Can complexity theory help understanding tomorrow e-justice?

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Introduction

This paper investigates the e-Justice design and implementation experience taking place at EU level for the provision of **e-Justice cross border judicial services** through the complex theory lenses. The purpose is to investigate the capacity of the complexity theory to describe and provide a better understanding of the e-Justice phenomenon. e-Justice has been part of the EU political and policy making discourse for the last ten years, reaching the highest levels of political discussion since June 2007, when "the JHA Council decided that work should be carried out with a view to developing at European level the use of information and communication technologies in the field of justice, particularly by creating a European portal to facilitate access to justice in cross-border situations".[1] Since then, EU Member States, the EU Council, the EU Commission and the EU Parliament have worked to foster an overall e-Justice strategy and to create synergies between efforts at European and national levels. In particular, while the "development of e-Justice depends primarily on the will of the Member States"[2] at national level, Commission has financed the development, operation and translations of the European e-Justice Portal and provided funding opportunities for e-Justice projects through a number of means, including DG Justice, the Connecting Europe Facility, the Interoperability Solutions for European public administrations, and the Competitiveness and Innovation Framework programs.

While these initiatives are laudable, the e-Justice discourse has been so far typically characterized by an instrumental stance, according to which technology is seen as a passive tool that may support the justice service provision. As an example, in its communication 'Towards a European e-Justice Strategy',[3] the European Commission, e-Justice represents a means of "placing information and communication technologies (ICT) at the service of judicial systems creates possible solutions by improving their functioning and contributing to a streamlining of procedures and reduction in costs".[4] Even when complexity of e-Justice is addressed, the focus is typically on the large number of technological, legal and organizational components and the difficulty to a complete description in terms of individual constituents. For this reason, actions undertaken have focused on providing support and developing technological artefacts. Not much attention was given to the interactions, interdependencies, and mutual adaptations of the technological artefacts with the broader socio-legal context.

The main drive of this paper is to better understand the elusive features of this broader phenomenon, which is resulting very difficult to tackle (and to explain) through the traditional process modeling and normative driven approaches typically implemented in the field. It is an attempt to tackle the inadequacy of the "technological determinism and instrumental rationality underlying systems development",[5] which characterises the "current orthodoxy within IS theory and research"[6] and the current ICT and e-Justice

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1 Draft strategy on European e-Justice 2014-2018, OJ C 376, 21.12.2013, p. 7–11

2 COM(2008)329 final p.4

3 European Commission communication to the Council, the European Parliament and the European Economic and Social Committee COM(2008)329 final

4 COM(2008)329 final p.2

5 Howcroft D., "Information Systems" in Alvesson, M. et al. (2009) The Oxford Handbook of Critical Management Studies, Oxford University Press on Demand, p. 393

6 Howcroft D., "Information Systems" in Alvesson, M. et al. (2009) The Oxford Handbook of Critical Management Studies, Oxford University Press on Demand, p. 393

development practice.[7] The authors are interested in theoretical perspectives, frameworks, and methods that can help achieve a better understand and manage large scale e-Justice systems. Given its characteristics, complexity theory seems to provide a framework capable of supporting such initiative.

In order to explore the capacity of the complexity theory to describe and provide a better understanding of the e-Justice phenomenon, this paper focus on the e-CODEX experience. e-CODEX is a EU e-Justice system developed over a period of 66 months by a €25m EU co-funded Large Scale project, which involved 25 partners from 20 Member States. The project succeeded in creating an infrastructure to support the communication and the exchange of legal information in EU cross-border judicial procedures.

The paper is structured in a number of section seeking to provide a clearer image of the e-Justice phenomenon from a theoretical and practical perspective. The first section introduces the theoretical framework provided by the Complexity theory and Complex adaptive systems theory. This will be used as a guide for the analysis of the e-CODEX case. The second section will offer an overview of the justice service provision and of the changes that have affected the justice domain in the last years. The third section describe the design and implementation of ICT (EU cross-border) justice service provision systems through the case of e-CODEX as well as some of the projects and initiatives that followed e-CODEX in an attempt to provide 'usable services'.

1. Complexity theory and Complex adaptive systems

The pressing need to better understand the on-going e-Justice phenomenon and help better govern it has driven us to explore developments in large scale ICT systems and organizational theory which may provide a guide or at least a support in this endeavor. Within these fields of research, Complexity theory (CT) and Complex adaptive systems (CAS) have a relevant position as they help address many relevant problems and seem to have a strong explanatory capability for the observed phenomena. But what is complexity? How can it be defined? How can it be applied to better understand ICT systems, their development and change?

To answer all these questions, several steps need to be taken. As a first step, following Cilliers suggestion, it is important in our perspective to "distinguish between the notions 'complex' and 'complicated'. If a system— despite the fact that it may consist of a huge number of components—can be given a complete description in terms of its individual constituents, such a system is merely complicated. […] In a complex system, on the other hand, the interaction among constituents of the system, and the interaction between the system and its environment, are of such a nature that the system as a whole cannot be fully understood simply by analysing its components. Moreover, these relationships are not fixed, but shift and change, often as a result of self-organisation. This can result in novel features, usually referred to in terms of emergent properties".[8]

After this general but very relevant distinction, the second step is a contextualization of Complexity Theory within the broader context of theoretical approaches investigating

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[7] Steigenga E. and M. Velicogna (2016) Envisioning the Next Step in e-Justice: In Search of the Key to Provide Easy Access to Cross Border Justice for All Users

