.’ The Municipal Police, on their side, try to contain this general trend by tightening controls, with particular emphasis on those issues that generate more social alarm. Yearly reports on Police performance are filled, in fact, with quantitative data that would seem to confirm these efforts. Yet the still too high level of driving misconducts, combined with the public’s wide distrust over the effectiveness of the Municipal Police, would seem to suggest the

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<sup>93</sup> C. Rizzo, *Guidare a Palermo? Una storia di ordinaria anarchia*, Palermo Today, 1 oct. 2014

existence of a specific mismatch between official reports on Police performance and community's perceptions. Perhaps the indicators of performance, currently adopted by the Municipal Police, should be revisited to steer priorities towards those aspects that could help to reduce such a contradiction: as widely discussed in previous chapters, in fact, pure quantitative indicators, like the amount of fines issued per year, or the reduction in the overall number of accidents, are believed to be insufficient to offer a comprehensive picture of a complex situation. They could, in fact, rather measure departments' individual outputs but they would be still inadequate to pursue global outcomes. To translate this assumption into a practical example, using the variables that will be analysed in the case study, it could be said that an increase in the number of fines, issued to offenders, is not in itself a robust evidence that can demonstrate a structural contribution of Police action in reducing driving-related fatalities. Roughly they could probably indicate an optimization of their sanctioning activity but no wider or extremely optimistic implications should be inferred by this single parameter. Conversely, a larger spectrum of indicators, including also a measure about preventive activities would offer a stronger basis to get to sounder conclusions. The need to approach the issue of road safety through a more systematic approach seems to be confirmed by other studies on police work, which have clearly shown that the relationships between inputs and outputs are rarely driven by pure linear logics. The need to investigate the dynamic interactions existing between police action and behavioural responses has therefore induced the author to rely on a methodology capable of letting such dynamics emerge. Through the design of Dynamic Performance Management approach (DPM) according to the 'instrumental



view perspective', in fact, it will be attempted to show how the Municipal Police can pursue their targets (end-results) in a sustainable way with respect to the fundamental imperative of assuring a proper balance between the objectives and the resources devoted to reach them.

## **5.2 Traffic congestion in Palermo: an overview of the main causes**

Palermo is one of the most burdened European cities in terms of chaotic traffic and the Italian capital for time wasted in queues.<sup>94</sup> According to a research conducted by the Dutch company TOM TOM, world-leader in the development of navigation system, it has been estimated that for every hour spent in the car 39 minutes are lost in inevitable traffic standstills. This estimation has been done by comparing the time necessary to cover a given traject with no traffic (at night) against the same operation conducted during day time. During peak hours the situation worsens considerably with 67% of wasted time per single hour. In Europe cities scoring worse than Palermo are Moscow with an average time waste of 65% and Istanbul with 57%. It is no wonder that this paradoxical situation has given rise to a nationwide gag after being mentioned in a notorious Italian movie (Johnny Stecchino) when R. Benigni, the main starring, displaces his interviewer's prejudices stating that the major criticality in the city is not the Mafia but traffic. Let go of the brilliant hilarity the problem is that this statement is not at all far from reality: traffic jams in Palermo are, in fact, not only a severe burden, heavily affecting the daily quality of life, but they also are highly conducive to road

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<sup>94</sup> A. Ribaudò, *'le città più trafficate d'Europa, Palermo e Roma fra le peggiori,'* Corriere della Sera/Motori/Attualità, 6 nov 2013

accidents and driving misbehaviour. Chaotic circulation in the city can be attributed to a mix of natural, demographic, behavioural and infrastructural factors which, altogether, contribute severely to traffic jams. In particular traffic congestion can be attributed to the disproportion between the capacity of roads and the number of car-users utilizing them. This mismatch is even further aggravated by the lack of parking facilities, causing motorists to park their cars wherever possible, with obvious consequences on the smooth-flowing of circulation. Next to such structural constraints the widespread disregard of the prescriptions of the Highway Code complicates this scenario even further. Here follows a listing with more detailed descriptions over the factors mentioned above and having a strong influence on chaotic circulation:

1. the physical layout of the environment, for example, limits severely the available space especially along the north-south axis: Palermo, in fact, is a city laying between the sea and the mountains and it is spread over a surface of approximately 159 square kilometres. The city, in the last forty years, has been undergoing an impressive rate of building activities, driven by not always transparent economic interests but also fuelled by internal immigration which has brought the resident population to total the figure of 700.000 units. The urban development has mainly been occupying the east-west direction, where physical space was larger to reach, nowadays, a built-up extension of approximately seventeen kilometres. A possible alternative development, along the north-south axis, on the contrary, has always

been limited by the presence of such natural obstacles as the Tyrrhenian sea, on the northern side, and a group of mountains, on the southern side, locally known as the *Conca D'Oro* mountain chain. The maximum available space, in fact, between these two opposite poles does not exceed 3,5 kilometres. Such a space limitation makes it complex to envisage adequate infrastructural projects, such as a road ring around the city, to lower the traffic pressure on the city.<sup>95</sup> The peculiar outstretched shape of the urban environment relies on a road network involving a grid layout with a consequent excess of intersections and their related consequences in terms of reduced safety and heavier traffic flows;

2. A second factor, which has severely restrained the irregular space available, can be found in the huge building activity that has characterized the city in the last forty years and whose impact is one of the first and most enduring perception of visitors.<sup>96</sup> The tragedy is that in far too many cases this development has unfolded out of any planning logic with evident severe consequences for long-term development plans. The period between the sixties and the seventies, in particular, labelled as the period of the '*Sacco di Palermo*' (the ravage of Palermo), has been one of the shadiest ever undergone by the city, when millions of cubic metres of concrete were poured on an environment not apt to sustain it. Buildings often deprived of own

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<sup>95</sup> 'Viale della Regione siciliana', accessed on 30 october 2015, available from [https://it.wikipedia.org/wiki/Viale\\_della\\_Region\\_Siciliana](https://it.wikipedia.org/wiki/Viale_della_Region_Siciliana)

<sup>96</sup> J. Brown, '*The Rough guide to Sicily*,' Anaya-Spain, 1994

parking facilities, not letting residents other options but park their cars along the public streets, with the obvious result of burdening circulation even more and consequently increasing chances of accidents; This way of proceeding, justified by huge economic interests, often encouraged by organized crime, has been extremely short-sighted, posing severe hindrances in terms of sustainable development and causing severe limitations for future developments of efficient mobility systems as it has been revealed by present days' experience.

3. The demographic factor is another element of strain to the an already burdened road network: the city totals, in fact, a permanent population of approximately 700.000 inhabitants which, during rush hour, can increase substantially due to the flows of commuters coming from suburban areas; As recalled previously time wasted in car queues during rush-hours rockets to 65% per hour spent in the car. The lack of an efficient mobility infrastructure encourages the use of private transport, causing constant massive traffic jams on a daily basis that enhance frustration among motorists and leads to widespread disregard of basic Highway Code's prescriptions in an attempt to reduce the inevitable waste of time generated by traffic's standstill. Frustration is a dangerous feeling in terms of safety since it can foster aggressive behaviour inducing motorists to step on the pedal whenever they see an opportunity to do so. Pedestrian, in particular, seems to be the category more exposed to the risks of being victims of run-over;

4. The general disregard for basic driving rules is another factor affecting road circulation in the city. From bikers, to pedestrians, to motorists no category seems to be immune by this pandemic. Certainly the described structural deficiencies described above do not encourage compliance with rules by the population. When frustration exceeds certain limits the temptation to find short-cuts becomes extremely likely. But unfortunately such short-cuts, while apparently delivering initial benefits to single offenders do indeed worsen the traffic situation when they become a rule generally applied by most of the drivers. Finally anarchic behaviour takes over and the situation gets out of control with obvious consequences in terms of road-safety. The risk is that when people start believing that infringing rules is a sort of ‘survival right,’ justified by the described situation, a dangerous mental habit consolidates; confusion reigns, in particular, over the extent to which every single infringement can be stretched. To these local peculiarities, other factors could clearly be added: factors that international research has found as prevailing also at other latitudes: drivers are often not deterred by infringing the laws because they perceive chances of being caught as unlikely. Nor are they particularly concerned about possible risks of being involved in an accident. Surely, in Palermo, confusion over the degree of tolerance exercised by authorities as to certain infringements amplifies the general confusion. As a result of this uncertainty, drivers tend to rely on personal interpretations as to the definitions of 'careless' and 'dangerous' and this leaves scope for a wide range of errors, inattentiveness and aggression.<sup>97</sup> Other factors playing a

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<sup>97</sup> D. Wilkinson, S.Hope , *‘the deterrent effect of enforcement in Road-safety – research findings,*

role in the causation of accidents can be traced in the soft social stigma attached to certain infringements this latter aspect being something clearly related to the previously discussed issue as to how a given social context can influence attitudes. Repression could limit certain extremes although little is known about the role of legal enforcement and penalties in influencing driving behaviour and, hence, safety on the roads. Enforcement has a different deterrent magnitude depending on to the type of offence; for drunk driving and dangerous driving, it has a very strong effect but when it comes to speeding it appears that such an effect is more limited. This last evidence is not surprising though given the persistent general perception that speeding is common-place and, is to a certain extent, a tolerated behaviour; The main effect of penalties on speeding is to make drivers more conscientious about staying within the limits, but this result is often limited around speed cameras or in their immediate proximities. However, for those drivers who speed habitually and excessively, getting caught is regarded as an 'occupational hazard' and something that is bound to happen from time to time. It is not seen as having any implications for their future driving and since they share the perception that detection is unlikely. The principal difference between those who would speed excessively and other drivers was the point at which risks were perceived to become too great.

Authorities are, therefore, nowadays, more involved in developing alternative mobility solutions to make up for long-standing structural deficiencies. The development of parking facilities, pedestrian areas and

mobility infrastructural projects are examples of this systemic effort to move on to a new chapter. Offering alternatives can be a paying back strategy to loosen the pressure on traffic circulation and in this way tackle that vicious circle where citizens often tend to justify their infringements as a result of a general lack of options. Furthermore an administration offering options can rightly expect more compliance on the part of motorists, which indirectly would lead to a certain reduction in the number of misconducts.

### **5.3 Changes in drinking habits in the population: the phenomenon of ‘movida’**

The term ‘Movida’ has made its first appearance in the Italian vocabulary in 1990. The origin of this word can be found in Spain where it was intended to designate the particular momentum of cultural and artistic activity characterizing that country after the loom years period experienced under the Franco’s regime. But in Italy a similar phenomenon starting in the early nineties has often been associated to some negative connotations. Movida is, in fact, a synonymous of chaotic, often unregulated night life events characterized by excessive alcohol consumption, made easily accessible by the moderate prices at which it is offered and emphasized by the loud music played till early hours. This trend has quickly led not only to the misery of entire neighbourhoods, exposed to the presence of night-life venues and bars, but it has, in particular, undermined the safety of road circulation by exposing more and more drivers, especially among the youth, to the risks of

excessive alcohol consumption. The consequences of this phenomenon can be extremely serious since statistics reveal a clear strong correlation between alcohol consumption, speeding and serious accidents. Similar phenomena have been commonplace abroad already for a long time: in 2014 in France a new bill was presented to Parliament to severe sanctions against those who incite consumers under age to drinking competitions also known as ‘binge drinking.’ According to Marisol Touraine, head of the Health Department in France, alcohol consumption in France has been declining since the fifties whereas ‘binge drinking’, a sort of drinking competition, has been a growing trend, in recent years, among certain categories of consumers, especially the youth. According to statistics from the French Health Department 27% of the youth under the age of 17 declares to having been drunk at least three times in a year with 10% declaring to having been drunk at least ten times. The problem is affecting the whole country from north to south but the lack of a nationwide coordinated plan been, has opened the way to a plethora of local initiatives, based on different and sometimes creative solutions, but all inspired by the common goal of discouraging those hordes of out-goers to hang around till very early hours, especially at week-ends: in some cases local rules were made stricter and sanctions severed as in the case of the ordinance issued by the Mayor of Palermo, L. Orlando, permanently banning outdoor loud music and use of glasses beyond certain hours. In other cases protocols were signed between pub owners and municipalities to agree on a number of reciprocal obligations to be met by both parties to foster a smooth-running of night-life activities in the concerned areas.<sup>98</sup> In other

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<sup>98</sup> *‘Patti Chiari per la notte, nuove regole condivise per la movida fiorentina.’* accessed November 4; available from



cases some curious strategies were devised, such as the one chosen by the Municipality of Florence where the street-cleaning service, involving the use of hydrants, has been delayed to later hours as a way to discourage protracted permanence of out-goers in the streets beyond a certain time. Extreme solutions, in other cities, have displayed the recourse to the public prosecutor's office as a way to force municipalities to enforce more severely regulations. In Turin, for example, a bar owner was convicted, pursuant rule 659 of the criminal code, and subjected to a fine of Euro 2500,00 to be liquidated to the plaintiffs. In Sardinia the Administrative Tribunal in Cagliari found the Municipality of Santa Margherita guilty for failure to implement the consequent measures to guarantee the right to tranquillity of residents in a neighbourhood being affected by widespread night-life activities. These described complexities show how many factors are behind drinking trends: the right to enjoy cannot of course be obliterated but it needs to be carefully balanced with the right to sleep and to an smooth-running of urban dynamics. In Palermo, widespread alcohol consumption would appear to have been encouraged by the relatively recent multiplication of drinking opportunities combined with low prices for drinks. Especially the downtown area has been interested, since the early nineties, by a proliferation of bars and pubs allowed by authorities as a strategy to revive dilapidated areas and to increase work opportunities in a territory heavily struck by economic crisis. This policy has undoubtedly generated some desirable results, as confirmed by the steady increase of take-over and renovation of real-estate in the concerned area; but, in the long run, this has generated also some

unintended consequences paving the way to an increase in alcohol consumption, especially among the youth seeking some ‘tough’ alternatives to the boredom of their daily routines. Clearly these issues cannot be easily tackled by an understaffed Police corps. Alcohol enforcement measures, in fact, are limited by the Police capacity. Just like with speeding the described phenomenon is per definition spread out on the territory and the Police do not have and probably could not have the necessary staff capacity to exercise such a capillary control. Since the issue needs structural solutions starting from clear organizational rules for all parties concerned a more realistic targets for the Police would be to focus on those drinking habits associated with driving that seriously jeopardize safety on roads. Technology used to detect speeding offences could indirectly help to deter alcohol abuse provided that cars are actually stopped when a speeding offence is detected. Technological solutions to this effect exist as it will be outlined in following chapters describing the state of the art of the possible options available to enforcement agencies.

