

# On Enabling Smart Government: A Legal Logistics Framework for Future Criminal Justice Systems

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## ABSTRACT

While in business and private settings the disruptive impact of advanced information communication technology (ICT) have already been felt, the legal sector is now starting to face great disruptions due to such ICTs. Bits and pieces of innovations in the legal sector have been emerging for some time, affecting the performance of core functions and the legitimacy of public institutions.

In this paper, we present our framework for enabling the smart government vision, particularly for the case of criminal justice systems, by unifying different isolated ICT-based solutions. Our framework, coined as Legal Logistics, supports the well-functioning of a legal system in order to streamline the innovations in these legal systems. The framework targets the exploitation of all relevant data generated by the ICT-based solutions. As will be illustrated for the Dutch criminal justice system, the framework may be used to integrate different ICT-based innovations and to gain insights about the well-functioning of the system. Furthermore, Legal Logistics can be regarded as a roadmap towards a smart and open justice.

## CCS Concepts

• Applied computing → E-government.

## Keywords

Law enforcement, smart governance, open justice, efficiency, effectivity, legal design, and penal law.

## 1. INTRODUCTION

Advanced information and communication technology (ICT) is perceived to have a major impact in various important settings of our society. On the one hand, in a business setting, new innovative products and services have entered, and are still entering, the marketplace. Brick and mortar businesses are partly replaced by e-business and new business models and channels to trade are being developed. In some business fields, this has led to a disruptive impact on their established working practices, thereby creating a completely new industry (e.g., newspapers and television broadcasters). On the other hand, in a private setting, the use of computers and smart devices and applications have become integrated in the daily life of ordinary people.

Compared to the business and private settings, the public sector

tends to take a more conservative attitude, at least when it boils down to adapting and adopting technology. Yet, bits and pieces of an innovative e-government have been emerging for some time [1-5,12-14,48]. Such innovations reach a range of different services in the public sector, affecting the performance of core government functions and the legitimacy of public institutions.

The enforcement of public safety is an important task of a government, since it is one of the cornerstones of an affluent and healthy society. Legal systems, especially criminal justice systems, are one of the main means to enforce public safety. In these legal systems the developments in ICT are a potential game changer.

Concrete ICT solutions are already emerging to improve the functioning of legal systems. For instance, services performed by computers are replacing the task of document review that was performed by lawyers in the past. The expensive and time-consuming process of legal research is being outsourced to a digital expert, who helps with processing through massive amounts of legal case research [16]. We agree with scholars [7,8,9], who envision that ICT will have a disruptive impact on the core tasks within a legal system. As a consequence, working practices in legal agencies and professions may need to be thoroughly revised in order to keep and to gain the trust of citizens [6,7,9].

In [6], it is discussed that computational based services are on the verge of substituting core legal tasks: from the generation of legal documents to predicting outcomes in litigation. According to [7], lawyers are behaving more as ‘knowledge engineers’. In [9], it is argued that lawyers in fact are (transaction-costs-) engineers; they make devices for others that try to reduce or prevent transaction costs, conflicts and other problems [10]. In this context, devices are “contracts, conveyances, wills, trusts, regulations, statutes and constitutions, and companies” [9].

However, between ambition and reality discrepancies can arise. One of the discrepancies can be caused by logistical issues in the ‘fabric’ of law and regulation, in particular now that due to several factors [8, chapter 10], like jurisdiction, contractualization (i.e. outsourcing) and (over)regulation, legal devices have become more and more important in volume and in impact. The challenge for legal professionals and agencies will be to introduce innovation in their services to practice law by taking advantage of ICT and the data that are generated by ICT-based devices. This relates to the Smart Government vision, which aims to improve government services and to enable collaboration among and participation of government entities, nonprofit agencies, private-sector companies and the public [25].

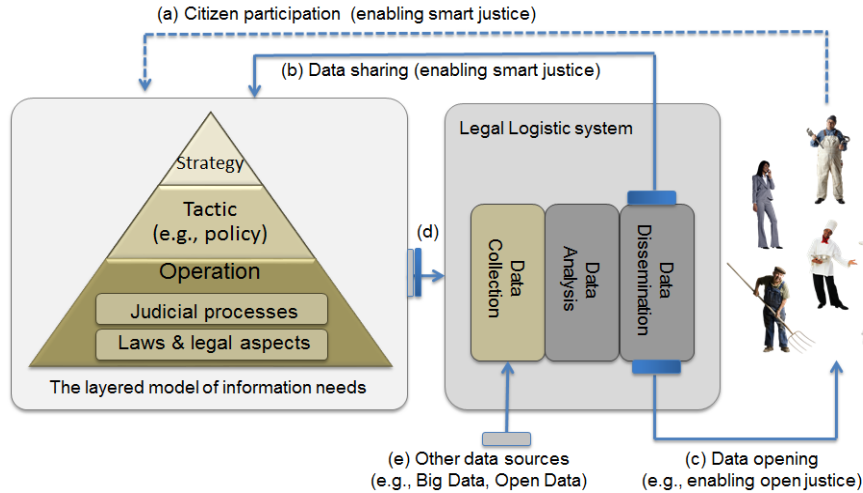
In this paper, we will argue that criminal justice systems, in particular, benefit from unifying different innovative isolated ICT-based solutions. This is because well functioning criminal justice systems aim at transparency, effectiveness and efficiency [11],

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**Figure 1: An illustration of the Legal Logistics framework**

integrity, correctness and carefulness, and compliance to imposed rules and other generally accepted principles. Agencies involved in criminal justice systems perform a wide range of tasks to meet and implement these properties. They are, therefore, searching for opportunities to perform their tasks in a better way by taking advantage of ICT.