[8] Cilliers, P. (1998). Complexity and postmodernism: Understanding complex systems. New York: Routledge, pp. viii-ix

complexity. Simon [9] shows how alternative views of complexity have emerged from successive waves of interest toward complexity and complex systems. Many concepts were developed starting from the beginning of the twentieth century, concepts such as *holism* (as opposed to reductionism), *gestalt* (the ability to perceive a pattern, a form that shows properties cannot be derived from the simple summation of its parts),[10] and *creative evolution* [11] where investigated. After the second World War, attention moved to *cybernetics* and the role of *information*, *feedback* and *homeostasis* in maintaining complex systems, and *Allgemeine Systeme* (general systems). Most recently concerns to complexity have shifted to the study of "mechanisms that create and sustain complexity and on analytic tools for describing and analyzing it",[12] and "is often associated with 'chaos,' 'adaptive systems,' 'genetic algorithms,' and 'cellular automata.' ".[13] This latest wave of research falls under the umbrella of the so-called *Complexity Theory*. It originated in the disciplines such as biology, cybernetics, mathematics and computing, to extend to the other fields of research to include social [14] and legal systems. [15] "Geographers, and environmental, human, and regional planners have applied complexity theory to topics ranging from cultural transmission and economic growth to the braiding of rivers." [16]

"Complexity theory is a trans-disciplinary development (Capra 1997), so it is important to be careful as to the specific nature of the translation of concepts and theories from between different disciplines, especially between those based on mathematical abstractions and those that include the complications of empirical observations. While there have been attempts to develop a unified theory of complexity (Holland 1995), the significance of the relationship of a system with its environment, ambiance or context means that this is fraught with difficulties (Chu et al 2003)." [17]

At the same time "neither a single science of complexity nor a single complexity theory exists yet". [18] Indeed, it has been argued that "there are separate kinds of complexity that have different and sometimes conflicting assumptions and conclusions". [19]

The third step is therefore the identification of the key complexity theory elements which can be used to better understand ICT systems, and to arrive at a definition of complexity theory that will be used in this paper. Mitchell describes a complex systems theory as "an interdisciplinary field of research that seeks to explain how large numbers of relatively

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9 Simon, H. A. (1996). The sciences of the artificial. MIT press.

10 von Ehrenfels, C. (1988). On "Gestalt qualities". Foundations of Gestalt Theory. Munich: Philosphia Verlag.(Original work published in 1890).

11 Bergson, H. (1911). Creative evolution (Vol. 231). University Press of America.

12 Simon, H. A. (1996). The sciences of the artificial. MIT press, p.170

13 Simon, H. A. (1996). The sciences of the artificial. MIT press, p.169

14 Walby, S. (2003) Complexity Theory, Globalisation and Diversity, Paper presented to conference of the British Sociological Association, University of York, April 2003, p.6

15 Zhang, K and Schmidt A.H.J. (2015) Thinking of data protection law's subject matter as a complex adaptive system: A heuristic display, computer law & security review 31 (2015) pp. 201-220

16 Manson (2001) Simplifying complexity: a review of complexity theory, Geoforum 32, p. 405

17 Walby, S. (2003) Complexity Theory, Globalisation and Diversity, Paper presented to conference of the British Sociological Association, University of York, April 2003, p.6

18 Mitchell, M. (2009). Complexity: A guided tour. Oxford University Press, p.14

19 Manson (2001) Simplifying complexity: a review of complexity theory, Geoforum 32, p. 406

simple entities organize themselves, without the benefit of any central controller, into a collective whole that creates patterns, uses information, and, in some cases, evolves and learns".[20] Furthermore in complex systems "relatively simple components collectively give rise to very complex behavior involving signaling and control, and in which adaptation occurs over time".[21] Indeed, one of the constitutive characteristics of complex systems is that they are "made up of large numbers of active elements that […] are diverse in both form and capability".[22] Such elements are referred to in terms of agents, entities and **components**. In this paper we will try wherever possible to use the latter term as it is consistent with the descriptions made so far in the e-Justice sector and in our opinion more appropriate to refer to technological, legal and organizational components in addition to the human ones which constitute such systems. Individual components typically have different functions or goals that guide their behavior. At the same time, the presence of a plurality (however large) of components is not enough to define the system as complex.[23]

A key element of complex systems is in the nature of the **relationships** (interactions) between the components that constitute it. Such relationships are contingent and may vary in number, intensity and nature, and must be therefore investigated to understand the system. At the same time, "Understanding and tracing the relationships of a single entity is difficult, while tracing them in an entire system verges on the impossible. Given the number and variety of these relationships, they extend beyond simple feedback into higher order, non-linear processes not amenable to modeling with traditional techniques (Costanza et al., 1993)".[24] Even in the case of systems composed of homogenous components, internal diversity can be generated through realignment of relationships to create non-identical systems.