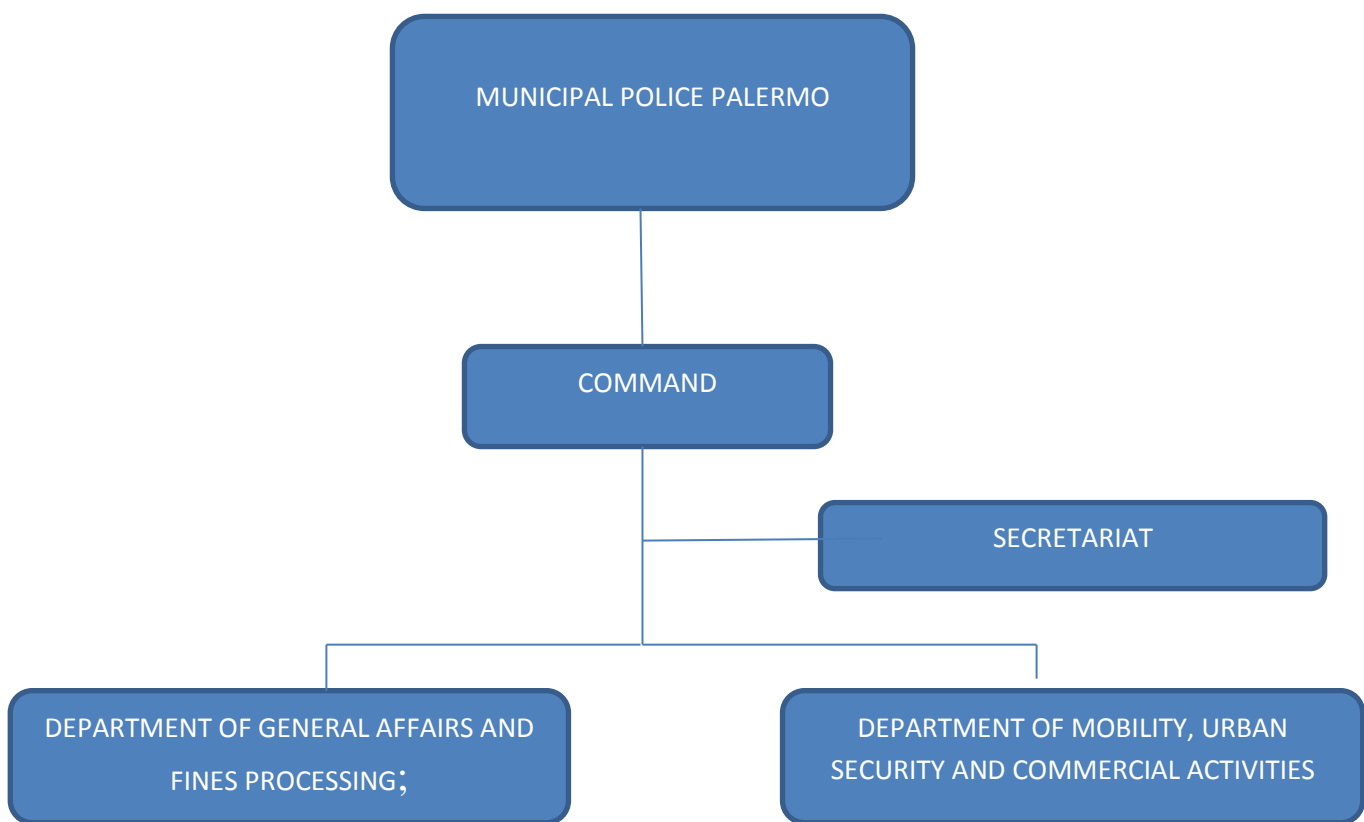
#### **5.4 The Municipal Police Corps in Palermo: An overlook of their internal organization**

The Municipal Police in Palermo are a specialized police corps being the direct expression of the Municipal authority and exercising multifaceted functions in ambits of strict relevance to the territory which they serve. In particular the primary responsibilities of the Municipal Police cover such aspects as:

- the enforcement of the Highway Code within municipal boundaries;
- controls of conformity of commercial activities to national and local regulations;
- controls of conformity of buildings to the national and local regulations as well as the prescriptions stated in building permits;
- cooperation with the Judiciary in criminal investigations;
- Competences in urban security with particular emphasis on peaceful cohabitation and furthering of public décor;

These activities are globally exercised by the departments the Municipal Police in Palermo consists of and which can be broken down as follows:

- Command of the corps;
- Department of General Affairs and fines processing;
- Department of Mobility, Urban Security and Commercial activities;



**Fig. 5.1:** Structure of the Municipal Police organization

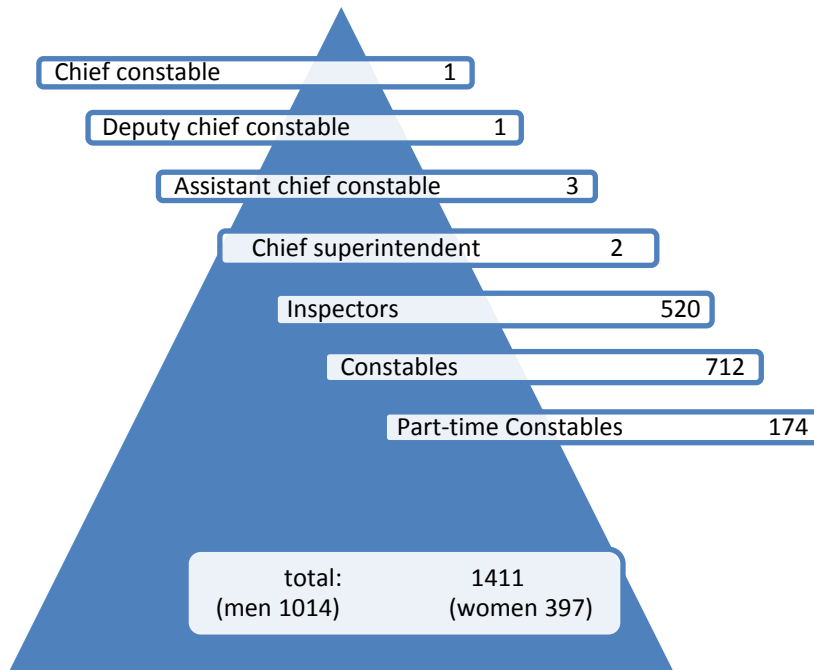
More in details:

**The Command** of the corps has responsibilities for smooth-running of the corps' institutional activities, for the training and for the practical implementation of the Major's directives on the city priorities to be pursued. A specific secretariat (*Ufficio di Staff*) supports the activity of the Commander in his multiple responsibilities;

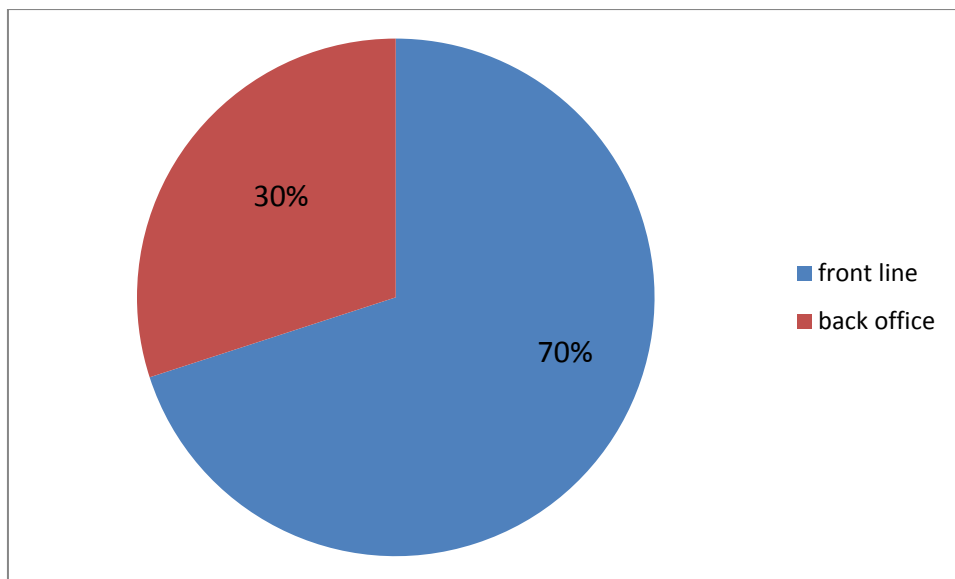
**The Department of General Affairs and fines processing** is responsible for the follow-up of all the administrative procedures related to fines: from the processing to notifications, to the management of possible appeals filed by offenders and to the necessary coordination with other institutional bodies playing a role in the sanctioning procedure.

**The Department of Mobility, Urban Security and Commercial activities (MO.SI.C.)** exercises, among other things, the functions of Traffic Police within the urban area, enforcing the prescriptions of the Highway Code and possible local contingent regulations. Another fundamental responsibility of the department concerns controls of commercial activities with respect to administrative issues, to conformity of activities to norms, to consumers protection. In addition to these core activities the Department also deals with pollution checks, coordination of staff deployment to preside over institutional events, to municipal buildings protection.

Total staff presently available amounts to 1400 officers. Out of this overall figure 174 units are working on a part-time basis. Figure 6 provides a visual description of how the force is broken down according to the different attributions and grades. Figure 7 reveals the ratio of the allocation of the force between internal and external activities:



**Fig. 5.2:** the staff in force at the Municipal Police in Palermo



**Fig. 5.3:** internal and external staff in force at the Municipal Police in Palermo

The activities, within each department, are split among the so called ‘operational units,’ representing the Department’s basic cells, each of which

is specifically responsible for a given segment of the global responsibilities. Although not directly responsible for ‘public security’ issues - which laws reserve primarily to the State Police - the Municipal Police corps may be, and as a matter of fact is, more increasingly required, by the former, to assist with certain activities. In Palermo this cooperation has been increasing, in recent times, in particular with those joint-police activities, labeled under the acronym CIT (*Controllo Interforze del Territorio*), coordinated at territorial level by a committee (*Comitato Provinciale per l’Ordine e la Sicurezza Pubblica*) presided by the local representative of central Government, with the contribution of Mayors when specific issues affecting communities are involved. The goal of this initiative is to improve the perception of security by the population. Further to the theoretical authorized strength, in fact, the Corps should rely on 2100 employees but the financial restrictions faced by municipalities have practically impeded recruitments in recent years. This fact, inevitably, translates into a progressively aging of the workforce with obvious consequences on the quality of the service: in particular night-shifts are severely affected by these constraints since age requirements forbid the deployment of officers beyond a certain age-limit to night beats. Out of the possible solutions, to make up for such structural weaknesses, technology has been seen by many as a valuable option: technology, in fact, as it has been outlined in previous chapters, can help in many ways: from streamlining processes to favouring a capillary geographical monitoring, technology, in police activities, enables to optimize the use of personnel by allowing a more efficient redeployment. In Palermo the Municipal Police currently rely on technological solutions for the following aspects:

- internet-based communication systems to ease interactions with citizens inquiring into administrative issues:
- ‘geographic information systems’ (GIS) to more efficiently screen the territory and easy detection of criticalities in the road network (i.e. ‘hot spots’);
- ‘street control’ initiative which through cameras installed on mobile patrols allows a more effective sanctioning process for parking offences;
- speed enforcement

Oncoming technological solutions in the city will allow deterrence to irregular accesses to traffic restricted zones through a permanent system of fixed cameras. Worth-mentioning is also an initiative, soon to be launched at national level, to tackle the widespread phenomenon of vehicles circulating without a proper insurance coverage. A specific software in fact, connected to a national database, will process pictures detected by cameras, in use to police forces, and capturing cars’ plates so identifying those not in order with insurance obligations. By all evidence, this initiative, will optimize the efforts of enforcement agencies which will not have to rely any more on time-consuming random checks but will be able to focus immediately on specific trespassing as detected by cameras. Clearly the whole set of these described technological applications have contributed and will further help streamline a number of processes with a view to allowing a more efficient redistribution of personnel and to reducing the duration of procedures. In the wake of this optimism a particular attention has been recently devoted to



how technology could contribute to reduce road accidents and, in particular, the phenomenon of speeding and drunk driving: for these specific offences the police presently relies on the following sorts of equipment:

- Autovelox 105 SE
- Tele-lasers
- Permanent installations (*boxes*)