Unfortunately, recent ICT innovations for criminal justice systems have created many isolated research and development solutions and implementations. As a result, a unifying framework on these developments, which is often used in classical information systems, is missing. Such a framework is needed to streamline the ICT innovations in criminal justice systems, which can also be considered as a roadmap towards smart and open justice. Such a framework, for example, enables other parties outside the judiciary domain (e.g., journalists) to scrutinize and question the functioning of the rule of law. Opening data to the public, moreover, enables involvement and participation of citizens in the criminal justice system, thus indirectly enables the vision of smart justice.

In this paper, we will introduce a framework, coined as Legal Logistics. This framework exploits data ICT for realizing a well-functioning criminal justice system. Important building blocks of the framework are the Legal Logistics system and the stakeholders (e.g. legal professionals, agencies, government, and the public). The Legal Logistics system represents the technical core of the framework where all ICT solutions are unified. It is divided into three parts: data collection, data analysis and data dissemination. The challenges of implementing the building blocks of the Legal Logistics system in relation to criminal justice systems will be discussed.

The remainder of this paper is organized as follows. Section 2 provides our definition of Legal Logistics and proposes the framework with its relevance to implement important properties set by legal systems. Section 3 describes the framework applied to criminal justice and the challenges when implementing it. Throughout this paper, we will take the Dutch criminal justice system as an example. In Section 4 we demonstrate, as a proof of concept, some practical implementations of information systems based on the Legal Logistics framework and describe an example case for policy advisors. Section 5 describes some related work, while Section 6 concludes the paper.

## 2. LEGAL LOGISTICS

In this section we describe our Legal Logistics framework. We begin with the definition and chosen terminology of Legal

Logistics in Subsection 2.1. We then explain the framework in 2.2. Section 2.3 describes the relevance of using Legal Logistics to achieve the objective of a smart government.

### 2.1 Definition and Terminology

The term ‘Legal Logistics’ is defined as a framework to collect, analyze and integrate all relevant data to gain descriptive, predictive or comparative insight into the functioning of legal systems. To do so, the objectives of legal systems have to be transformed into meaningful indicators (e.g. the elapsed times of work processes) that can be measured using the data available in different information systems. With this insight the stakeholders (i.e. legal professionals, agencies, researchers and policymakers) of legal systems have a mean to achieve the key objectives and innovate the services of the legal system.

In a sense, an information system based on the Legal Logistics framework is a measurement tool to gain insight into the level of well-being of a legal system using statistical information on the past, present, and future state of the system. You can compare it to a thermometer that measures the actual body temperature. Whether this measured temperature level indicates the person has the flu depends on the interpretation of a domain expert.

Logistics is usually (e.g., in businesses or the military) defined as a planning framework for the management of material, services, information and capital flows. It includes increasingly complex information, communication and control systems required in today’s business environment [15]. It is the science of planning, design and support of business operations that deal with procurement, purchase, inventory, warehousing, distribution, transportation, financial, human resources and customer support. Based on this common definition, Legal Logistics would, relate to successful case management with the help of the right legal information. This restrictive view is, however, not our definition of logistics in the legal domain.

The key differences between Legal Logistics and business or military logistics are found in characteristics pertaining to the rule of law and in the data used. Legal Logistics is part of the rule of law, which implies characteristics such as transparency and openness to respective parties so that they are kept informed and can keep questioning the functioning of the rule of law. For the rule of law this is an essential aspect, while for the military or business this is not the case. Legal data is also different from the standard administrative data used in military and businesses, as it is more volatile because of changing semantics (e.g., the legal articles that change over time). Moreover, for Legal Logistics it is

more difficult to gather appropriate data due to the autonomy of the various agencies involved and the privacy sensitivity of the data.

Thus, the legal domain brings forward special challenges for collecting, integrating and sharing legal data, which are not easy to overcome. In Section 3.3, we will elaborate more on these challenges, specifically those related to the criminal justice system.

## 2.2 The Framework

Figure 1 shows the Legal Logistics framework. The framework consists of 1) the Legal Logistics system (Figure 1, right rectangle) and 2) various stakeholders who require insight into the legal system. These stakeholders are in turn divided into two groups: 1) the people working in the legal system (Figure 1, left rectangle) and 2) the public (Figure 1, on the right). The Legal Logistics system represents the technical part of the framework where various ICT solutions are implemented. The system is divided into three blocks: 1) data collection, 2) data analysis and 3) data dissemination.

The first stage in the legal logistics system is data collection. The input to the system is the collected data from the information systems of the agencies within legal systems (see arrow-d in Figure 1). Other (third party) sources deliver data, e.g., social media data, open data, and big data (see arrow-e in Figure 1). The collected data is subsequently analyzed in the next stage of the Legal Logistics system and exploited to determine relevant and meaningful indicators (see e.g., Subsection 3.2). In the third stage, the statistical information from the indicators is shared with the agencies within the criminal justice system (see arrow-b in Figure 1) or is disseminated to the public (see arrow-c in Figure 1).