Another key element is that of **aggregation**. Aggregation in complex systems theory refers to the "emergence of complex large-scale behaviors [and proprieties] from the aggregate interactions[25] of the system constituent components. In producing this large-scale behavior, though, "components are largely limited to local interactions. There is no omniscience or constantly updated common body of information".[26] Following on this, as a general rule, each system component "is ignorant of the behaviour of the system as a whole, [… and therefore] responds only to information that is available to it locally".[27] Furthermore, the interactions of these aggregated systems are often best described in terms of their aggregate properties.[28] From this the interest in looking at aggregate

[20] Mitchell, M. (2009). Complexity: A guided tour. Oxford University Press, p.4

[21] Mitchell, M. (2009). Complexity: A guided tour. Oxford University Press, p.6

22 Holland, J. H. (1995). Hidden order: How adaptation builds complexity. Helix Books. P.6

23 Cilliers, P. (1998). Complexity and postmodernism: Understanding complex systems. New York: Routledge, p. 3

24 Manson (2001) Simplifying complexity: a review of complexity theory, Geoforum 32, p. 409

25 Holland, J. H. (1995). Hidden order: How adaptation builds complexity. Helix Books. P.11

26 Manson (2001) Simplifying complexity: a review of complexity theory, Geoforum 32, p. 409

27 Cilliers, P. (1998). Complexity and postmodernism: Understanding complex systems. New York: Routledge, p. 4

28 Holland, J. H. (1995). Hidden order: How adaptation builds complexity. Helix Books. P.11

complexity, which "lies in relationships between components",[29] also considering that often "a complex system is defined more by relationships than by its constituent parts".[30] A useful element of Complexity theory is the possibility to study the components and their behavior at individual, aggregate (aggregate agents or components or sub-systems) and system level.

Another concept which is key to the complex theory perspective is that of **adaptation** which may take place both at both the micro (component) and macro level (system). According to Mitchell "Sometimes a differentiation is made between complex adaptive systems, in which adaptation plays a large role, and non adaptive complex systems, such as a hurricane or a turbulent rushing river".[31] "Adaptation, in biological usage, is the process whereby an organism fits itself to its environment. Roughly, experience guides changes in the organism's structure so that as time passes the organism makes better use of its environment for its own ends".[32] Following Holland example, translating the concept for use in a socio-technical environment "we expand the term's range to include learning and related processes".[33]

An important element of complex adaptive systems (CAS) is that "their behavior is not well described by the trajectories around global optima. Even when a relevant global optimum can be defined, the system is typically so 'far away' from that optimum that basins of attraction, fixed points, and the other apparatus used in studying optima tell little about the system's behavior."[34] As complex systems operate under conditions far from equilibrium, "There has to be a constant flow of energy to maintain the organisation of the system and to ensure its survival. Equilibrium is another word for death".[35]

Components change and adapt one another over **time** generating a path dependency. Indeed, when dealing with complex adaptive systems, their environment and that of their adaptive components consists of other adaptive entities, so that a portion of any system and/or component adaptation is directed toward adapting to other adaptive system and/or component. In this sense, systems do not evolve but co-evolve, and "the concept of co-evolution replaces any simple notion of single directional impact."[36] According to Holland, "This one feature is a major source of the complex temporal patterns that *cas* generate. To understand *cas* we must understand these ever-changing patterns".[37] Given this perpetual flux and perpetual novelty of the parts of the system, "Standard theories … are of little help

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29 Manson (2001) Simplifying complexity: a review of complexity theory, Geoforum 32, p. 409

30 Manson (2001) Simplifying complexity: a review of complexity theory, Geoforum 32, p. 409

31 Mitchell, M. (2009). Complexity: A guided tour. Oxford University Press, p.13

32 Holland, J. H. (1995). Hidden order: How adaptation builds complexity. Helix Books. P.9

33 Holland, J. H. (1995). Hidden order: How adaptation builds complexity. Helix Books. P.9

34 Holland J.H. (1992) Adaptation in Natural and Artificial Systems p.x

35 Cilliers, P. (1998). Complexity and postmodernism: Understanding complex systems. New York: Routledge, p. 4

36 Walby, S. (2003) Complexity Theory, Globalisation and Diversity, Paper presented to conference of the British Sociological Association, University of York, April 2003, p.3

37 Holland, J. H. (1995). Hidden order: How adaptation builds complexity. Helix Books. P.10

because they typically concentrate on 'end points,' whereas complex adaptive systems 'never get there.'"[38]

As introduced talking about aggregation, a complex system observed as a whole presents many unexpected large scale proprieties including "its overall structure, the way in which it grows, how information propagates over its links, and the coevolutionary relationships between the behavior"[39] and features of its components. In other words, a "system can have emergent qualities that are not analytically tractable from the attributes of internal components (Baas and Emmeche, 1997)".[40] Accordingly, the aggregate emergent system is much **more complex that the sum of its components behavior**.

In particular, complex systems, their changes and evolutions are sensitive to small, incremental changes resulting in non additive, non linear dynamics.[41] There is, in other words, the "potential for small changes in one place to result in large changes elsewhere".[42] "nonadditive interaction (Le., "epistasis" or "nonlinearity") makes it impossible to determine the performance of a structure from a study of its isolated parts. Moreover possibilities for improved performance must usually be exploited at the same time that the search for further improvements is pressed".[43] An important feature of complex system is therefore that they show **non-linear behaviors**. "Nonlinearities mean that our most useful tools for generalizing observations into theory - trend analysis, determination of equilibria, sample means, and so on - are badly blunted".[44] In the everyday understanding of systems, local events have by themselves limited impact on the larger scale processes. In light of non-linear dynamics (the butterfly) "a local action may directly affect those at a larger scale without moving through intermediary scales. Similarly, local action, instead of being dampened out, may become amplified through the non-linear interactions between components across scales."[45] To take this into account, "planning must be sensitive to the transformative effect of local interactions".[46] At the same time, as Cilliers highlights, "the robust nature of complex systems, i.e. their capability to perform in the same way under different conditions, [… ensuring] their survival"[47] play a key role in determining the effects on the overall system of non-linear interactions and chaotic behaviors.