1. Autovelox" is a trademark registered by Sodi Scientifica SpA but for many it has become a synonym for speed control. The first studies, by Fiorello Sodi, on this tool date back to 1966. In the 1970's, following the oil crisis, these studies took the concrete shape of a product with the model "101" sold to the Italian Traffic Police. Autovelox is based on a pair of laser beams crossing the road at right angle towards the traffic flow. Interruption of the two beams by the passing vehicle (car, motorcycle or truck) leads to the speed on the basis of the space/time ratio, where the space is the space between the two laser beams and the time is the time passing between the interruption of the first and the second beam. When two cars appear in the same picture it's the position of the vehicles in the picture that establishes with certainty which one has committed the violation. Recent versions of this tool like the "Autovelox 105 SE" have improved the quality of pictures so reducing the chances of appeals by motorists: thanks to a special device, the latest generation of Autovelox takes two pictures of each violating vehicle, and one of these shows only the violating vehicle. "Autovelox 105 SE" signals the definitive change to digital imaging

technology in speed enforcement. No more wet-film development or analog video system evaluation, but digital images recorded and retrieved via central computer. Digital information management allows a substantial increase in efficiency through the complete automation of the violation process. Image and violation data can be easily processed at once, thus avoiding any operation required by the traditional film.<sup>99</sup>

2. Tele-laser The measurements employ a pair of harmless, undetectable class 1 laser beam that are directed to the approaching vehicles frontally. Beams in sequence (Doppler's effect) results in a speed measurement and, in case of excess of speed, the infraction is immediately registered. The laser's beam is approximately 3 feet wide when it reaches a distance of 1000 feet away. This is how it is possible for officers to visually identify a speeding vehicle, pinpoint its exact location on the roadway, and then validate its precise speed. The previous generation of such tools were not relying on images and therefore , for legal purposes, the offending vehicle needed to be stopped immediately;<sup>100</sup>
3. The permanent installations (*boxes*) rely on laser beams too, placed perpendicularly to the flow of traffic; breaking the beams in sequence results in a speed measurement and, in case of excess of speed, activates the imaging equipment to register the image of the violating vehicle on magnetic tape;

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<sup>99</sup> *SODi Scientifica, Traffic division*, accessed on 4 november 2015, available from <http://www.sodi.com/>

<sup>100</sup> *Laser Measurement, 'experience the power of reflector less laser measurement technology'* accessed on 4 november 2015, available from <http://www.lasertech.com/>

Among the downfalls associated to the described tools was the quality of pictures of previous version which was frequently used as a basis for the numerous legal challenges undertaken by motorists to escape the sanction. Additional arguments used by motorists for similar purposes was the alleged lack of regular calibration of such tools. Nevertheless, with respect to calibration, a recent decision by the Italian Constitutional Court has excluded these tools from such an obligation.<sup>101</sup> Despite these legal challenges the described tools seem to have made their way as reliable instruments for speed enforcement purposes. Some doubts still persist as to the reliability, in terms of speed and drunk driving prevention, of camera-based solutions as opposed to other technological options.<sup>102</sup>

## **5.5 The mobility division (MO.SI.C) and its contribution to tackle speeding and alcohol abuse**

The mobility division is a specific department, within the Municipal Police, with responsibilities to enforce, among other, the prescriptions of the Road Code within the urban area. The main goal of the division is to foster road safety in the city through preventive and repressive activities designed to reduce conducts that could eventually lead to road-related fatalities. This task is implemented through a regular two-shifts patrolling of the main roads mainly performed by motorcycle units. As it appears from the table below

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<sup>101</sup> Corte Costituzionale, *'Giudizio di legittimità in via incidentale, norma impugnata: art.45 CdS'*,113/2015

<sup>102</sup> G. Foti, *'l'esperienza delle videocamere sugli autobus torinesi e sulla linea uno della metropolitana automatica di Torino'* Atti del convegno, Regione Piemonte 2005

speeding is, by far, the most recurring infringements out of the those committed most frequently.

<b>Most recurring infringements of the Highway Code Year 2013</b>		
<b>ARTICLE</b>	<b>REASON</b>	<b>CASES</b>
Art 142	Speeding	982
Art 154	Drivers' error or reaction	552
Art 145/4	Junction overshoot	265
Art 145/5	Disobeyance of the 'STOP' sign	236
Art 145/1	Careless driving at crossroads	72
ART 191	Careless driving towards pedestrians	310
Art 145/2	Failure to give priority to the right	142
Art 190	Pedestrians careless crossing	34

**Table. 5.1:** Most recurring infringements of the Highway Code Year 2013

The specific peculiarities of this infringement necessarily require effective tools to enable the police to rely on sufficient legal evidence that can sustain any legal challenge. Although alcohol related offences are not listed in this table the specific potential of danger inherent to such offences has induced the Municipal Police to exercise particular attention to this particular case too. Detecting alcohol offences require different approaches since they can of course be detected by cameras although they require specific personal checks to be performed by trained patrols equipped with alcohol-test devices. It would seem that these two offences can only be tackled through different modalities although it is assumed in this thesis that specific modalities to

tackle speeding could simultaneously lead to detection of drunk driving too. To perform the different tasks effectively the MO.SI.C division would need to rely on more staff but the present situation, characterized by understaffing coupled with an increasingly aging workforce, puts the efficacy of the division under severe strain.

<b>Breakdown per function of staff in force at the Mobility division</b>	
<b>Total staff</b>	<b>520</b>
Traffic police	273
Presidiums at institutional buildings	66
Speed-enforcement unit	25
Accident-investigating unit	58
Towing unit	13
Street control unit	4

**Table 5.2:** staff in force to the MO.SI.C division

The mobility division, in particular, more than other Police services, is expected to be operational on a 24-hour basis since road circulation, obviously, does not stop. Approximately 270 policemen dedicated to traffic are split between the two main shifts covering the time frame from 7:00 to 14:00 and from 13:00 to 20.00. Providing adequate coverage of night-shifts and week-ends has proven to be one of the most critical issues since the lack of staff coupled with the age restraints for night-shifts, of a substantial percentage of the members of the division, make the fulfilment of this duty quite complicated. Technology is expected to cover some gaps and therefore

it has been increasingly hailed as one of the possible solutions to direct efforts to. At present the Municipal Police is equipped with the such instruments as described in the previous chapter like the tele-laser, the autovelox and some fixed cameras. Some increase in such technological appliances could be encouraged by recent legal prescriptions that allow the utilisation of revenues proceeding from fines to finance safety-dedicated investments.

## **Chapter six**

# **THE CONSTRUCTION OF A DYNAMIC PERFORMANCE MANAGEMENT MODEL TO ANALYSE MUNICIPAL POLICE STRATEGIES IN PALERMO TO TACKLE SPEEDING AND DRUNK DRIVING**

## **6.1 Introduction**

This chapter focuses on an empirical case, conducted within the MO.SI.C division, to assess the potential contribution of different technological solutions to improve the division's overall performance in reducing road-related fatalities. In particular the analysis intends to focus on the possible effects that the alternative or combined use of the currently available speed enforcement tools can have with respect to the following points:

- improving the territorial control capacity;
- prevention;

- assuring an adequate flow of sanctions-generated income to finance road-safety related initiatives;

Previous paragraphs described the difficulties, encountered by the Municipal Police in Palermo, in tackling such driving offences as speeding and drunk driving. Understaffing is claimed to be the main reason for such difficulties, in particular during the peculiar time-frame when these offences are more likely to occur, and when the operational capacity of the Municipal Police is even more limited. To make up for this lack of workforce technological solutions are going to be considered here to evaluate how they might impact the Municipal Police's effectiveness in reducing dangerous driving behavioural patterns. Besides, the very peculiarities of these driving phenomena require specific metrics, which necessarily have to be performed by machines. The question is whether to rely on fully automated solutions or to favour other options involving the use of some workforce. The tools currently used by the MO.SI.C division can be divided in two main categories:

1. Those essentially relying on images captured by specifically designed cameras and not requiring a physical stop of the offending vehicle;
2. Those using a laser-based technology which on the contrary require an infringement notice to be issued directly on the spot;

The common aspect between these tools is their capacity to enhance the sanctioning potential for the Municipal Police, but they differ in terms of

workforce utilisation and in their preventive effects. Presently the equipment in use within the MO.SI.C. division includes the following tools:

- Permanent installation;
- Autovelox;
- Tele-lasers;

Permanent installation perform their operations automatically and send the pictures of any detected speeding infringement to the administrative unit responsible for processing the images and for issuing the sanctions. This solution minimizes the workload for the officers which need not be physically deployed to 'hot spots.' Autovelox devices, based as well on cameras recording systems, differently from the full automated options, require some additional capacity in terms of human resources: cameras, in fact, need to be operated by the personnel in force to the speed enforcement unit to be later processed by the administrative department following the usual procedure. Tele-laser on the contrary require less administrative work for the administrative department - since the infringement notice is issued right away without the need of any further elaboration by other departments - but more police capacity on the spot: next to the patrol responsible for performing the measurement, in fact, there needs to be another one in the vicinities to allow an actual stopping of the offending vehicle. All these options guarantee a financial return for the Municipal Police which, further to the recent reform of rule 208, of the Italian Highway Code, provision 4, states that at least 50% of all revenues proceeding from sanctions must be



reinvested in road safety initiatives with particular emphasis on educational campaigns, acquisition of equipment and the reduction of fatalities occurring at night. The same reform states that part of the proceedings from sanctions may be used also to finance additional working-shifts or for temporary recruitments to cover peak periods. In addition the city Council can discretionally rule that also the remainder of the total be invested for the same purposes. Clearly this is a formidable opportunity for municipalities to obtain additional funding at times of severe budget cuts. The temptation looming ahead could be that of increasing the fines-generated revenues by, surreptitiously, pretending to be pursuing deterrence. Clearly this is a theoretical hypothesis since such an extreme strategy would probably be exposed to drastic political challenge, by interest groups and concerned parties, not to mention the discredit that it could generate to the image of the Corps itself. Nevertheless this hypothesis is still useful as a theoretical point of departure to analyse possible degrees of implementation of cameras to pursue the above mentioned targets. Maximising the financial aspect through an increase of cameras-based sanctioning does not seem to be a desirable policy though. Fines can be considered, in fact, as an output measure but certainly not an outcome for the community. In fact it would probably be naïve to expect that such an impersonal law enforcement method can really have an enduring effect on drivers' perceptions so as to modify their attitudes. The temporal divide, in fact, between the moment when the misconduct takes place and its actual sanctioning can dilute the awareness of the misbehaviour. Secondly, but not less important, cameras cannot detect any other possible offence but speeding. If the vehicle is not stopped, in fact, other possible infringements would remain undetected. Thirdly, the

Municipal Police cannot afford to spoil their image and be considered as an Institution mainly dedicated to be a drain on drivers' purse. Authoritativeness and credibility are two intangible assets that cannot allow a spoiled image. More realistically to achieve a global service outcome technological options and human action need to be balanced to pursue a result that can be beneficial to the community on the whole and not just to internal reporting statistics. To this effect a need arises for a methodology capable of serving as a learning tool to analyse the impact of different policies and of identifying the best mix of resources that can guarantee long-term sustainability. Therefore the following paragraphs will present an in-depth analysis of the different effects deriving from the alternative or simultaneous use of the such speed enforcement tools, as those in use within the MO.SI.C. division, to pursue both goals of road accidents reduction and sustainable increases from fines-generated revenues.

## **6.2 The instrumental view of Dynamic Performance Management applied to the MO.SI.C division**

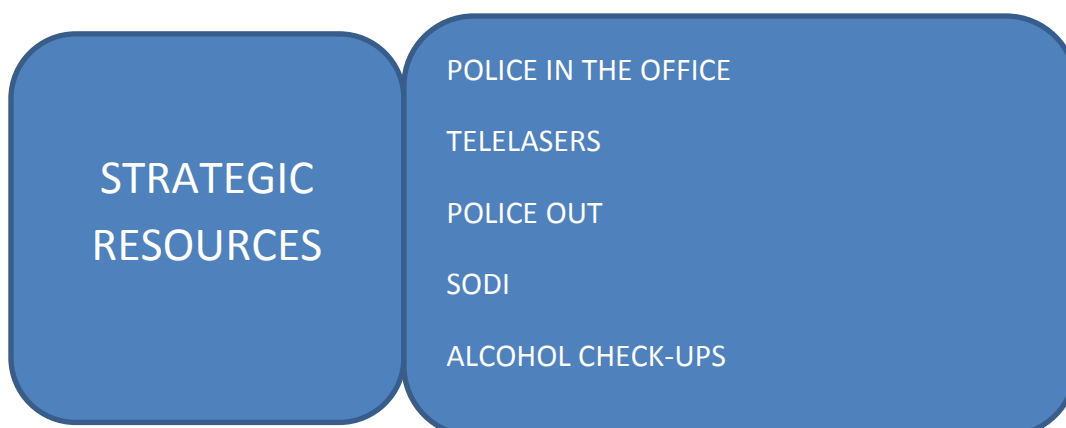
Given the number of trade-offs that could be generated, by the preference for either of the potential solutions described in the previous paragraph or by their reciprocal combination, the goal of this analysis is to use DPM as a learning tool to supply the Municipal Police with an instrument allowing to identify the best possible fit between alternative policy options and the results to be achieved so as to guarantee durable achievements in service outcomes. The design of a Dynamic Performance Management system,