With respect to the stakeholders in the framework, the agencies in legal systems have different types of tasks and, as a result, different information needs. These tasks and information needs can be viewed as different layers (see Figure 1, the triangle on the left). The lowest level encompasses operational tasks where legal professionals carry out the required operations for every legal case. These operational tasks can be divided into two sublevels, one related to the (legal) content of every case related to the laws that apply to it, and the other related to procedural aspect of handling every case. The middle layer includes those tactical tasks that policymakers carry out to devise judicial policies and legislations. The highest level is concerned with those strategic tasks carried out by top management (i.e. parliament, ministers) to set the long term objectives of the judicial system and the strategies for achieving these objectives.

In general, this framework is applicable to all legal systems. For most tasks, regardless of their type, collaboration and data sharing among involved agencies are required. Agencies involved in operational tasks (e.g. the police) need to share data to perform routine day-to-day operations, for example, to determine the identity of a person. For such tasks, one often needs to share detailed individual-level data. For tactical or strategic tasks, in turn, agencies may need statistical data about some (categories of) cases in order to make informed decisions. Such decisions may involve the optimization of the policies and strategies of underlying agencies. For example, the Minister of Security and Justice requires insight into the number of drug-related crimes to see whether they are on the rise and fighting it should become a priority. This new direction can be considered as a strategic decision, which should, in turn, lead to more detailed plans at the

lower task levels where more specific information about the agencies (and intra-agency processes) is needed. This will lead to changes all the way down to the operational level (e.g. the individual police or parole officer).

## 2.3 Relevance of Legal Logistics

Legal Logistics is not only relevant for criminal justice systems (as explained above), but for (almost) all types of legal systems and policy-making in them. For example, civil law and the recently established behavioral research field called civilology, see e.g. [18], have to do with ‘logistics’ issues. Think in terms of evidence that is used when ADR (Alternative Dispute Resolution) is at stake, and where parties may work with different ‘datasets’, think about the role of e-justice and e-courts outside the traditional judiciary system, where legal big data are becoming more important.

Additionally, in the field of comparative legal research in the European Union, CEPEJ (the European Commission for the Efficiency of Justice, established in 2002) explicitly addresses issues related to Legal Logistics. Its goal is the improvement of the efficiency and functioning of justice in the member States, and the development of the implementation of the instruments adopted by the Council of Europe to this end.

Also in the field of international law, Legal Logistics has arrived on the agenda. Comparative studies into the Rule of Law of different countries, and societal perceptions of it, also address aspects of Legal Logistics (e.g. judiciary efficiency, perceptions of the level of compliance of countries with the rule of law, including human rights).

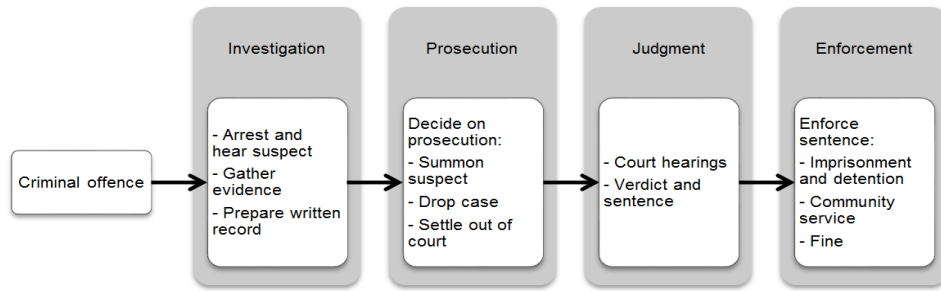
In general, Legal Logistics applies to all legal systems in which professionals are looking for opportunities to take advantage of innovative ICT developments. It is particularly useful for providing insight into the functioning and performance of a legal system and determining whether its objectives are met. In the next subsection we will elaborate more on such objectives.

### 2.3.1 Objectives of Legal Systems

A well-functioning legal system should adhere to various objectives. The primary objectives of a legal system pertain to the rule of law, i.e. to exercise power by officials in accordance with the law and regulations. The rule of law serves various objectives like predictability; the absence, to a large degree, of arbitrary power; formal equality (i.e., fairness) and order [50]. To conduct the rule of law correctly and appropriately, professionals need all the right information at the right time. The secondary objectives of legal systems pertain to performance concepts like efficiency, effectiveness, accountability and transparency. Below, we will outline some of these secondary objectives in more detail.

Realizing an effective and efficient legal system depends on soundness of the planning, complexity of the organizational structure, effective communication between people and agencies, and effective leadership and supervision [9]. To this end, all the primary work processes in the system should be timely, smooth, accurate and reliable. In practice, however, this is not always the case, for instance, when long waiting times occur. Such delays undermine one of the central ideals of a legal system: the promise of a speedy trial. Reduction of delays is therefore an important aspect in achieving efficiency and effectiveness.

Agencies involved in a legal system should acknowledge and accept responsibility for their actions, products, decisions, and policies; both individually and collectively. Achieving such accountability asks for, among other things, independent



**Figure 2: An schematic overview of the Dutch criminal justice system.**

stakeholders (like the public and press) in order to be able to verify whether the judicial procedures are effective, fair, and efficient.