Another important aspect of CAS is that the development, behavior and evolution of such systems "depends on the interactions much more than the actions".[48] While a large array of components interact together to allow the system to perform its functions, this array

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38 Holland J.H. (1992) Adaptation in natural and artificial systems, MIT, pp. 184-185

39 Mitchell, M. (2009). Complexity: A guided tour. Oxford University Press, p.10

40 Manson (2001) Simplifying complexity: a review of complexity theory, Geoforum 32, p. 410

41 Manson (2001) Simplifying complexity: a review of complexity theory, Geoforum 32, p. 408

42 Manson (2001) Simplifying complexity: a review of complexity theory, Geoforum 32, p. 408

43 Holland J.H. (1992) Adaptation in natural and artificial systems, MIT, p.xiii

44 Holland, J. H. (1995). Hidden order: How adaptation builds complexity. Helix Books. P.5

45 Manson (2001) Simplifying complexity: a review of complexity theory, Geoforum 32, p. 408

46 Manson (2001) Simplifying complexity: a review of complexity theory, Geoforum 32, p. 407

47 Cilliers, P. (1998). Complexity and postmodernism: Understanding complex systems. New York: Routledge, p. ix

48 Holland, J. H. (1995). Hidden order: How adaptation builds complexity. Helix Books. P.3

itself is constantly in flux, as individual components and their interactions change over time leaving us with only vague ideas and a limited understanding of longer range dynamics.[49]

"Complex systems are usually open systems, i.e. they interact with their environment".[50] As a result, defining the boundaries and components of a system can be problematic.[51]

Building on these elements and on Mitchell definition of complex system,[52] we here define a complex (adaptive) system as system in which large networks of components operating at least partially without central control, more or less homogeneous and linked by relations which may vary in intensity and nature, which may give rise to complex collective behavior, sophisticated information processing, and adaptation via change, learning or evolution. This definition, and the key concepts derived from this short description of Complexity theory and Complex adaptive systems will be used to describe the e-CODEX system, a concrete example (and core part of) of EU e-Justice development.

2. EU justice systems and EU justice domain – an overview of the broken equilibrium

Before tackling the issue of cross border e-Justice and its complexity, a short introduction on EU justice systems features and recent trends is required. Justice systems have been traditionally designed as **highly structured and regulated systems**, characterized by high level of formality, where standardized procedures and practices are designed to support and uphold the Law (and its liturgy) through the justice service provision. The image of the temple, detached by everyday byplay, provides the classic representation of the place where justice is administered. [53]

This vision and the reality of the justice service provision underlying it are now being challenged. All around Europe, over the last 20 years, 3 drives for change have started shaking the pillars of the (national) temples of the law. Firstly, the growing relevance of the **European dimension,** through common legislation aimed at providing shared minimum procedural and substantive standards, judicial cooperation tools, cross-border judicial procedures, the case law of the Court of Justice of the European Union, but also monitoring and evaluation initiatives, such as the EU Justice Scoreboard.[54]

Secondly, the diffusion of **New Public Management values,** requiring public administrations (including the judiciaries) to commit to a deliberate (and continuous) change of the process. This does not look just at normative reforms but adopts a managerial orientation to improve efficiency, accountability and user orientation.

Thirdly, the rise of **Information and Communication Technologies** at national and EU level, with ICT supporting an increasing number of key areas. This is resulting in the

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49 Holland, J. H. (1995). Hidden order: How adaptation builds complexity. Helix Books. P.3

50 Cilliers, P. (1998). Complexity and postmodernism: Understanding complex systems. New York: Routledge, p. 4

51 Manson (2001) Simplifying complexity: a review of complexity theory, Geoforum 32, p. 411

52 Mitchell, M. (2009). Complexity: A guided tour. Oxford University Press, p.13

53 Mohr, R., & Contini, F. (2011). Reassembling the Legal: 'The Wonders of Modern Science' in Court-Related Proceedings. *Griffith Law Review*, *20*(4), 994-1019.

54 Dubois, E. et al. (2013). The functioning of judicial systems and the situation of the economy in the European Union Member States (Conseil de l'Europe).

Ng, G. Y. et al. (2007). Monitoring and evaluation of court system: A comparative study. Council of Europe Publ..

diffusion of an increasing number of technological applications and of their interconnectedness (between them and with the judicial practices), and in the growth of their relevance for the functioning of the justice system.[55] Looing at EU e-Justice an increasing number of initiatives have been carried out so far. A key political starting point is the Justice and Home Affairs Council June 2007 decision, which was followed by the EU Commission and Parliament initiatives. These initiatives sketched an overall strategy for the development of e-Justice at European level in synergy with the Member States.[56] This resulted in more concrete effects such as the e-Justice portal, and a number of EU co-funded projects such as e-CODEX, e-SENS, API for Justice, Pro-CODEX, Find a Lawyer, interconnection of insolvency registers etc. All these projects have and are designing and implementing additional components to the EU e-Justice initiative. Figure 1 Representation of European e-Justice landscape offers a glance of some of the key e-Justice projects dividing them by user group, channel (e-justice portal, closed or open public national application or third party application) and kind of service provided.

These three drives for change challenge the conventional notions of stability and change that have driven the evolution of justice systems in the past. Furthermore, justice systems are in the midst of such a process of change without a complete understanding of the phenomenon and its dynamics, and without being able to fully explain its effects or to predict its side effects.