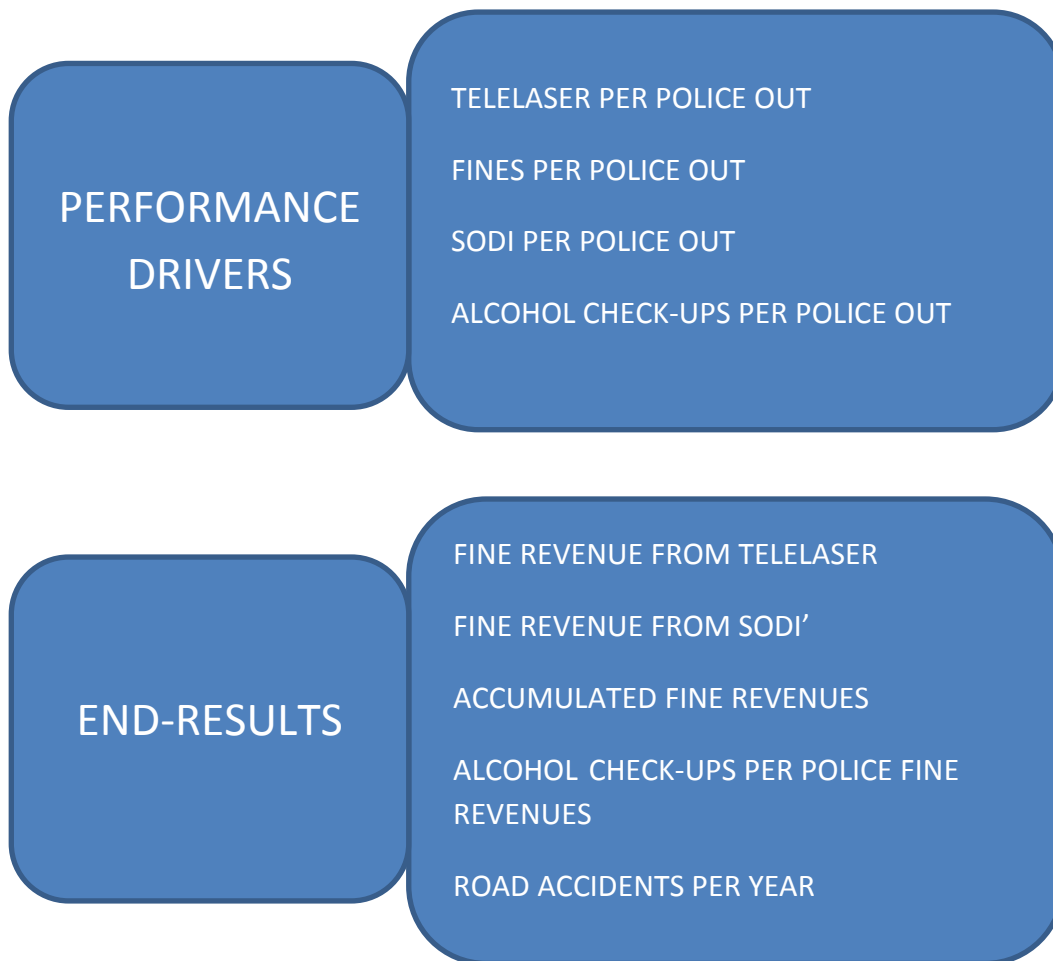
according to the “instrumental view” perspective, is a useful approach to analyse the ambit of operation of the MO.SI.C. division which is clearly characterized by a dynamic nature where processes are regulated by in and out-flows, operating over time. These flows, affecting the strategic resources, are basically the end-results which, synthetically, measure the overall organizational performance of decision-makers. The accumulation/ depletion of strategic resources depend on the value of corresponding inflows and outflows, which are modelled as “valves,” and which decision-makers can regulate through their policies (Bianchi, 2010). Furthermore the visual framework provided by this methodology enables to grasp, more easily, the circular interdependencies among main variables. Another advantage of this dynamic approach regards the possibility to detect those inertial signals, characterized by time-delays and non-linear relationships, which as explained by Bianchi, need to be constantly monitored to avoid unexpected scenarios that could drive the system towards unsustainability. Three are therefore the “must” for a correct implementation of this methodology:

- a) identifying those strategic resources that most determine success in the environment where an organization or different organizations operate;
- b) ensuring that the endowment of such resources is satisfactory over time;
- c) keeping a proper balance between the different strategic resources;

The strategic resources are the key factors that allow processes to start since they enable to determine the degree of effort that can be deployed to achieve end-results. It would be, in fact, extremely detrimental, to every organization’s long-term sustainability, to pursue unrealistic goals which the

strategic resources would not be able to sustain. Unrealistic management of the end-results would probably generate a gradual, unsustainable consumption of the available resources, exposing organizations to a sudden exhaustion of their strategic assets. On the other hand, an efficient and well-calibrated management of the system would generate value, which could be moved from the end-results back to the strategic resources, creating an reinforcing feedback. With this introduction in the background, the attention can now be turned to the three-layered framework of DPM describing the main variables, characterizing the ambit in which the MO.SI.C. division operates, to reduce road-related fatalities and which is going to be the object of this case-study:





**Fig. 6.1:** Overview of the main variables characterizing the MO.SI.C. ambit of operation according the DPM perspective

To apply this perspective a three-layered framework is presented with all the involved variables grouped according of the nature that this methodology attributes to them: **the end-results (objectives)**, in the bottom layer, were made explicit first, as a starting point. Then, going backwards, the intermediate layer displays **the performance drivers (policies)** that affect the end-results and, finally, the top layer presents **the strategic resources** whose allocation allows decision-makers to influence performance drivers. In our model the end-results have been categorized as **'initial' end-results**,

of purely financial nature, deriving from the revenues proceeding from the sanctioning activities, and **‘final’ end-results** basically coming down to the ‘reduction of road accidents per year’ as a result of the combined effects of the preventive effect of remote sanctioning and infringement notices issued on the spot by the Municipal Police. Every single end-result is referred to at least one related indicator and to one strategic resources although this is not a necessarily strict requirement for the methodology does not pose any particular limit to the amount of drivers that can be activated to drive a given end-result. In the specific case being investigated here four key performance drivers have been identified against the three financial end-results described above. These drivers can be described as a ratio between a given amount, say the number of technological devices available to the Municipal Police and the number of policemen to operate each one of them. Their importance, as policy levers, is evident since their increase allows, up to a certain extent, to enhance the deterrent effect and increase the fines-related revenues for the Municipal Police. The table below displays the respective associations of these drivers to their corresponding end-results:

<b>Performance driver</b>	<b>Related end-result</b>
- ‘fines per police in the office’ - ‘SODI per police out’	- ‘fine revenues from SODI’
- alcohol check-ups per police out	- ‘fine revenues from alcohol control’
- ‘tele-laser per police out’	- ‘fine revenue from tele-laser’

**Table 6.1:** outline of Performance drivers against end-results

Out of the four identified performance drivers three respond to the same logic: **‘alcohol check-ups per police out,’** **‘tele-laser per police out’** and **‘SODI per police out’** represent, in fact, the individual pieces of technological equipment dealt out per police officer. The underlying idea is that the more individual pieces available the more controls could potentially be performed. We will see later how this linear equation is bound to encounter some limits related to the amount of officers available to operate single devices. The fourth driver **‘fines per police in the office,’** on the contrary, reveals a different logic applicable to those sanctions that are not directly issued on the spot but which require further elaboration by back-office staff. In conclusion, only the end-result **‘fine revenues from SODI’** depends on two drivers, namely the **‘SODI per police out’** i.e. individual devices available for controls’ and **‘fines per police in the office’** i.e. amount of back-office staff to perform the necessary administrative procedure to extrapolate the content of pictures and issue the sanction. The other two financial end-results **‘fine revenues from alcohol control’** and **‘fine revenue from tele-laser,’** on the contrary, would seem, in the first instance, to depend on the numerical availability of the related devices to be used for controls. This latter assumption is only partially true since, as it will be outlined in the paragraph describing the causal loops, the virtual unlimited potential in the increase of manually-operated devices is going to be limited by the finite value of the workforce which cannot be increased accordingly. In principle such variables as ‘tele-laser’ or ‘SODI’ equipment, which in this model are considered as drivers, could, on their own, be seen, as strategic resources as well. The same could be said for police as a human capacity. But in this model it is the ratio of the two that drives the flows of end-results

and that justify their utilisation as drivers. In other words that ratio between the devices and the staff gives rise to the performance driver as it is in our structure. These drivers are then compared to their respective standard values (benchmarks), which in the case of the Municipal Police in Palermo are represented by past performance, deduced from yearly observations about the correlation between certain amount of fining activity and its effect on the variation of accidents around the normal/acceptable value. However, since the drivers do not influence the situation directly but through a chain of flows (revenue flows) the benchmark/standard values are calibrated for those values rather than drivers. The strategic resources, identified in this model, are five. The table below gives a synthetic outline of their association with the end-results:

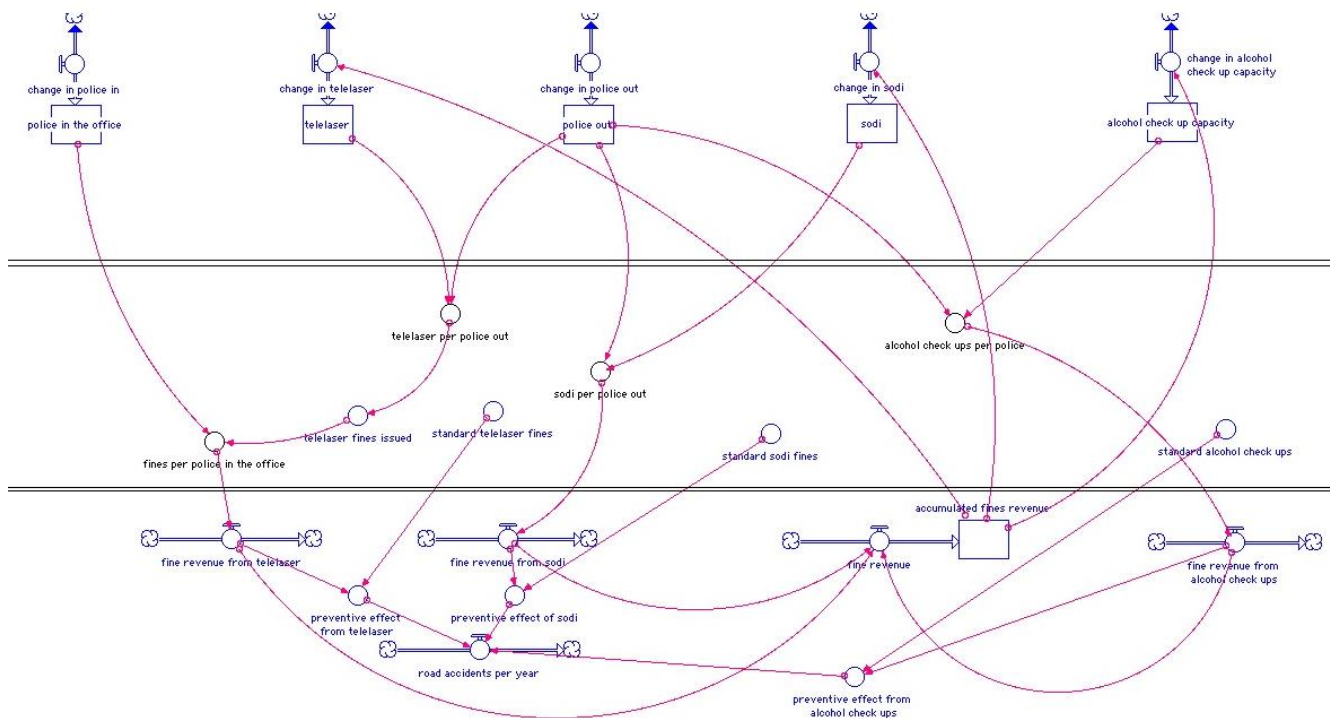
<b>strategic resource</b>	<b>end-result</b>
- tele-laser	‘fine revenue from tele-laser’
- SODI	‘fine revenues from SODI’
- alcohol check-up capacity	‘fine revenues from alcohol control’

**Table 6.2:** outline of strategic resources against end-results

**Tele-laser, SODI and alcohol check-up capacity** are represented by the number of individual pieces of equipment available to the MO.SI.C division and to be assigned to the single patrols for speed enforcement purposes. Some additional clarification is felt necessary for the variables ‘**police in the office**’ and ‘**police out**’ since they have been inserted in the layer where the



strategic resources are grouped although they are not, strictly speaking, fulfilling that function in our model. By closely looking at it, in fact, it appears that the police-related variables are not fed back by possible increases in the fines-generated financial resources the way, on the contrary, it happens with the technological devices. This specific mechanism can be justified by the fact that, in this thesis, the human resource variable has been considered as 'static.' In previous chapters, in fact, it was widely described how the recruitment option is not, for the time being, a viable one for municipalities due to budget cutting. Nevertheless in the real organizational patterns of every day's routine some minimal movement from back-office to operational activities and *vice versa* are, not only potentially possible, but, as a matter of fact, happen. Obviously the distribution of police will be affected by the performance of the related end- results. That means that, despite the rigidities characterizing the human factor in terms of new recruitments, it is nevertheless possible to rely on *ad hoc* programmes that allow some officers to be made available for specific contingencies. And it is this flexibility between the two categories of police (in, and out) which brings those two towards a strategic resource concept. In conclusion, despite our assumption which technically does not allow to consider staff-related variables as strategic resources on their own, it is the distribution between back-office and operational activities that counts. And while in the model we do not have a decision rule for allocating police explicitly, we do however formulate explicit police allocation variable (in and out) which allows us to run scenarios. This ensures that the model is not extremely complex but still useful to identify the trade-offs generated by the decision to keep more or less police in the office.