Transparency is related to and required for accountability and is often referred to as “open government”. By being transparent the system ensures that the rights of citizens are upheld and the necessary oversight is given to protect the public interest. Transparency in the form of data dissemination and data opening enables smart justice and open justice visions. Opening data to the public, moreover, enables involvement and participation of citizens in legal systems, thus indirectly enabling the vision of smart justice. Ultimately this may build citizens trust. Transparency can also be achieved through traceability, that is, being able to follow legal cases and people throughout the system and determining their status collectively, categorically or individually

### 2.3.2 From E-administration to Smart Government

Related to these objectives, Legal Logistics is important in order to transform the use and role of ICTs from e-administration to smart government. This transformation takes place in several stages: from e-administration, to open-government, and, finally, smart-government.

E-administration aims at increased efficiency by using ICT to automatize the existing operational workflows within public agencies. E-government relies on ICT tools to deliver e-services to citizens as well as to enable bidirectional flows of information between a government and citizens.

Open-government aims at providing citizens with governmental agencies’ data, which are often funded by the public, in order to improve government transparency, increase government accountability and compliance, support participatory governance (as a first step towards engaging citizens in governance process), to foster innovations (through, for example, enabling citizens to devise new commercial services), and to enable citizens to make informed personal decisions (when, for example, buying a new house).

Smart government, being the latest stage recognized so far, aims at using ICT for open-government, open innovation in public agencies, and maximum interoperability among public agencies (i.e., along semantic, technical, organizational, governance, ... dimensions [20]). A smart government seeks for the best way to serve citizens and the society, and it is a result of an evolution process in public agencies by using ICT to transform public agencies internally and to help public agencies to achieve their objectives externally. Gartner [24] defines Smart Government as an administration that applies and integrates information, communication and operational technology with planning, management and operations across multiple domains, process

areas and jurisdictions to generate sustainable public value. This smart government vision aims to improve government services (i.e., by making them quick, measurable, affordable and sustainable) and enable collaboration among government entities, nonprofit agencies, private-sector companies and the public. This collaboration results in integration and improvement of previously distinct processes, systems and policy domains [24]. Similarly, [26] defines Smart Government as: “the implementation of a set of business processes and underlying information technology capabilities that enable information to flow seamlessly across government agencies and programs to become *intuitive* in providing high quality citizen services across all government programs and activity domains.” Providing high quality government services and policies internally and externally [20] in a sustainable [24] and intuitive [26] way requires a self-learning public agency that improves its functioning based on newly acquired information. Legal Logistics provides a framework to materialize such a vision of smart government with its open data component in judicial settings.

## 3. LEGAL LOGISTICS FOR CRIMINAL JUSTICE SYSTEMS

A criminal justice system is a legal system that is put into place to enforce penal law and involves many different legal professionals and agencies. Each nation has a criminal justice system, although there are differences between these systems. These differences usually pertain to the role and tasks of the agencies and legal professionals. For example, in Anglo-American Law courts often make use of juries to come to decisions, which is not the case for Roman law courts.

The Dutch criminal justice system is chosen as an example in this paper. Section 3.1 briefly introduces the Dutch system. In Section 3.2 we describe the Legal Logistics framework in relation to criminal justice systems, and gives some examples of meaningful indicators to gain insight into the functioning of the system. In Section 3.3 we describe the challenges of implementing the building blocks of the Legal Logistics system in relation to criminal justice systems.

### 3.1 The Dutch Criminal Justice System

The Dutch criminal justice system consists of many different interdependent agencies and legal professionals that provide different kinds of services. The (most important) agencies involved in the criminal justice system are: the police, the Public Prosecution Service (PPS), the courts, the Central Fine Collection Agency (CFCA), the agency of correctional institutions (prisons) and the Probation Service (PS).

In Figure 2, a schematic overview of the Dutch criminal justice system is given. The system is presented as a linear chain that

consists of the following stages: investigation, prosecution, judgment, and enforcement (see [51], for a more comprehensive overview). It is linear in the sense that a stage must be concluded before the next stage may begin. Therefore, in the figure we depict the different stages of the chain from left to right. However, as a whole it is not strictly linear, as some agencies, like the PS or Dutch Institute for Forensic Psychiatry can work on a criminal case in parallel with the police and the PPS. Loops in chain are also possible, for example in some cases (e.g., those with wrongly convictions) the supreme court decides that a case has to be heard again by a court of appeal (or even by a new court) that consequently has to go through the entire case again.

### 3.2 Legal Logistics Applied to Criminal Justice Systems

In Figure 1 we showed the Legal Logistics framework. When related to a criminal justice system, the layered information structure (the pyramid on the left) represents the agencies and legal professionals that are part of this system. In Figure 3, we give an example of different stakeholders who can provide information to the Legal Logistics system, and who may benefit from the information received from the Legal Logistics system in order to improve their tasks.



**Figure 3: A layered model of a typical justice system**

In a Legal Logistics system that is applied to a criminal justice system, the data collected from the information systems of the agencies within the criminal justice system (police, PPS, etc.) are taken as an input.

In the next stage of the Legal Logistics system, this data is subsequently analyzed to determine meaningful indicators. For criminal justice systems, one can think of a number of indicators, such as: 1) elapsed time, 2) output, 3) stock, and 4) production. These are based on the objectives mentioned in Section 2.3.1. Note that although the objectives accountability and transparency cannot be measured directly through indicators, they are an indirect result of gaining insight through such indicators.