Within this broader context, design and implementation of **ICT (EU cross-border) justice service provision systems** has revealed a plurality of complexity factors which traditional ICT development approaches are not capable to address properly.

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[55] Velicogna, M. (2007). Justice Systems and ICT: What Can Be Learned from Europe?. *Utrecht L. Rev.*, *3*, 129. *Available at SSRN* 998246.

Velicogna, M. (2011). Electronic Access to Justice: From Theory to Practice and Back. *Droit et cultures. Revue internationale interdisciplinaire*, (61).
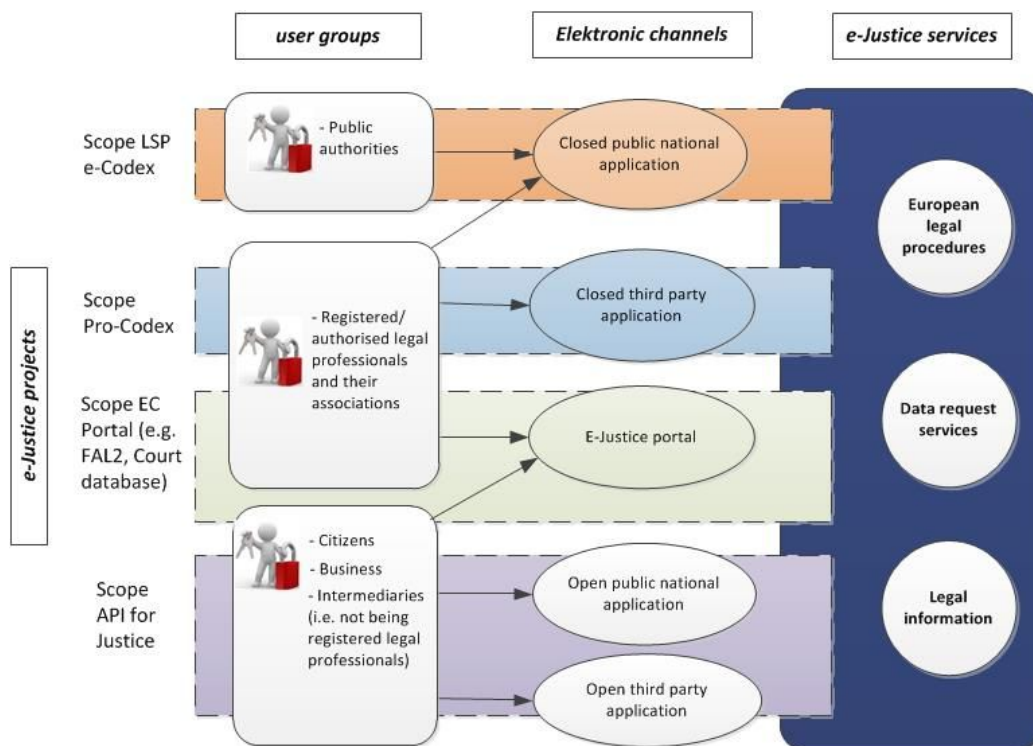
[56] COM(2008) 329 final, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2008:0329:FIN:EN:PDF

Figure 1 Representation of European e-Justice landscape

3. Complexity theory and e-Justice: the e-CODEX case

This section explores the applicability of the Complexity theory and Complex adaptive systems concepts and their capability to explain the e-CODEX project and infrastructure main features and their complexity. As surprisingly as it may appear, we will show how e-justice systems seems to share many of the features and puzzles presented by systems typically addressed by main stream(s) CAS research such as immune systems, insects collectives.

The first difficulty that presents itself in describing e-CODEX is its definition. Depending on the focus of the attention and on the aims of the analysis, e-CODEX has been defined as a project,[57] a technology,[58] a cross border infrastructure developed and implemented in the EU justice domain,[59] a governance player in the EU justice domain,[60] an assemblage of heterogeneous components, and a method.[61]

We will try to address these many facets starting with an introduction of e-CODEX as a project, to address the complexity of technical, legal and organizational layers of

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57 e-CODEX Technical Annex, website etc.

58 e-CODEX technical Deliverables, e-CODEX D7.6

59 Velicogna, M. (2014). Coming to Terms with Complexity Overload in Transborder e-Justice: The e-CODEX Platform. In The Circulation of Agency in E-Justice (pp. 309-330). Springer Netherlands.

60 Velicogna, M., & and Lupo, G. (2016). From drafting common rules to implementing electronic European Civil Procedures: the rise of e-CODEX. Presented at the "From common rules to best practices in European Civil Procedure" conference, 25 and 26 February 2016, Rotterdam.

61 Steigenga E. & M. Velicogna (2016), Envisioning the next step in e-justice: In search of the key to provide easy access to cross border Justice for all users.

components, the operational complexity and the long term sustainability of the system. As the description of the case will show, while a separation between groups of components is done for descriptive purposes, relationships, interactions and interdependencies takes place between such heterogonous groups of components.