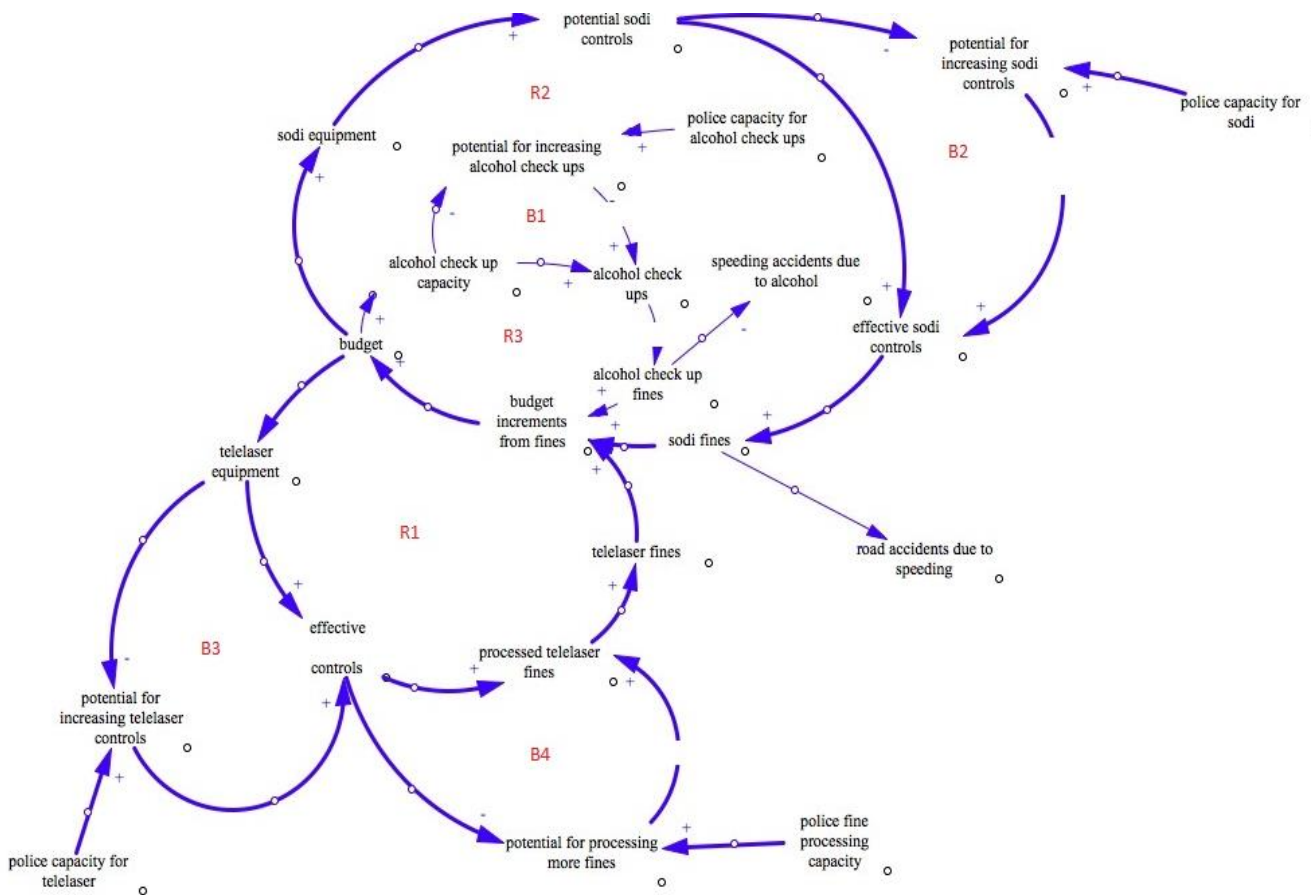


**Fig. 6.2:** an instrumental view outline of the MO.SI.C ambit of operation

### 6.3 The feedback perspective: the Causal Loop Diagram (CLD)

Figure 6.3 portrays the causal loop diagram of the model (CLD). As Richardson stated, the loop concept, in the social sciences, underlies the notions of feedback and circular causality so as embedded in the very foundation of systems theory<sup>103</sup> As previously stated, the CLD allows to sketch a visual representation of the feedback perspective in the current analysis. In other words CLD tells the whole story behind the model in an extremely concise way.

<sup>103</sup> G. Richardson, *Feedback Thought in Social Science and Systems Theory*, System Dynamic Review (1999)



**Fig. 6.3:** the causal loop diagram

Feedback loops are fundamental in SD since they help us understand the behaviour of a system by focusing on its structure (endogenous view), without considering external variables. The causal loop model presented in this chapter highlights the causal relationship between the fine-generated revenues, the number of technological devices available to the MO.SI.C. and the availability of staff. The diagram displays three reinforcing loops (R1, R2, R3) characterized by a direct linear logic between the financial resources available to the Municipal Police and the number of speed and alcohol enforcement devices that can be acquired. In principle it would seem that the more fines issued, the more they can lead to additional devices being purchased. This sort of relationship is clearly reinforcing but, as we will see,

only up to some extents: the virtual unlimited mechanism, according to which ‘more fines lead to ‘more tools’ in a seemingly ever growing pattern is eventually bound to be interrupted by impossibility for the workforce factor to grow accordingly. In other words the growth of strategic resources (SODI, tele-laser, alcohol check-up devices) generated by the described reinforcing loop will hit the limits posed by the police capacity. Having, in fact, too many devices and too few operators to operate them would lead to a virtual impossibility to obtain a growing impact on our system. To make this explicit the loops B1, B2, B3 and B4 display a variable called **“potential for increase..”** which is different from the label **“potential SODI/tele-laser etc....”** appearing in the reinforcing loops R1, R2, R3. More potential SODI /tele-laser, etc...,at a certain point, will actually be leading to a minor increase in the devices to be acquired (SODI, tele-laser...etc) because of the capacity limits in the availability of officers. Despite the many similarities affecting both reinforcing and balancing loops some additional explanation is felt necessary for loops R1, R2 and R3: in all the three loops, in fact, we have an **‘effective control’** variable (SODI, tele-laser): this variable implies that the effective number of controls will generate a given amount of fines issued as displayed in the loops themselves. This is immediately true for loops R1 and R2 though whereas in loop R3 we note that the **‘effective control’** variable does not directly lead to the related fine but to a **‘potential...’** for such fines: the difference described here is not only terminological but it reflects a clear structural difference between different strategies focusing on sanctions deriving from automated tools requiring further elaboration by the administrative unit, and semi-automated solutions involving more involvement of patrols in the streets but guaranteeing a better preventive

effect. As we will see in the paragraph describing the stock and flow model the main trade-offs identified through simulation derive specifically from which of the two options the Municipal Police decides to favour/implement.

## 6.4 The simulation

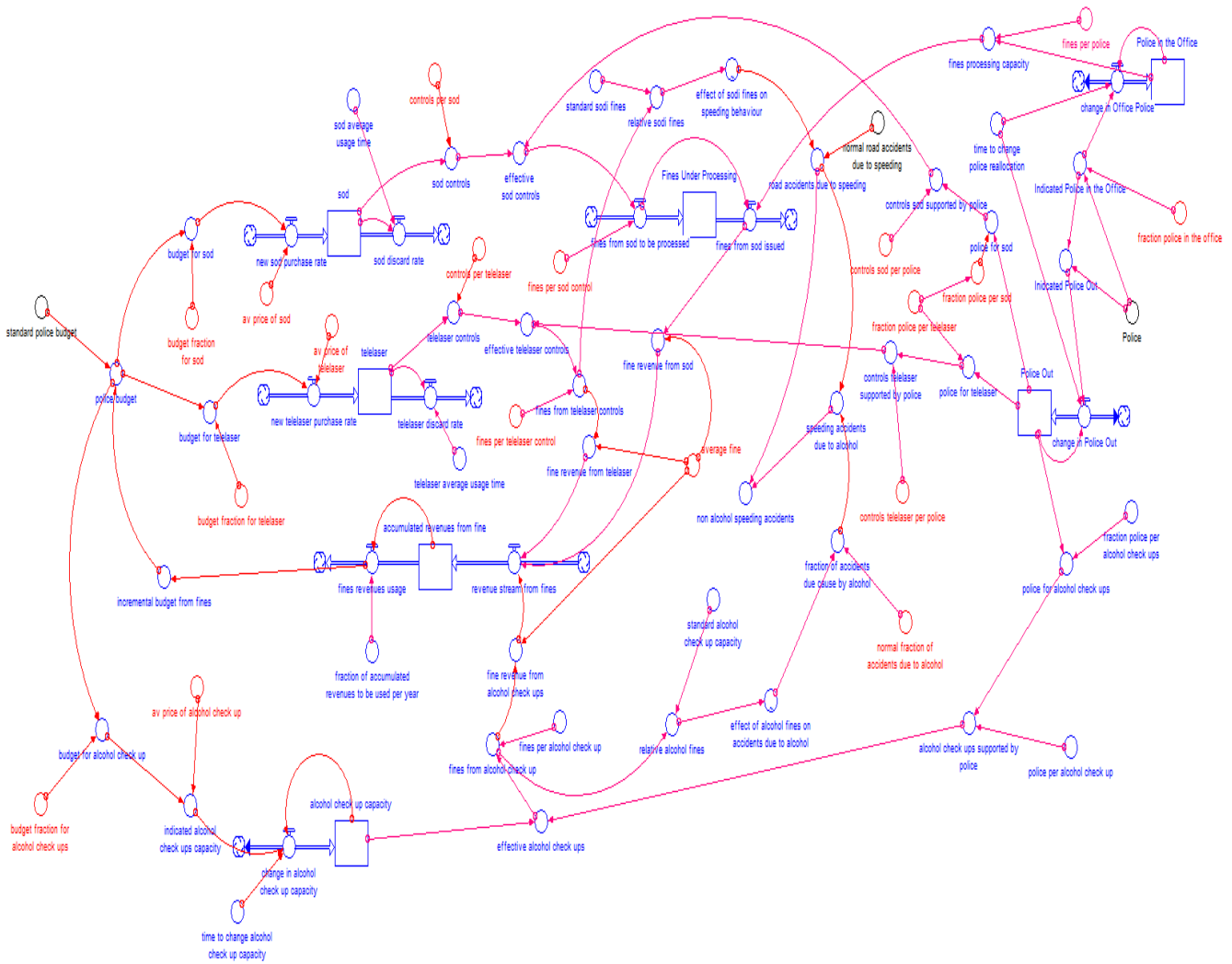
Based on the descriptions and the assumptions exposed in previous paragraphs, in this paragraph we portray four simulation scenarios derived by the responses of the model which has been specifically built to evaluate the best fit of policies which the MO.SI.C division could implement with a view to achieving a proper balance between meeting its financial targets and improving its institutional duties with regard to the reduction of road accidents. In particular, simulation runs are made to show the effects of:

- Scenario 1. The revenue from fines is NOT used for expanding technical equipment. This is achieved by setting the value of '**fraction of accumulated revenues**' to be used per year to be 0. The result is equilibrium. All the variables are in equilibrium here.
- Scenario 2. We allow all the fine revenues to be used for expanding equipment. By setting **the same variable** to 1. The result is growing strategic resources; the decline in speeding and alcohol accidents.
- Scenario 3. Since fine processing capacity limits the growth in the model, we can try a different reallocation within the police. We set the variable '**fraction police in the office**' at 0.3 now (we decrease it from 0.4). The result is higher fine revenues (we can process more) and

decreasing road accidents (we prevent more through more usage of SODI).

- Scenario 4. We know that SODI has an inherent potential for even further prevention of the accidents. Thus, we try a new allocation between SODI vs tele-laser police. We set ‘**fraction police per SODI**’ to be 0.4. The result is interesting. We do not have more revenues (because in this model SODI and tele-laser do not differ in terms of number of fines; we just redistributed within) but the road accidents drop even further because now we focused more on SODI and it’s the SODI that effects the prevention more. This is a good illustration of the importance of monitoring several indicators and not just one.

The stock and flow diagrams as well as the graphs resulting from different simulations were developed with iThink© 9.1.4. The model consists of seven ‘stocks’ and their corresponding inflows/outflows. For the sake of clarity these stocks will be grouped in categories so as to underline in an orderly way the different logics underlying their respective accumulation/depletion processes. The labelling chosen for the tables may slightly vary from the terminology used in the model but the overall meaning has been maintained.



**Fig. 6.4:** The MO.SI.C model

Category A

Stocks	Inflows	Outflows
sodi	new purchase rate	sodi discard rate
telelasers	new purchase rate	telelaser discard rate
alcohol check-up (tools)	change in capacity (+)	change in capacity (-)

**table 6.1** – category of stocks that can increased through financing

The category for these stocks reflects the idea that for any increase in the technological devices the Municipal Police need to rely on sufficient funds that could be generated by increasing their sanctioning activity. Obsolescence is, conversely, what determines the natural decrement of such devices.

Category B

<b>STOCK</b>	<b>INFLOW</b>	<b>OUTFLOW</b>
accumulated revenues from fines	revenues stream from fines	fines revenues usage

**table 6.2** – category of stock that accumulates all revenues proceeding from sanctioning activities

This category reflects the convergence of all revenues generated from fines into a stock where the moneys accumulate to be later reinvested to finance road safety initiatives.

Category C

<b>STOCK</b>	<b>INFLOW</b>	<b>OUTFLOW</b>
fines under processing	fines from sodi to be processed	fines from sodi issued

**table 6.3** – category of stock accumulating revenues from camera-detected offences



The logic forthcoming from this category reveals that the corresponding stock is fuelled by all those offences detected through camera-based solutions which, as described in previous chapters, require a further elaboration by the administrative unit before the fine proper can be issued and forwarded to offenders. This stock pinpoints an important trade-off between the need of processing as many offences as possible, through a full utilisation of back-office staff i.e.” to increase revenues for the Municipal Police” and that of increasing the street patrols so as to enhance the preventive activities related to tele-lasers controls. The more officers dedicated to back-office activities the less capacity for the operational units and *vice versa*.