Also other essential conditions for a well-functioning judicial system like: integrity, correctness and carefulness, and compliance to the imposed rules and other generally accepted principles relate to legal and ethical guidelines that are difficult to measure. Therefore, they are outside the scope of Legal Logistics.

First, the elapsed time indicator of a case is built up from several time-components, such as waiting, transfer and working times for criminal cases. This indicator provides vital information on the various steps in the process of handling criminal cases and, consequently, constitutes an important basis for improving and speeding up of such processes. See [12] for how elapsed times can be utilized in criminal justice systems.

Elapsed time can provide stakeholders with valuable insights into delays in or bottlenecks of the system. Additionally, it can show whether policy changes have any effect on improving the work processes. Thus, this indicator measures those aspects related to efficiency and effectiveness.

Second, the output indicator gives an insight into the number of cases or people that leave a certain agency or the system as a whole. This allows policymakers to follow the flow of cases (input vs. output) through the chain of agencies and, for instance, monitor whether cases or people get lost. Outputs of criminal cases can happen at various moments in the system. Therefore the nature of the output indicator can vary.

Policymakers can use this indicator to see how many criminal cases that entered in a certain period were processed within a certain time span and left the system, and how many cases were still in the criminal justice system after that time span. The authors in [13] describe a study of the output of cases in the Dutch criminal justice system. In this study, individual cases were followed through the system. Thus, this output indicator provides transparency through traceability.

Third, the stock indicator denotes the number of cases to be processed by an agency. When the number of cases in the stock is piling up, this may be an indicator that the input is increasing or that the processing of cases is slowing down and needs to be accelerated. Therefore, this stock indicator is related to efficiency. Insight into the stocks of different agencies can give insight into possible bottlenecks in processing cases.

Fourth, the production indicator relates to the amount of work that has been conducted on in a certain period. Where the output indicator is the number of cases that left the system, production relates to the work an agency turns over. Within the criminal justice system this can give insight into product consumption of an agency and the space left for other agencies to demand products. This insight can also be used for budgeting because the production can tell how much of the planned budget is already consumed.

In the last stage of the Legal Logistics system, measures from these indicators are shared with the agencies in the criminal justice system or with the public. Agencies can use this information to adhere better to the objectives of the criminal justice system. People outside the judiciary domain can use the information to question the functioning of the rule of law.

### 3.3 Challenges

The implementation of information systems based on the Legal Logistics framework is not that straightforward. In the following subsections we describe some challenges particular to criminal justice systems. To describe these challenges we follow the three stages of the Legal Logistics system shown in Figure 2, namely: data collection, data integration, and data dissemination.

#### 3.3.1 Data Collection Issues

Data collection is not a trivial process. In general, there are three strategies to data collection: 1) top down (i.e., ‘I need to know this, get the data’), 2) bottom up (i.e., ‘I have these datasets, which insight can I obtain from it?’), and 3) mixed (i.e., ‘start simple, grow gradually, and learn from practice’). Deciding the best strategy depends on how clear the information need is.

A problem in the Dutch criminal justice system is that information is registered in various information systems because these systems are primarily built to support every agency’s own operational processes. Each agency registers data, for instance, about cases



and suspects, based on own data needs and requirements. Typically, the data registered in these systems are streams of raw facts representing events in a case, such as (court) decisions.

### 3.3.2 Data Integration Issues

In order to measure meaningful variables in the justice domain, data on suspects or criminal cases from different ICT systems have to be integrated. Based on the chain structure of the criminal justice system, one would expect that relating the data of a case from one agency to the next is simple. Thus, making it easy to follow a particular criminal case or suspect through the system. However, this is not always the case, as in the justice domain there is no strict 'one-on-one' relation between the data exchanged between agencies. An example of this can be found in the relation between the data sets of the police and the PPS. One would expect the input of the PPS to be equal to the output of the police. This is not always the case, since the police and the PPS use different definitions of the entity "case". For the police, a case corresponds to one criminal offence, which can have multiple suspects. A case at the PPS is unique to one person, but may contain multiple crimes. Thus, one case with multiple suspects registered by the police, results in two cases for the PPS, while two cases with the same suspect may result in one case for the PPS. Consequently, it may be hard to relate the entities registered by the police to the entities registered by the PPS. This phenomenon is called semantic interoperability.

Data can be integrated on two levels: on an individual level or an aggregate level. The first approach is preferred as this allows us to follow cases throughout the whole system. Integrating data on an individual level involves data reconciliation, that is, the identification of data in different sources that refer to the same entity. This is relatively straightforward when a unique identifying key is present in all databases to be combined. If such a key is not available, as an alternative, data can be integrated using a set of common characteristics [17]. This method utilizes the following general rule of thumb: the larger the number of common attributes with the same values for two records from two different systems, the higher the chance that the records relate to the same object in reality. Note that this rule requires that the selectivity factors of the common attributes are small.

Despite having a unique identifying key in part of the Dutch criminal justice system, there are still several issues, related to the nature of the data, that make reconciling data complicated. The first issue has to do with the fact that various information systems have overlapping attributes and that redundancy may lead to inconsistencies. The second issue is concerned with the errors that occur in the registration of cases or offenders. Some information about a case may not be registered correctly or not be registered at all, by one of the agencies involved. Additionally, it may be so that even though data are integrated successfully, information about relevant events in the case is still missing. These data characteristics make data integration (in this domain) a challenging task involving domain knowledge.