3.1. The e-CODEX project

As a project, e-CODEX is the first European Large Scale Pilot project of the Information and Communication Technologies Policy Support Programme (ICT PSP) in the domain of e-Justice. Within the Competitiveness and Innovation Framework Programme (CIP), the ICT PSP is part of the European Union effort to exploit the potential of the new information and communication technologies. e-CODEX started as a 36 months project involving 19 partners and 15 European States, mainly through their Ministries of Justice or their representatives, as well as three other institutions: the Council of Bars and Law Societies of Europe, the Council of the Notaries of the European Union, and the National Research Council of Italy. From its beginning, in December 2010, the project has been extended twice to last 66 months. The extension also had its budget risen from €15m to €24m (EU contribution: €12m). The number of participants increased to 25 and the number of States actively involved to 20. The explicit aim of the e-CODEX project is to improve the cross-border access of citizens and businesses to legal means in Europe as well as to improve the interoperability between legal authorities within the EU.[62]

3.2. Complexity of the technical components

ICT development is generally acknowledged to be a complex activity.[63] The process of identifying and translating technical and procedural requirements into software "magnifies the complexity inherent in systems development. Thus, system specification, design, and implementation are highly complex and interrelated tasks that greatly complicate the design of custom solutions able to satisfy user requirements".[64] The cross-border and judicial dimensions together with the diversity of national software applications, architectures, software technological and legal environments, and the variety of users and tasks involved, all contribute to the complexity.

Having the general aim of the project in mind, e-CODEX partners worked on the development of an e-delivery solution that uses building blocks from previous EU Large Scale Projects[65] (LSP) and national projects to allow data and documents exchange, and the validation and cross-border recognition of e-identities and e-signatures.[66] All these are

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62 M. Velicogna et al., "D7.6 Architectural Hands on Material (Update of D7.4)", e-CODEX Deliverable, 2016.

63 Ciborra, C. (2000). From control to drift: the dynamics of corporate information infastructures. Oxford University Press on Demand.

Hanseth, O., & Ciborra, C. (Eds.). (2007). Risk, complexity and ICT. Edward Elgar Publishing.

Hanseth, O., & Lyytinen, K. (2010). Design theory for dynamic complexity in information infrastructures: the case of building internet. Journal of Information Technology, 25(1), 1-19.

64 Benbya H. & B. McKelvey, (2006),"Toward a complexity theory of information systems development", Information Technology & People, Vol. 19 Iss 1 p.13

65 PEPPOL: e-procurement, epSOS: e-health, STORK: e-identity and SPOCS: e-business services. More information can be found here: http://ec.europa.eu/information_society/newsroom/cf/document.cfm?action=display&doc_id=1250

66 M. Velicogna, "The Making of Pan-European Infrastructure: From the Schengen Information System to the European Arrest Warrant", in F. Contini and G.F. Lanzara (eds.), *The Circulation of Agency in E-Justice:*

key requirements to have legally effective communication (see next section on complexity of the legal components).

In line with the principle of subsidiarity, and considering the consistent investments already made in e-Justice systems by several Member States, a gateway-based architecture was selected. As clearly stated in e-CODEX already in the project proposal, "these national solutions ... cannot simply be replaced in favour of new, centralised approaches".[67] No central technical component is involved in the communication, as the interconnection is provided through national Gateways.[68] "The function of the gateways is to separate national and EU portal solutions from e-CODEX allowing them to exist independently. It converts messages from the national or EU portal format to a format supported by e-CODEX and *vice versa*".[69] Member States have the possibility to use their national instruments (if available) to provide access e-CODEX infrastructure not only to the justice administration and justice professionals, but also to their citizens. Additionally, where no national access is provided, the general public should be able to access the infrastructure through the EU e-Justice portal,[70] which is intended as a central entry point for citizens, business and legal professions.[71] The idea of using the EU e-Justice portal as central entry point was not initially planned. It emerged as a solution suggested in the high level architecture meetings of the project to the problem of allowing access to justice in all cases where national systems did not have available solutions (which were most of the cases). This project level idea was then discussed with the Commission and agreed upon. While a viable solution from the project perspective, it should be noted that the deployment of this part of the system has been delayed several times and is still pending at the time this paper is being written.

While "Traditionally, IS design relied mainly on the systems development life cycle (SDLC), which is viewed as a single stage in defining a detailed physical form for the technical component of an information system",[72] e-CODEX partners found themselves in need of exploring a wide range of technical and practical possibilities in light of different national technical, legal and socio-political contexts only partially and individually known to the participants. The partners had to develop a method to explore and negotiate goals and solution requirements. It is not a case that e-CODEX 'High Level Architecture Definition report' highlights how "longer than initially anticipated information gathering, but also discussion and negotiation has been required"[73] and that on several areas it leaves the definitions open to further investigation. One of the first steps was to move from the idea of

Interoperability and Infrastructures for European Transborder Judicial Proceedings, Dordrecht: Springer, 2014.

Velicogna, M. (2015) e-CODEX and the Italian Piloting Experience, IRSIG-CNR Working Paper V. 1.0 Available at SSRN 2726515

[67] e-CODEX Technical Annex V.1.1 p.11

[68] Hommik L., Klar A. (2016) e-CODEX Deliverable D4.11 WP4 Final Report

[69] G. Borsari et al., D7.3 High Level Architecture Definition, e-CODEX deliverable (2012) p.9

[70] For more information please see https://e-justice.europa.eu/home.do?action=home

[71] Natalie Nickel et al. (2016) e-CODEX Deliverable D1.16 Final sustainability report and recommendations (Update of D1.12 Sustainability Plan)

72 Benbya H. & B. McKelvey, (2006),"Toward a complexity theory of information systems development", Information Technology & People, Vol. 19 Iss 1 p.15

[73]. G. Borsari et al, "D7.3 High Level Architecture Definition" e-CODEX Deliverable 2012 p.8

developing a solution that satisfies cross-border legal procedure requirements to a more feasible one providing a working solution in a simple case (the EOP procedure). This could then be implemented and tested to address emerging issues, and then extended to include other cases. Some of the other cases were initially studied only from a business process model perspective and for providing some inputs that could be used to explore the evolvability requirements of the system.