#### Category D

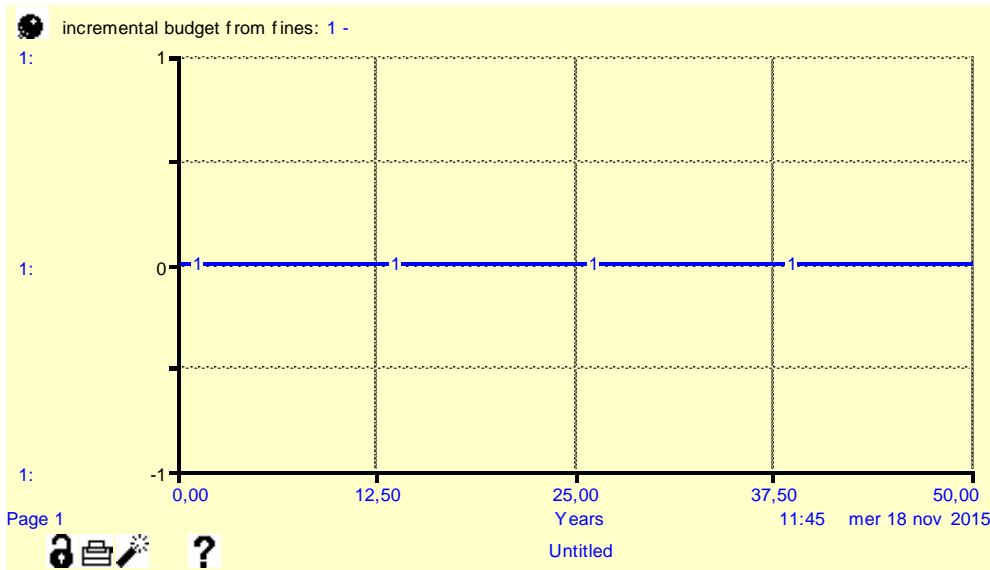
<b>STOCK</b>	<b>INFLOW</b>	<b>OUTFLOW</b>
police in the office	change of police in the office	change of police in the office
police out	change of police out	change of police out

**table 6.4** – category of stock that be increased/decreased through intra-departmental reshuffling of personnel

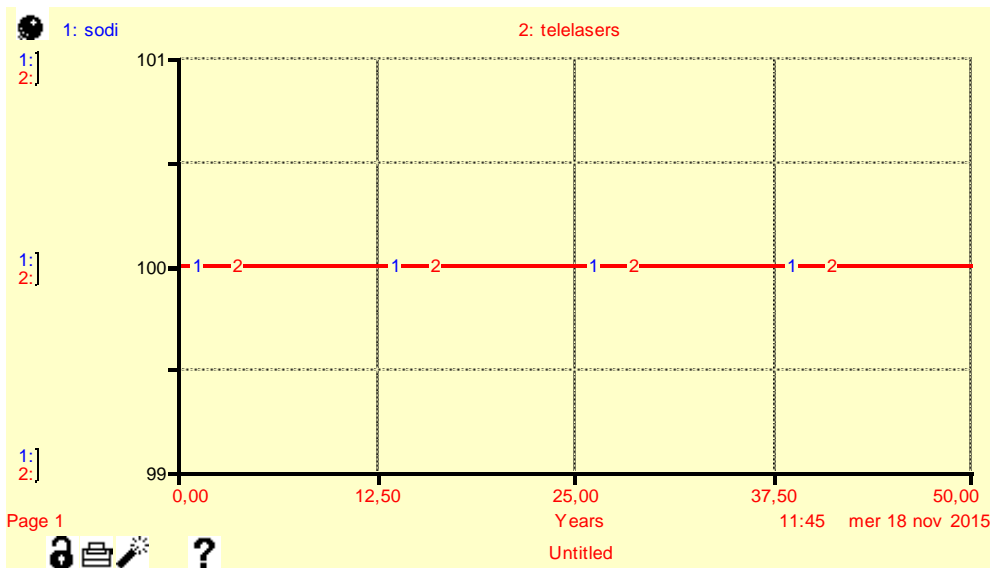
The two stocks appearing in this category represent the repartition of staff between back-office activities and external patrolling. On their own they are ambiguous stocks since they, unlike the other five, are not part of any feedback loop. In other words they cannot be increased/depleted by

endogenous mechanisms of the system. In principle they could since fine-generated revenues could be, theoretically, used to finance some recruitment policy but legislation in force presently rules out such an option. Nevertheless in the model they are still considered as stock since their numerical size, so as daily Police's routine displays, can be increased decreased by processes of intra-departmental reshuffling of staff. Officers can be required, in fact, to temporarily be deployed to either administrative tasks or to beats. With such a description in the background we can now move to describing the findings that simulation allowed to bring to the surface. The following graphs show the results achieved:

Graphs 1 and 2 display what happens in scenario I where explicitly no usage is done of the revenues proceeding from fines. This is what we call the *equilibrium* stage before the implementation of any policy whatsoever. Road accidents maintain their real level and so do the speed enforcement tools available to the Municipal Police. This initial situation is graphically displayed by the following graphs:

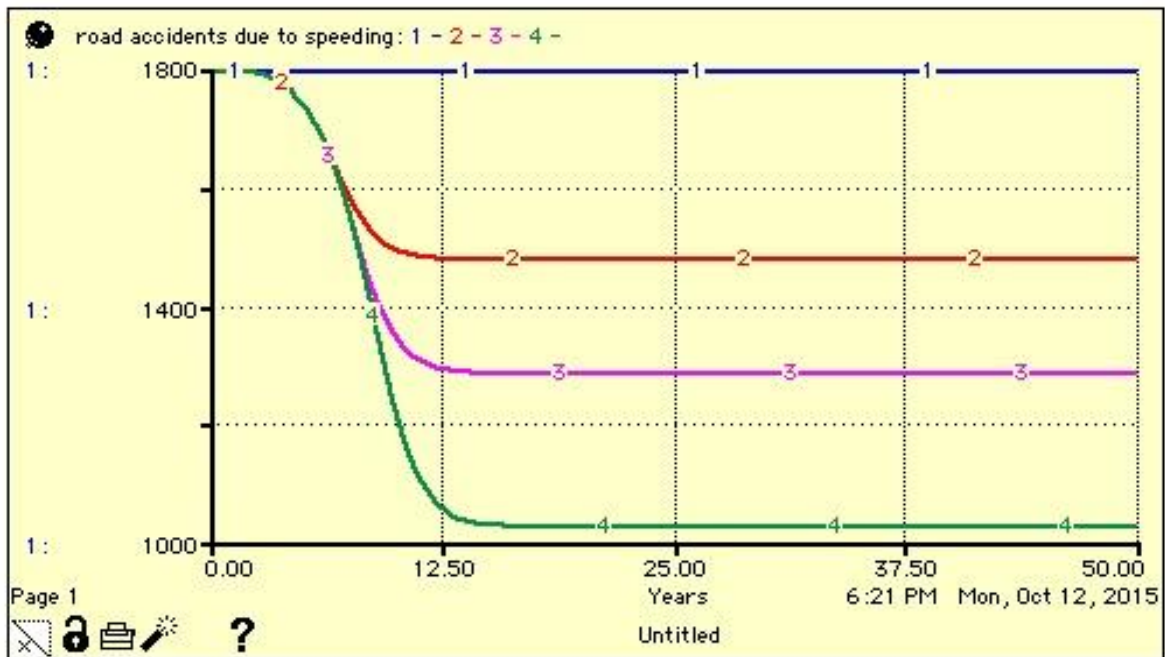


**Graph 6.1:** budget size before increase from fine-generated revenues



**Graph 6.2:** speed enforcement devices before implementation of policies

Graph 6.3 Here we move to a simulation where policies are explicitly applied: graph 6.3 displays the patterns of accidents resulting from the alternative implementation of the four policies related to the four scenarios introduced above:



**Graph 6.3:** simulation of four alternative scenarios on fines-generated revenues

Graph 6.3 displays on top of the X axis **the real value of of accidents** registered in 2013. The four curves correspond to the results that simulations delivered after testing the alternative policies introduced before: Curve 1 represents the pattern of accidents before any policy is implemented. It's the initial stage of 'equilibrium.' The additional curves, numbered 2 and 3, are related, each, to its respective scenario; from a quick glance we notice that curve 4 confirms the assumption according to which the actual stopping of offenders does enhance the preventive effect of police action. The number of accidents drops, in fact, to the lowest level as depicted by the graph. Nevertheless, at this stage, we do not know yet what the effect is of policy 4 on the target of fines-generated revenues. As a matter of fact the financial aspect

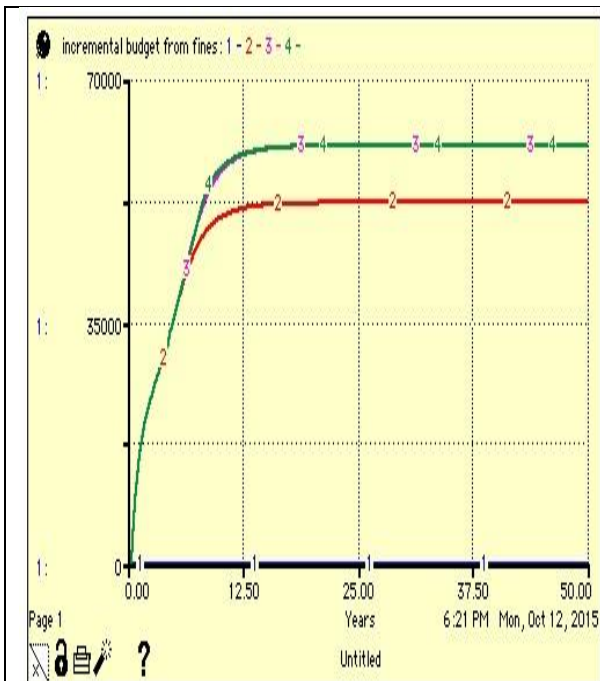
deserves also careful consideration since revenues are an important asset that the Municipal Police can invest to enhance road safety initiatives. In other words, when deciding on a possible policy to be implemented, the Municipal Police needs to balance possible trade-offs carefully against each other. It could very likely happen that pushing a target, beyond a certain degree, might generate undesirable implications to other objectives. Therefore a second simulation is needed to find out the effect of the four alternative policy scenarios on the financial factor:



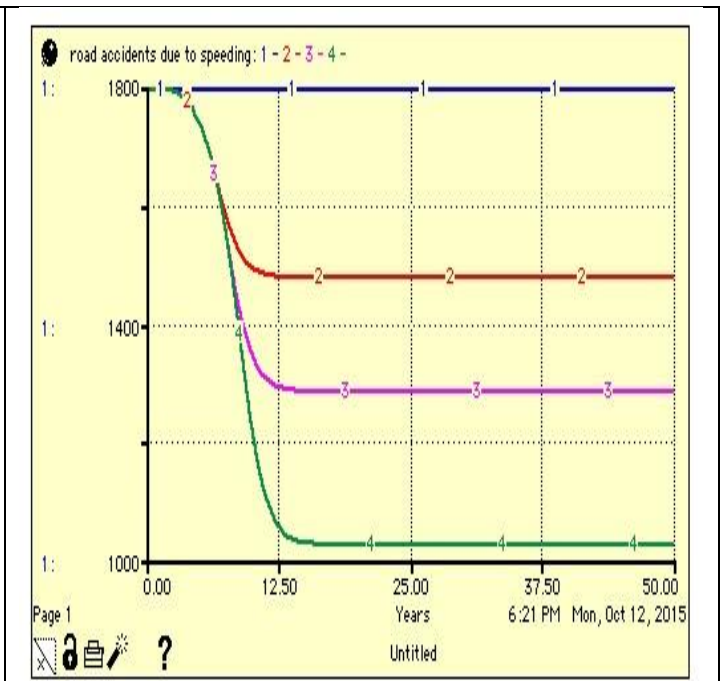
**Graph 6.4:** simulation of four alternative scenarios on road accidents

Since scenario I explicitly maps out the possibility to use fines-generated revenues for expanding the speed enforcement tools, graph 2 is accordingly not displaying the curve related to it. But from a quick glance at the other curves represented in this graph it clearly emerges that no difference, in terms of generated revenues, derives from the adoption of both policies 3 and 4. Since scenario II scores lower, in terms of financial gains for the

Municipal Police, this latter option must clearly be ruled out because of better alternatives are available to the Municipal Police. Consequently we are left with the choice between scenarios III and IV; but this dilemma is easily solved since it immediately appears, from a quick comparison of the two graphs represented below, that policy 4 guarantees the same financial gain as policy 3 but it scores better in terms of accident reduction.