### 3.3.3 Data Dissemination Issues

In the public sector data integration and dissemination (i.e., sharing data with partner agencies as well as opening data to the public) are important for an agency in delivering better services and to gain citizens' trust by being, for example, transparent. When sensitive data are integrated and shared, privacy protection and information security become extremely important. This means that information systems must be secured, data must be sanitized considering its usage purpose and utility, and access to sensitive data must be controlled.

Also, with the advent of cloud computing and big data paradigms we witness that data often propagates from its origin (i.e., data owners or data subjects) and goes through a number of data processing units. Along its path the data is quite likely processed and integrated with other information about the subject in every data processing unit. One can foresee that at a certain point in the chain of data processors, a data processor may infer more privacy-sensitive information about a data subject than the data subject desires. This can lead to breaches of privacy-sensitive data if inadequate privacy preserving measures are in place.

A Legal Logistics system obtains data from various autonomous systems. Therefore it is quite foreseeable to encounter data quality issues and data semantic discrepancies when we receive data from such sources. When data is disseminated with other parties or with the public it is important, considering the sensitivity of criminal justice system and processes in the society, to minimize (or preferably eliminate) data quality issues and thereby reduce the possibility of data misinterpretation.

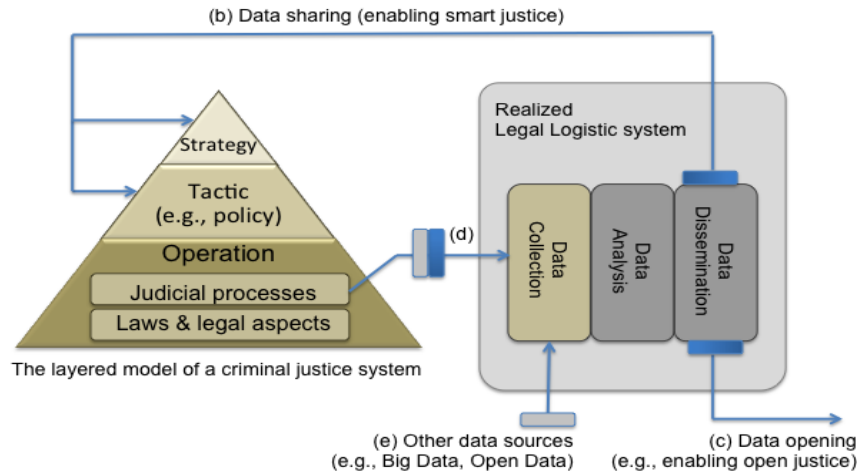
## 4. PROOF OF CONCEPT

In this section we demonstrate a practical implementation of information systems based on the Legal Logistics framework. In Section 4.1 we describe the environment we created to enable judicial policy informatics. In Section 4.2 we describe how some of the challenges described above were addressed. In Section 4.3 we give an example of the implementation and use of Legal Logistics based system by policymakers of the Dutch Ministry of Security and Justice.

### 4.1 Enabling Judicial Policy Informatics

Within the research and documentation center of the Dutch Ministry of Security and Justice (WODC) we have realized a prototype of the Legal Logistics framework to systematically collect, analyze and disseminate data about the Dutch criminal justice system. Within this framework various ICT solutions are unified, see [2,3,4,5]. As mentioned before, the data collected from various agencies in the criminal justice system like the police, PPS and courts, is mainly about judicial processes (e.g., temporal data corresponding to the beginning and ending of criminal cases), as shown by arrow-d in Figure 4. The WODC also obtains relevant information indirectly through external sources as shown by arrow-e in Figure 4.

The collected criminal justice data is used for two purposes mainly: 1) to improve the Dutch criminal justice system and 2) to provide transparency. For the former purpose, as shown by arrow-b in Figure 4, the enriched information is shared with governmental agencies or policymakers in the criminal justice system to allow them to define the future research agenda, to answer policy-related questions, and to assess the possible implications of standing policies of the ministry. For the latter purpose, as shown by arrow-c in Figure 4, the collected data and/or the enhanced information is shared with various agencies and user groups (like scientists, journalists and the public) to stimulate the open justice and open government initiatives. Engaging experts and individuals from the public can provide the public and other experts with a means to, for example, scrutinize the standing policies as well as the WODC's reports. Information dissemination and opening eventually affect and improve the criminal justice system directly and indirectly. In particular, dissemination to the public and external experts enables those public participation principles of smart government vision [25].



**Figure 4: Realized Legal Logistics system, an infrastructure for judicial policy informatics.**

In the following subsections we describe how the challenges of Legal Logistics are addressed in the prototype and present some examples of services realized and used in recent years.

## 4.2 Addressing the Challenges

As explained in section 3.3, there are two important challenges in Legal Logistics: 1) data quality and semantic interoperability issues when collecting and integrating data and 2) privacy-related issues when disseminating data. In this subsection, we will describe how these challenges are tackled in our implementation of the Legal Logistics framework.

Firstly, as said, integrating data from various sources requires establishing unambiguous relations among the data attributes from these sources. There are often, however, no standard formats for such attributes. Even if the data formats were well defined, there are always data quality issues like inconsistency, incompleteness and inaccuracy among such homogeneous data sets, which make an unambiguous integration of these data sets an expensive and challenging task.