Following this approach, a first working solution was developed and tested. In practice, the e-CODEX e-delivery solution receives and hands over (route and forward) data, documents and evidences of the main process steps asynchronously. The solution is content agnostic, in the sense that the transport of data is independent from the format of the files being exchanged and from the business processes being supported. Finally, it is multilateral, in the sense that common standards are agreed upon by the partners to develop common solutions, instead of implementing bilateral arrangements, which create the need for the maintenance of a higher number of solutions and agreements.[74] As the agreement on common standards, common solutions are not stable but subject to change as new Member States are connected and the infrastructures of Member States which are laready connected evolve over time, an organizational component was developed.

At the same time, the function of e-CODEX is not limited to the transportation of data and documents. To enable meaningful exchange of information between national systems, it also supports semantic interoperability. Every Member State participating in the pilots has national solutions for procedures in civil and criminal law (either existing or developed in the context of e-CODEX). Such solutions are typically based on domestic semantic structures. To support the exchange of semantic information, e-CODEX uses common document standards and semantics. Specific coding schemas used by national systems need to be transformed in order to be interpreted by other systems using different schemas. This transformation is better known as mapping. To this end, "e-CODEX has to and will provide the means to connect rightfully and meaningfully that data that is presented in a different format and may carry different interpretations within the Member States".[75] Following a use-case centric modelling approach, for each use-case, with the support of national experts, e-CODEX has developed specifications which ensure mutually equal interpretation of data exchanged between national electronic systems in cross border legal procedures. In practice, for being processed through e-CODEX, the national solutions need to be converted into basic "European" semantic concepts. Member States are responsible for *when*, *if* and *how* the messages are transformed from European to national level and vice versa. The result is that the data being exchanged "is clearly and uniformly understood when exchanged through the e-CODEX infrastructure".[76]

While the theory seems to be quite simple, the actual deployment of the e-delivery solution has been more challenging. A number of issues have emerged in the deployment and testing of the infrastructure at national level, ranging from installation of the e-CODEX gateway, the migration from one version to the following one, configuration of firewalls to allow the communication, the mapping of national schemas with the e-CODEX ones, the testing of communication with the other partners of the network. One clear indication has been that while some problems can be anticipated, a number of other difficulties cannot. In

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[74] G. Borsari et al, "D7.1 Governance and Guidelines Definition", e-CODEX Deliverable 2011

[75] E. Francesconi et al. "D6.3 Concept for Implementation of WP6", *e-CODEX Deliverable, 2011*

[76] E. Francesconi et al. "D6.3 Concept for Implementation of WP6", *e-CODEX Deliverable,* 2011

order to identify all actual problematic aspects an actual installation and testing is required. As the number of partners increased, coordination problem of having the personnel managing other gateway available for testing the new systems increased. As a partial solution, a tool simulating a complete e-CODEX infrastructure and to provide a full e-CODEX test environment for sending and receiving test messages for existing e-CODEX pilots was introduced. One of the main difficulties was to setup such a tool very quickly after recognising its importance. The Greek team volunteered not only to implement the tool (called a Central Testing Platform, CTP) but also to host it and provide access to all piloting partners. The CTP started with the EOP use case and then extended to include Small Claims, Mutual Legal Assistance and Business registers.[77]

While the CTP helped reducing interdependencies in the initial testing of the gateway, tests with all live partners are still required and the whole process may require some time. In some cases, go-lives of new partners have been postponed for more than one year, as specific problems of communication with one of the partners of the network could not be solved.

In addition to fulfil e-Delivery and semantic functions, an e-ID and expression of will solution needed to be developed. From a technical perspective, identity management systems (systems supporting the indication of intention by identified users and signature verification solutions) were already in place in the different Member States. The main issue was the impossibility at the time to have national e-ID verified in other member states as technologies and infrastructures are national specific. After much discussion it was decided to make e-ID interoperable cross-border through a mechanism of validation of the signature/identification that works at the level of the sender's e-CODEX components and which creates a certification signed by the sending connector authority (i.e. the Ministry of Justice of the sending MS), the so called Trust-Ok-Token. [78] The legal basis for this component will be discussed in the next section, in relation to the legal basis for e-services in the cross-border justice domain. However, it should be mentioned here that while technically feasible, it was recognized that the final appreciation on the validity of the signature belongs the judge deciding on the case. Therefore, while legal opinions in the matter where carried out, his or her interpretation on the legal validity of the mechanism needed to be verified in the actual use.

More in general, the performance criteria to assess the components and the system as a whole and guide their adaptation efforts from a technical perspective included a large number of variables such as technical effectiveness, compliance with international standards, maintenance requirements, evolvability. At the same time, such criteria where not predetermined ex-ante, but emerged in the practice from the discussion between the various project participants, in the dialogue between the project and the EU Commission and in the dialogue between the project participants and their national organizational and political context.

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[77] Velicogna, M., et al. (2016). D7.6 Architectural Hands on Material (Update of D7.4). e-CODEX Deliverable

G. Pangalos, et al., "Using IT to Provide Easier Access to Cross-Border Legal Procedures for Citizens and Legal Professionals-Implementation of a European Payment Order e-CODEX pilot", International Journal for Court Administration (2016) 6(2).