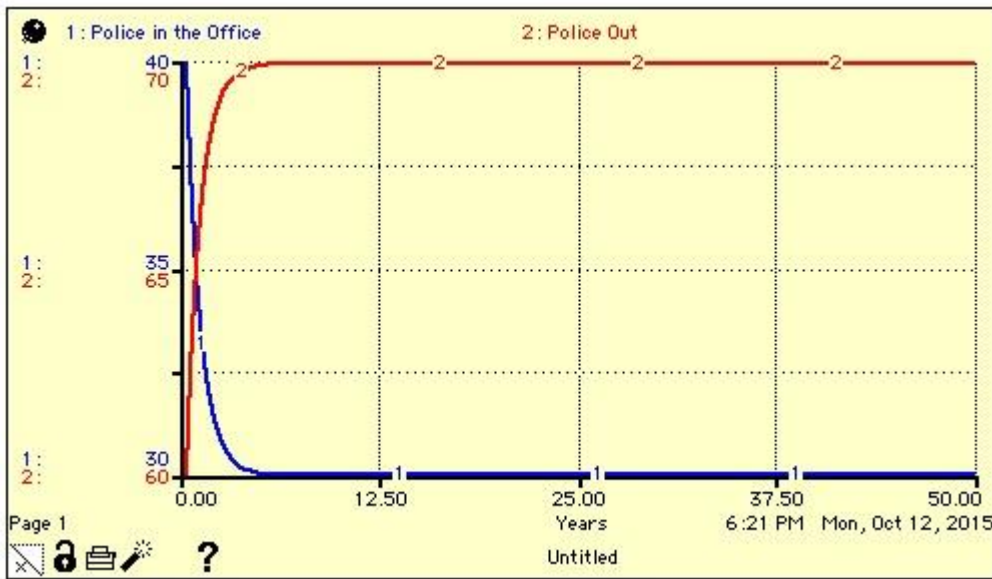


**Graph 6.3:** effect on revenues



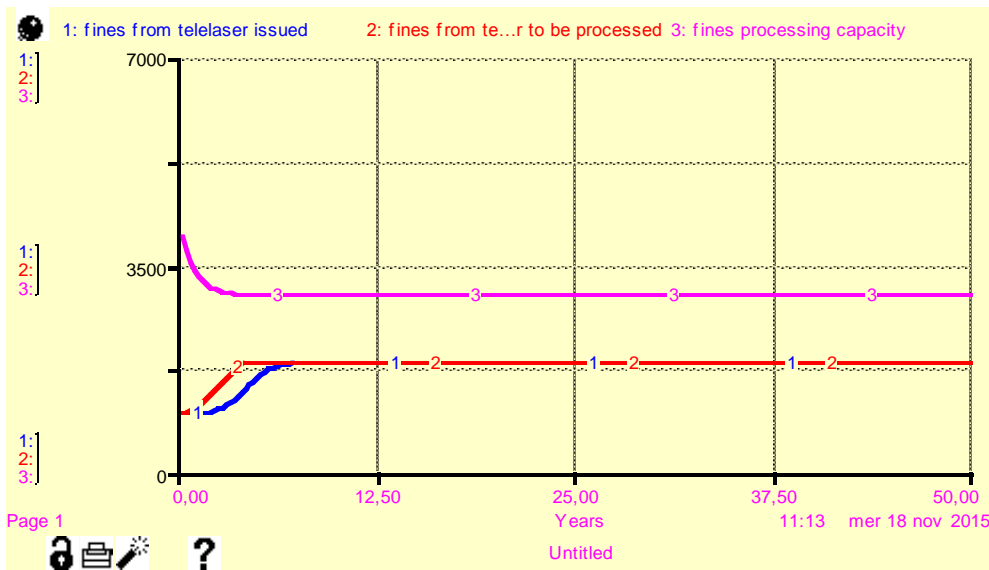
**Graph 6.4:** effect on fines

Graph 6.5 introduces us to the policy of intra-departmental staff reshuffling:



**Graph 6.5:** limits to growth of intra-departmental staff reshuffling

The initial ratio of staff distribution in this scenario displays the standard situation with no staff reshuffling policy between departments. Curve 1 substantiates the possible redistribution of back-office staff to beats and curve 2 sketches the resulting effects of such redistribution on the magnitude personnel dedicated to external activities. After an initial specular decrease/increase of staff in both the two sectors of activities, as displayed by the curves, somewhere, along the lines, both curves become flat to clearly reveal that the reshuffling policy cannot continue indefinitely since by so doing either the two sectors would be completely deprived of its minimum capacity for its activities to be carried out. The following graphs display this risk very clearly:



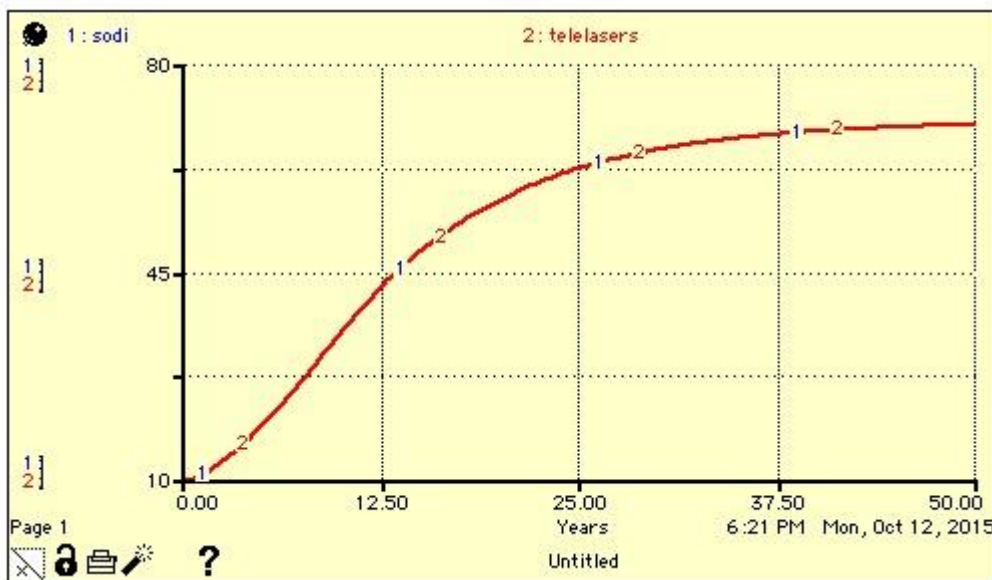
## Graph 6.6 limits to growth of fines issuing and processing

Basically, we touch here upon one important dynamic issue which is **‘fines processing capacity:’** namely when decisions are taken on how to distribute staff between beats and back-office activities one might think that the more police out the better is the outcome since beats directly drive fine generation and allow more effective prevention. But we pinpoint here that this is not as easy as it looks since some important dynamic trade-off need to be taken into consideration: the amount of police in the office, in fact, determines the fines processing capacity, as our graph clearly reveals. Reallocating police, from back-office activities to beats, actually decreases this capacity. In a real situation this choice is dictated by circumstances since this depends on the amount of fines laying in the office to be processed. If this amount is not excessive we can allow ourselves to decrease it and then we can also see on the graph how nicely the fines to be processed (curve 2) adjust to the fines issued (curve 1) although with a certain time delay because it takes time for the fines to be processed. However, if we put all that to the extreme and leave the office extremely understaffed this would seriously jeopardize the



processing capacity and thus our fines issued would flatten to a much lower value.

This limitation had already been mentioned in the qualitative analysis where the balancing loops had been described. The flatness of the curves indicates the moment when the balancing effect kicks in so implying an implicit limit to growth. This conclusion is backed by the S-shaped slope of the curve outlined in the following graph:



**Graph 6.7:** limits to growth of speed enforcement devices

Graph 6.7 confirms the assumption according to which there can be no infinite reinforcing loop between speed enforcement devices and related revenues. In other words if it is true that, at the initial stages, the more such devices being purchased the higher will result the related revenues for the Municipal Police, so allowing a further purchase of even more technological equipment in a reinforcing fashion, it is also true that, at a certain point of time, the finite number of police staff, to operate the tools, will make it pointless to proceed with any further acquisition.

## CONCLUSIONS

This part of the thesis is intended to offer a brief summary of the intentions which drove the interest for this research. Throughout the whole work the focus has been cast on road-related fatalities and possible ways to improve the performance of police agencies to contain them within tolerable limits. In particular the role of technological speed enforcement devices has been analysed for the contribution that they could generate to make up for the understaffing which is currently affecting police forces in Italy and in particular Municipal Police corps. This analysis, carried out within the MO.SI.C. division of the Municipal Police of Palermo and presented in the case study, was conducted with a view to identifying the best fit of resources, both technological and human, for the Municipal Police to tackle specific driving misconducts that statistics indicate as persisting serious threats to road safety. Identification and management of resources, within complex systems, is not an easy task though: the trade-offs, counterintuitive effects and time-delays, inherent to such systems, could, in fact, mislead decision-makers in the appropriate selection of the best set of policies to be implemented. Besides, this latter difficulty can further be emphasized especially under circumstances of budgetary restrictions and extreme pressure for delivering results. The majority of performance systems, usually adopted by police agencies, do not seem particularly tailored to monitor the intertwined dynamics of complex systems. Apart from some exceptions, in fact, the currently adopted P&C assessments seem, rather, to be mainly calibrated on sectoral output-based targets. Such approaches may well give a

temporary persuasion of control (i.e. ‘illusion’) but the risk looming ahead is that this too narrow a focus, on short-term micro achievements, could jeopardize the achievement of longer-term service outcomes. For this reason the effort in this thesis has been devoted to proposing a methodology of analysis capable of widening the perspective of analysis and enlarging the boundaries of the investigated system by trying to include prevention next to the traditional repressive approaches usually adopted by the Police. Throughout the development of the research three major aspects have emerged and which this conclusive paragraph will attempt to clarify:

1. First the ability of this research to provide satisfactory answers to the research questions that were formulated at the outset;
2. Secondly the limitations that constrained the potentials of the research assumptions;
3. Thirdly the possible contributions offered by this research to studies in the field of police performance along with the future perspectives of similar investigations;

The research questions, formulated at the beginning of this thesis, basically set the stage by wondering over the contribution of Performance Management, combined with a dynamic approach, to help the Municipal Police enhance their performance in reducing road-related fatalities. The several paragraphs on the topic have clearly shown that enduring results cannot be achieved through single policies and that performance cannot be evaluated through the measurement of a limited set of variables. In the specific case of road safety, in fact, some chapters have widely insisted on

the fact that pure reliance on repression is not deemed sufficient to discourage certain driving attitudes. The need to impact motorists' psychological sphere more effectively would, on the contrary, suggest the adoption of mixed policies where both preventive and repressive actions are implemented. DPM, in this respect, was proven, by the simulations which the model allowed to conduct, to be a valuable tool to enable the Municipal Police to find their way through a scenario of conflicting options and limited resources. The 'instrumental view' framework, in particular, with its specific backward approach, from end-results to strategic resources, turned out to be particularly suited to allow a preliminary evaluation about the effects of planned targets on the endowment of available resources so as to keep policies within a framework of sustainability. This evidence, on its own, allows to affirmatively answer the first research questions, namely the one wondering about the ability of such a framework to help identify the optimal combination of end-results, leading to an effective accumulation and utilization of strategic resources. In addition, the time factor, which this methodology allows to duly take into account, is fundamental to enable a timely detection of any possible signals (weak) of deviation from the planned target and consequently steer appropriate corrections as deemed necessary. Although we know that DPM is not an instrument to predict the future we can certainly come to the conclusion that it, through simulations, can serve as a useful learning tool for testing policies before their actual implementation is formally decided. Important is also its potential in fostering a new mentality where awareness over inherent dynamics drives global analysis. In this respect we can conclude, and implicitly answer another research question, that DPM is a reliable tool for the design of road safety- based

policies. The simulations carried out during the testing of the model were very useful to learn over the impact of drivers (i.e. policies) on final end-results (i.e. targets). Particularly appreciated was the opportunity to discover the counter-intuitive potential of tele-laser as opposed to SODI. Otherwise stated, the former driver, which at first glance could have been, somehow, questioned in terms of revenues generation and strain on an already burdened workforce, proved to be not only equivalent to camera-based options in terms of sanctioning potential but, also more performing in terms of accidents reduction. This very fact, brings us to positively answer the next research question, wondering over the ability of DPM to lead to the identification of a best fit of drivers capable of impacting conducts and contributing to the accumulation and optimization of strategic resources. So far relates the identified insights which this research has allowed to gain have been presented but to be credible, next to highlighting what are believed to be the results obtained, it is just as important not to overview the weaknesses that are felt to have limited this work: several elements, for the sake of simplification, were not incorporated in the model. In some cases it was due to the inability to establish all the relationships and links between variables in the real system, in other cases it was access to data that acted as a constraining factor. The still limited propensity, in fact, by public institutions, to store data in a systematic fashion, or to release those well available or, again, the lack of formal measurement of several indicators, make the task of a researcher, wishing to use System Dynamics for exploring complex systems, particularly hard. This limitation was tackled, in this work, by combining real, available, data released by authorities or accessible to the public, with some other figures that were extrapolated through deductions.

When not readily available, in fact, data could be assumed from the responses of field operators or from experience-based approaches. Relatively disappointing to the author has been the necessity to keep the object of this analysis limited to police activities without including the contributions of other agencies having a fundamental influence on road safety. In itself, this choice appears to be in contradiction with the potential that SD allows to incorporate different elements but it must be said that the time constraints, data limitation and scarcity of resources would have not allowed the author to carry out such a challenging yet far-reaching task. While realizing that this narrow focus might clearly face some criticism, the persuasion remains of the good use that still could be made of the work done and presented through our model. As reiterated in previous circumstances, in fact, dynamic modelling is not expected to be an instrument to seek predictions about the future from. Rather it is a tool that enables to test hypothesis and to foster a dynamic approach to issues. If this mentality were to consolidate at all levels of Italian public institutions, this would, in itself, certainly be an important step forward in the adoption of a new, different way to look at management complexities. Another limitation which is felt to have emerged throughout this work is related to the metrics through which to measure the performance of the Municipal Police, according to a systemic view. As a matter of fact some of them are undeniably there: road accidents reduction, on the one hand, and the increase in fines-generated on the other, are, on their own, parameters of performance; but it is the feeling that these results were mainly obtained through repressive activities that leaves a sort of vacuum in the author's conclusive considerations about the work so far developed. The desire to enlarge the boundaries to incorporate more agencies and to screen a

wider array of performance indicators has been only partially satisfied: in this work, in fact, prevention is merely entrusted to vehicles' being actually stopped, exposing offenders to a more rigorous scrutiny by the Police or to the deterrent effect, of a technology-based speed enforcement policy on driving behaviour. But, in the end, measuring the deterrent effect of such a preventive potential could not really be translated into firm, unquestionable figures; yet it could only be hypothesized through recourse to graphical functions which notoriously are built through a high degree of speculation and wishful thinking. The same difficulties would have probably applied to the measurement of other preventive activities like educational campaigns and targeted seminars for students of all grades, whose insertion in the model would have been highly desirable. Such additional measures are, in fact, expected, over time, to exercise an influence on conducts but, again, it's their measuring that would have been hard to translate into objective numbers. Despite these reserves, the persuasion is still there of the usefulness of modelling, however partial this activity can be. Focusing on cause-and effects relationships among variables or being aware of the logic of circularity or of the effects of delays, is still an important exercise to move from a still too widespread linear approach to solutions to a new mentality where interdependencies are duly taken into consideration. Future research should be directed towards the expansion of the model through the refinement of some assumptions and limitations. This of course will depend on several aspects, among which the availability of data plays a crucial role. It is hoped that this research effort can serve as a brick to build upon to allow performance management to become more and more refined so as to offer an increasing contribution in the reduction of road-related fatalities.