Depending on, among others, the severity of such so-called semantic interoperability issues, one may use a specific data integration approach. When the attributes are already fully coherent, then this corresponds to or resembles a single database. When this is not the case, one should try to create it by adopting a data warehouse or a data space approach, depending on availability of microdata and information needs. Ontologies are often used to support semantic interoperability [49].

In the data warehouse approach attributes are integrated rather tightly and on an individual level [47]. Integration of data from various data sets in a data warehouse, requires an enormous amount of effort. These efforts include various data reconciliation activities like removing redundancies, searching for functional dependencies, and performing expensive join operations.

In contrast, in the data space approach, attributes are integrated rather loosely and on a higher level of aggregation [2]. Data integration in a data space involves using a management system that stores the relations among the databases and serves as a communicator between the databases and user queries. Here one relies on domain-expert knowledge to lay down relationship rules for integrating data sets. Developed within our research institute, the data space approach has widely been used for integrating aggregated judicial data sets [2]. We use some typical relationship rules for maintaining the mentioned data quality issues (e.g.,

related to the plausibility and consistency of the data) as well as interoperability issues, (e.g., handling similar data coming from different sources).

Secondly, another important challenge is that when seeking for transparency through data dissemination, we need to take into account particularly the validity and privacy of the disseminated data. Otherwise, negative consequences may be inflicted upon the trust in the agencies that disseminate the data. During data collection, data analysis and data dissemination, there should be necessary and sufficient privacy protection mechanisms in place, as schematically illustrated by small boxes on arrow-b and arrow-e in Figure 4.

For addressing privacy while disseminating data, we have adopted a design approach that is guided by a transition management process [22] to deal with the contending purposes of transparency and privacy preservation. Transition management relies on reflexive governance to guide a change process by taking small steps in strategically chosen directions. In our case, each step corresponds to designing and intervening a privacy protecting data dissemination artifact. The strategic direction chosen in our case is realization of open and smart criminal justice visions. So far we have designed a number of such artifacts, namely, 1) a restricted access procedure [21] (to disseminate our information directly with scientists and for scientific purposes), 2) an open access procedure [21] (to disseminate our information, via a third party, with scientists and for scientific purposes), and a 3) mashups tool [44] (to disseminate our information with policymakers within the ministry via an interactive web interface). Design of these artifacts is based on the principle of access control to limit the scope of data recipient to a special group and to a specific purpose.

Privacy breaches can also occur in internal processes, for example, during data analysis within the Legal Logistics system. To deal with this, we are currently exploring the usage control principle [23]. For example, a project member, who has access to two datasets of two different projects (i.e., for two purposes), should not be able to carry out ‘joins’ between these two datasets. It remains for future research to explore how such a usage control principle can also be imposed when disseminating data externally to other parties and the public.

Another side effect that a Legal Logistics system may face during data dissemination is concerned with low data validity issues, resulting in misinterpretation or misuse of the disseminated data. To this end, we apply data quality management within internal

processes based on data analyst observed issues. These user generated inputs enable us to detect and solve data quality issues based on their severity level, where the severity level is determined in an automatic way [24][45]. When disseminating data externally it is of outmost importance to provide metadata about the syntax, semantics, and context of the data so that the chance of data misinterpretation by data recipients can be minimized..

### 4.3 An example of Legal Logistics in Practice

In the Netherlands, the enforcement of sanctions is closely monitored by policy advisers of the Ministry of Security and Justice in a special program called Enforcement of Criminal Convictions (USB, which in Dutch stands for *Uitvoeringsketen Strafrechtelijke Beslissingen*). This program aims to improve the processes in the enforcement phase, while strengthening the collaboration between the agencies involved. To do so, policy advisers from the program have defined several key performance indicators (KPIs) in accordance with these agencies [5]. These KPIs pertain to different objectives of the USB program, such as promptness (the enforcement of the sanction begins quickly) and certainty (the convict is unable to avoid his punishment and completes it entirely). Thus, the KPIs examine the enforcement chain as a whole and measure whether the agencies work together properly. The performance on these KPIs is monitored in a system that brings together data from different agencies.

To calculate the defined KPIs, data referring to the same case need to be integrated on an individual level. Aggregate data cannot be used, because a case must be recognizable or identifiable throughout the whole enforcement phase, from the verdict to the completion of the sentence. For the purpose of data reconciliation, the unique case number registered by the PPS can be used, as it is also available in most registration systems in the enforcement phase. A data warehouse approach, therefore, was used to process and exploit the data.

#### 4.3.1 Implementation of the System

In the developed information system, data are first extracted from a set of sources (containing individual level data). These data are then encrypted, formatted, and cleaned. Finally, the relevant data are integrated and structured into a so-called event database from which the KPIs can be calculated.

The event database is obtained by performing a set of joins on the separate data received from the agencies involved. While doing so, it is assumed that data with the same case number are part of the same criminal case. The resulting database contains all relevant events that took place per case. These are sorted chronologically so that a detailed picture of the development of each case can be constructed. This allows for determining exactly which action was taken on which data by which agency. Thus, the structure of the event database resembles a timeline.

From the timelines in the event database the KPI results are calculated using classification trees. This is done using cohort analysis. Here, a cohort is a set of cases (with the same sanction) that have their starting point (the PPS's settlement or court's verdict) in the same particular period (usually a quarter). All these cases are followed for a certain predefined period (called the observation period). For this reason, depending on the length of the observation period, this method looks at relatively old cases. Based on the classification trees, for each case in the cohort its status at the end of the observation period is determined and each case is assigned to one of the categories. These results are then aggregated into KPI results per cohort.