## Appendix A: Model documentation

<b>stock</b>	$\text{accumulated\_revenues\_from\_fine}(t) = \text{accumulated\_revenues\_from\_fine}(t - dt) + (\text{revenue\_stream\_from\_fines} - \text{fines\_revenues\_usage}) * dt$ <p>INIT accumulated_revenues_from_fine = 0</p>
<b>inflows</b>	$\text{revenue\_stream\_from\_fines} = \text{fine\_revenue\_from\_alcohol\_check\_ups} + \text{fine\_revenue\_from\_telaser} + \text{fine\_revenue\_from\_sodi}$
<b>outflow</b>	$\text{fines\_revenues\_usage} = \text{accumulated\_revenues\_from\_fine} * \text{fraction\_of\_accumulated\_revenues\_to\_be\_used\_per\_year}$
<b>stock</b>	$\text{alcohol\_check\_up\_capacity}(t) = \text{alcohol\_check\_up\_capacity}(t - dt) + (\text{change\_in\_alcohol\_check\_up\_capacity}) * dt$ <p>INIT alcohol_check_up_capacity = 50</p>
<b>inflow</b>	$\text{change\_in\_alcohol\_check\_up\_capacity} = (\text{indicated\_alcohol\_check\_ups\_capacity} - \text{alcohol\_check\_up\_capacity}) / \text{time\_to\_change\_alcohol\_check\_up\_capacity}$
<b>stock</b>	$\text{Fines\_Under\_Processing}(t) = \text{Fines\_Under\_Processing}(t - dt) + (\text{fines\_from\_telelaser\_to\_be\_processed} - \text{fines\_from\_telelaser\_issued}) * dt$ <p>INIT Fines_Under_Processing = 0</p>
<b>inflow</b>	$\text{fines\_from\_telelaser\_to\_be\_processed} = \text{effective\_telelaser\_controls} * \text{fines\_per\_telelaser\_control}$
<b>outflow</b>	$\text{fines\_from\_telelaser\_issued} = \text{DELAY3}(\text{MIN}(\text{fines\_from\_telelaser\_to\_be\_processed}, \text{fines\_processing\_capacity}), 2, \text{fines\_from\_telelaser\_to\_be\_processed})$



<b>stock</b>	$\text{Police\_in\_the\_Office}(t) = \text{Police\_in\_the\_Office}(t - dt) + (\text{change\_in\_Office\_Police}) * dt$ $\text{INIT Police\_in\_the\_Office} = 40$
<b>inflow</b>	$\text{change\_in\_Office\_Police} = (\text{Indicated\_Police\_in\_the\_Office} - \text{Police\_in\_the\_Office}) / \text{time\_to\_change\_police\_reallocation}$ $\text{INIT Police\_Out} = 60$
<b>stock</b>	$\text{Police\_Out}(t) = \text{Police\_Out}(t - dt) + (\text{change\_in\_Police\_Out}) * dt$
<b>inflow</b>	$\text{change\_in\_Police\_Out} = (\text{Indicated\_Police\_Out} - \text{Police\_Out}) / \text{time\_to\_change\_police\_reallocation}$
<b>stock</b>	$\text{sodi}(t) = \text{sodi}(t - dt) + (\text{new\_sodisc\_purchase\_rate} - \text{sodisc\_discard\_rate}) * dt$ $\text{INIT sodi} = 10$
<b>inflow</b>	$\text{new\_sodisc\_purchase\_rate} = \text{budget\_for\_sodi} / \text{av\_price\_of\_sodi}$
<b>outflow</b>	$\text{sodisc\_discard\_rate} = \text{sodi} / \text{sodi\_average\_usage\_time}$
<b>stock</b>	$\text{telelasers}(t) = \text{telelasers}(t - dt) + (\text{new\_telelasers\_purchase\_rate} - \text{telelasers\_discard\_rate}) * dt$ $\text{INIT telelasers} = 10$
<b>inflow</b>	$\text{new\_telelasers\_purchase\_rate} = \text{budget\_for\_telelasers} / \text{av\_price\_of\_telelaser}$
<b>outflow</b>	$\text{telelasers\_discard\_rate} = \text{telelasers} / \text{telelaser\_average\_usage\_time}$
<b>converter</b>	$\text{alcohol\_check\_ups\_supported\_by\_police} = \text{police\_per\_alcohol\_check\_up} * \text{police\_for\_alcohol\_check\_ups}$
<b>converter</b>	$\text{average\_fine} = 100$

<b>converter</b>	$av\_price\_of\_alcohol\_check\_up = 100$
<b>converter</b>	$av\_price\_of\_sodi = 4000$
<b>converter</b>	$av\_price\_of\_telelaser = 4000$
<b>converter</b>	$budget\_for\_alcohol\_check\_up =$ $budget\_fraction\_for\_alcohol\_check\_ups * police\_budget$
<b>converter</b>	$budget\_for\_sodi = police\_budget * budget\_fraction\_for\_sodi$
<b>converter</b>	$budget\_for\_telelasers =$ $budget\_fraction\_for\_telelaser * police\_budget$
<b>converter</b>	$budget\_fraction\_for\_alcohol\_check\_ups = 0.2$
<b>converter</b>	$budget\_fraction\_for\_sodi = 0.4$
<b>converter</b>	$budget\_fraction\_for\_telelaser = 0.4$
<b>converter</b>	$controls\_per\_sodi = 10$
<b>converter</b>	$controls\_per\_telelaser = 10$
<b>converter</b>	$controls\_sodi\_per\_police = 10$
<b>converter</b>	$controls\_sodi\_supported\_by\_police =$ $controls\_sodi\_per\_police * police\_for\_sodi$
<b>converter</b>	$controls\_telelaser\_per\_police = 10$
<b>converter</b>	$controls\_telelaser\_supported\_by\_police =$ $controls\_telelaser\_per\_police * police\_for\_telelaser$
<b>converter</b>	$effective\_alcohol\_check\_ups =$ $min(alcohol\_check\_up\_capacity, alcohol\_check\_ups\_supported$ $\_by\_police)$

<b>converter</b>	$\text{effective\_alcohol\_check\_ups} = \min(\text{alcohol\_check\_up\_capacity}, \text{alcohol\_check\_ups\_supported\_by\_police})$
<b>converter</b>	$\text{effective\_sodi\_controls} = \text{Min}(\text{sodi\_controls}, \text{controls\_sodi\_supported\_by\_police})$
<b>converter</b>	$\text{effective\_telelaser\_controls} = \text{MIN}(\text{telelaser\_controls}, \text{controls\_telelaser\_supported\_by\_police})$
<b>effect variable</b>	$\text{effect\_of\_alcohol\_fines\_on\_accidents\_due\_to\_alcohol} = \text{GRAPH}(\text{relative\_alcohol\_fines})$
<b>graphical function values</b>	(0.00, 1.00), (0.167, 1.00), (0.333, 1.00), (0.5, 1.00), (0.667, 1.00), (0.833, 0.967), (1.00, 0.927), (1.17, 0.887), (1.33, 0.874), (1.50, 0.795), (1.67, 0.616), (1.83, 0.576), (2.00, 0.424)
<b>effect variable</b>	$\text{effect\_of\_sodi\_fines\_on\_speeding\_behaviour} = \text{GRAPH}(\text{relative\_sodi\_fines})$
<b>graphical function values</b>	(0.00, 1.00), (0.25, 1.00), (0.5, 1.00), (0.75, 1.00), (1.00, 1.00), (1.25, 0.973), (1.50, 0.938), (1.75, 0.891), (2.00, 0.822), (2.25, 0.745), (2.50, 0.654), (2.75, 0.577), (3.00, 0.542)
<b>converter</b>	$\text{fines\_from\_alcohol\_check\_up} = \text{fines\_per\_alcohol\_check\_up} * \text{effective\_alcohol\_check\_ups}$
<b>converter</b>	$\text{fines\_from\_sodi\_controls} = \text{effective\_sodi\_controls} * \text{fines\_per\_sodi\_control}$
<b>converter</b>	$\text{fines\_per\_alcohol\_check\_up} = 1$
<b>converter</b>	$\text{fines\_per\_police} = 10$
<b>converter</b>	$\text{fines\_per\_sodi\_control} = 1$
<b>converter</b>	$\text{fines\_per\_telelaser\_control} = 1$

<b>converter</b>	$\text{fines\_processing\_capacity} = \text{fines\_per\_police} * \text{Police\_in\_the\_Office}$
<b>converter</b>	$\text{fine\_revenue\_from\_alcohol\_check\_ups} = \text{average\_fine} * \text{fines\_from\_alcohol\_check\_up}$
<b>converter</b>	$\text{fine\_revenue\_from\_sodi} = \text{average\_fine} * \text{fines\_from\_sodi\_controls}$
<b>converter</b>	$\text{fine\_revenue\_from\_telelaser} = \text{average\_fine} * \text{fines\_from\_telelaser\_issued}$ $\text{fraction\_of\_accidents\_due\_cause\_by\_alcohol} = \text{normal\_fraction\_of\_accidents\_due\_to\_alcohol} * \text{effect\_of\_alcohol\_fines\_on\_accidents\_due\_to\_alcohol}$
<b>converter</b>	$\text{fraction\_of\_accumulated\_revenues\_to\_be\_used\_per\_year} = 1$ $\text{fraction\_police\_in\_the\_office} = 0.3$
<b>converter</b>	$\text{fraction\_police\_per\_alcohol\_check\_ups} = 1/3$
<b>converter</b>	$\text{fraction\_police\_per\_sodi} = 0.4$
<b>converter</b>	$\text{fraction\_police\_per\_telelaser} = 2/3 - \text{fraction\_police\_per\_sodi}$
<b>converter</b>	$\text{incremental\_budget\_from\_fines} = \text{fines\_revenues\_usage}$
<b>converter</b>	$\text{indicated\_alcohol\_check\_ups\_capacity} = \text{budget\_for\_alcohol\_check\_up} / \text{av\_price\_of\_alcohol\_check\_up}$
<b>converter</b>	$\text{Indicated\_Police\_in\_the\_Office} = \text{Police} * \text{fraction\_police\_in\_the\_office}$
<b>converter</b>	$\text{Inidcated\_Police\_Out} = \text{Police} - \text{Indicated\_Police\_in\_the\_Office}$
<b>converter</b>	$\text{non\_alcohol\_speeding\_accidents} = \text{road\_accidents\_due\_to\_speeding} - \text{speeding\_accidents\_due\_to\_alcohol}$

<b>converter</b>	$\text{normal\_fraction\_of\_accidents\_due\_to\_alcohol} = 0.1$
<b>converter</b>	$\text{normal\_road\_accidents\_due\_to\_speeding} = 1800$
<b>converter</b>	$\text{Police} = 100$
<b>converter</b>	$\text{police\_budget} = \text{standard\_police\_budget} + \text{incremental\_budget\_from\_fines}$
<b>converter</b>	$\text{police\_for\_alcohol\_check\_ups} = \text{Police\_Out} * \text{fraction\_police\_per\_alcohol\_check\_ups}$
<b>converter</b>	$\text{police\_for\_sodi} = \text{Police\_Out} * \text{fraction\_police\_per\_sodi}$
<b>converter</b>	$\text{police\_for\_telelaser} = \text{fraction\_police\_per\_telelaser} * \text{Police\_Out}$
<b>converter</b>	$\text{police\_per\_alcohol\_check\_up} = 10$
<b>converter</b>	$\text{relative\_alcohol\_fines} = \frac{\text{fines\_from\_alcohol\_check\_up}}{\text{standard\_alcohol\_check\_up\_capacity}}$
<b>converter</b>	$\text{relative\_sodi\_fines} = \frac{\text{fines\_from\_sodi\_controls}}{\text{standard\_sodi\_fines}}$
<b>converter</b>	$\text{road\_accidents\_due\_to\_speeding} = \text{SMTH3}(\text{normal\_road\_accidents\_due\_to\_speeding} * \text{effect\_of\_sodi\_fines\_on\_speeding\_behaviour}, 3)$
<b>converter</b>	$\text{sodi\_average\_usage\_time} = 10$
<b>converter</b>	
<b>converter</b>	$\text{sodi\_controls} = \text{sodi} * \text{controls\_per\_sodi}$
<b>converter</b>	$\text{speeding\_accidents\_due\_to\_alcohol} = \text{road\_accidents\_due\_to\_speeding} * \text{fraction\_of\_accidents\_due\_cause\_by\_alcohol}$

<b>converter</b>	standard_alcohol_check_up_capacity = 100
<b>converter</b>	standard_police_budget = 10000
<b>converter</b>	standard_sodi_fines = 100
<b>converter</b>	telelaser_average_usage_time = 10
<b>converter</b>	telelaser_controls = telelasers*controls_per_telelaser
<b>converter</b>	time_to_change_alcohol_check_up_capacity = 2
<b>converter</b>	time_to_change_police_reallocation = 1

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