As an example of how this works, consider one of the indicators formulated in the USB program: the timely start of the enforcement of sanctions (see also [5,12]). This indicator relates to the elapsed time between the sentence and the start of the enforcement and measures whether the agencies that enforce sanctions handle cases quickly and the convicts receive their punishment in time. Elapsed time is operationalized as the difference in time between a so-called starting and finishing point. For this particular KPI, the starting point is the date at which the sanction is imposed by the PPS or court. The finishing point is the time at which the enforcement of the sanction begins (e.g., by putting the convict in prison or him paying a part of the fine). Note that another KPI measures the time between the verdict and the completion of the sanctions (the time at which the enforcement of the sanctions ends).

#### 4.3.2 Practical Use

Currently, four different KPIs have been defined, while 15 sanctions are distinguished. In total there are 38 classification trees as not all KPIs are relevant for all sanctions. The results are updated periodically and are currently published in written reports. These reports contain a selection of results: a limited number of cohorts are shown, while one observation period is chosen as the default. A web interface provides access to all calculated results and the complete history of results.

The written reports are discussed in scheduled feedback groups. In these meetings, both policy advisers and representatives from the involved agencies deliberate. Together, they try to interpret the results and determine whether the measurements are correct or need to be altered. Each meeting focuses on one type of sanctions (i.e., custodial sentences, fines, community services, or conditional sentences). As the reports contain both the performance of the most recent cohort available and its preceding cohort (depending on the observation period these may be relatively long ago or fairly recent), the results are compared and sudden large differences investigated. Also, the reports show the long-term trend in the performance, which is monitored during the meetings.

To determine whether the performance is satisfactory or should be improved, norms were defined, relating to the chosen default observation period, per KPI and sanction. This was done in the mentioned feedback groups in which additional domain experts participated. These norms (for the chain as a whole) are partly based on standing working arrangement between agencies, and (implicit) norms per agency. Such explicit norms force the agencies involved to collaborate better. By relating the actual results to these norms, and watching whether the long-time trend is in line with or deviates away from it, policy advisers can use them to detect unwanted effects and evaluate current policy. This may help them to decide on implementing new policies to reduce any unnecessary delays.

## 5. RELATED WORK

In this contribution we introduced a framework for collecting, integrating and opening criminal justice data for open and smart government purposes, and described the way that we have realized and deployed this concept. This contribution, to the best of our knowledge, is unique in providing such a framework in a systematic and descriptive way, which can be used as a baseline information system for realizing smart and open government.

There are, however, several similar open government initiatives that aim at publishing of public sector information (see [27] [28] for an overview). Initiatives for open criminal justice have been



established in recent years to increase the transparency and accountability of criminal justice systems through releasing judicial public sector data to citizens, exerts, and/or enterprises. Compared to their counterparts in other parts of the public sector, open criminal justice initiatives have been reported less frequently in literature. The most important initiatives include websites with information about proceedings and verdicts [38,39] or crime related data such as crime trends [40] and crime maps [41,42,43].

Similarly to above mentioned websites, WODC publishes criminal justice data to the public as well as to partner agencies based on the Legal Logistics framework [2,4,21,48]. Nevertheless, unlike the initiatives and sites mentioned, we publish our data at a highly aggregated statistical level in order to counter and contain privacy and data quality issues.

There are also some criminal justice initiatives that aim at providing a systematic access to criminal justice data and/or a systematic data processing and exploitation for specific judicial processes. Most of the efforts to process criminal justice data in a systematic way have been concerned with improving specific processes at the operational level. For example, [37] and [38] the authors aim at improving the efficiency of courts in Taiwan and Brazil, respectively by predicting the amount of time a suspect would spend in the criminal justice system (i.e. the period between the date of arrest and the date of the final decision). Additionally, in [48], the authors present a comprehensive ICT infrastructure for collaboration between several agencies involved in the criminal justice system in Uganda.

Moreover, the research on using ICT for optimization of criminal justice systems, particularly at the policy level, is still in its infancy [2]. Our Legal Logistics framework aims at generating reliable and consistent management information that can be shared among partner agencies as well as with the public in order to realize the vision of open and smart government in the criminal justice sector. Such a systematic approach has only recently gained interest in the field of criminal justice [42,43], where heterogeneous data are traditionally related manually or semi-manually by domain experts (due to the complexity of data interpretation [45,46]) in a tedious and error prone process.

## 6. CONCLUSION

In this paper we proposed the ‘Legal Logistics’ framework that can be used to exploit ICT innovations in legal systems. This framework utilizes the information being generated by such a system in order to gain insight into and contribute to the properties required for it’s well-functioning. The framework, therefore, focuses on the collection, integration, and dissemination of all relevant data. These three processes come with various challenges that we addressed in this paper.

By applying the Legal Logistics framework to the (Dutch) criminal justice system we illustrated that such a framework can be used as a measurement instrument to gain insight in its well-functioning. We have shown that Dutch policymakers use the implemented framework. Thus, a Legal Logistics framework allows for streamlining the innovations in a criminal justice system and can be regarded as a roadmap towards smart and open justice.

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