[78] e-CODEX (2015) "e-CODEX achievements, use cases and technical building blocks"

3.3. Complexity of legal components

As it has already began to emerge due to the existing interconnectedness, in addition to its technical components, part of e-CODEX system are also rules and agreements that allow the actual provision of cross border judicial services. Being the legal domain, first of all, procedural rules (laws) are required to authorise and regulate the legal actions to be taken in order for them to have legal value.

Performance criteria for the legal components to be used by the system includes legal and procedural compliance of the legislative process (e.g. drafting process, signature, publication on the official journal, entrance in force, date since when it applies, amendments, position in the legal framework –e.g. relation with other norms-, national implementing legislation, etc.)

At the same time, the legal components provide the means to evaluate the legal compliance of all components and their actions within the legal domain. Laws define if a specific action can be legally carried out within a cross border procedure, and which are its legal effects; define the features that technological tools, communications and actions needs to satisfy to be legally valid, and so on.

An important element about the evaluation of the legal performance is that the 'final' legal interpretation and assessment on the validity of the acts carried out is done by the judge deciding on the case. The judge decides on the basis of local information, practices, perceptions. Its decisions, though may have system wide implications (e.g. if the system or electronic procedure is not considered legally valid in one judgment it may have repercussions on the whole system).

e-CODEX piloted cross-border procedures which had a strong EU legal basis (i.e. EU Regulation or Directive regulating the procedure). It was believed that piloting cross-border procedures based on Regulations would reduce complexity of the piloting. The e-CODEX participants discovered while exploring the processes that stem from the Regulations piloted that the national implementations in the Member States are not equal. The Regulations are not monolithic and self contained, not even from a legal perspective:

- The EU legal instruments regulating cross-border judicial procedures are a compromise between MS in the negotiation phase, leaving (more or less intentionally) space to national interpretation/implementation. In some cases a portion of the procedure is explicitly delegated to the national procedure;
- Even 'strictly regulated parts' such as legal basis are interpreted and implemented in the context of national procedural law, rules, organization and practices;
- The legal basis evolves over time: it is subject to a process of evaluation and re-negotiation investing the whole legal instrument or parts of it e.g. in the case of the European Small Claim Procedure and of the European order for Payment procedure, forms where modified by Council Regulation (EU) No 517/2013 of 13 May 2013, and then the whole procedures were amended by Regulation (EU) 2015/2421

In addition to the specific EU legal instrument regulating a cross-border judicial procedure and related national implementing legislation, the broader legal framework is composed of a number of potentially relevant legal components e.g. Council Regulation (EC) No 44/2001 of 22 December 2000 on jurisdiction and the recognition and enforcement of judgments in civil and commercial matters (now Regulation (EU) 1215/2012).

The legal framework on electronic communications, events and actions in cross-border procedures also provide a source of complexity. At the time of the development of the e-

CODEX system the legal framework on electronic communications and signature[79] was not sufficient to support legally valid exchange of legal documents or performing legal steps in cross-border procedures, an additional component was developed, the Circle of Trust. When electronic communication crosses national borders, mutual trust and acceptance of the national systems that manage such communication is needed. To support this, the e-CODEX project has drafted an agreement called the Circle of Trust, signed by all piloting partners. This established a legal basis to recognise exchanged electronic information. The Circle of Trust also establishes the minimum level of operational and technical requirements the partners need to satisfy to be connected to the e-CODEX system and provide services through it. One of the key concepts supported by the Circle of Trust is that if the information is trusted by the Member State where it originates from, then it may also be trusted by the receiving Member State/s, subject to certain conditions. A Circle of Trust is understood as the mutual recognition between Member States of electronic data, documents and signatures within the existing legal framework.[80] While adequate for the scope of the piloting of services within the lifespan of the project, increasing attention has been given to the extension of the agreement in time (after the end of the project) and in scope (outside the piloting phase). In addition, while so far the signing parties are the Ministries of justice of the Member States involved in the piloting, the question of the extension to other parties has begun being discussed, but it is not clear yet which solution will emerge.

3.4. Complexity of organizational components

In addition to the technological and legal components, the e-CODEX infrastructure and service provision stems from the cooperation and joined effort of a number of organizations, roles and people. These actors are not limited to the project partners' organizations and their staff, but involve also other parties such as DG Justice technicians working on the e-Justice Portal, software houses developing and managing national applications etc., and DG Connect, the DG financially supporting e-CODEX.

The project itself organized its technical activities in three development sub-groups dealing respectively with e-delivery, e-signature and e-identity, and semantic, in addition to one high-level architecture sub-group to help coordinate the technical solutions and a piloting sub-group to coordinate the piloting of the technical solutions in 'real life'. During the project the various partners have been more or less active in the various subgroups. Each subgroup was coordinated by a different project partner, although much of the initiatives on what to do and when rested in the single participants organizations or even single individuals. The initiative of the Greek team to take charge of the development and maintenance of the CTP is described in the section analysing the complexity of the technical components.

Aside of these subgroups, two other bodies played a fundamental role in the project governance: the project Management Board and its General Assembly. The Management Board included the project coordinator and the subgroup leaders. Its task were the overall coordination and monitoring of the implementation of the project, supporting the project coordinator in its interactions with the European Commission and preparing proposals to

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[79] e.g. Directive 1999/93/EC of the European Parliament and of the Council of 13 December 1999 on a Community framework for electronic signatures; Regulation (EU) No 910/2014 of the European Parliament and of the Council of 23 July 2014 on electronic identification and trust services for electronic transactions in the internal market and repealing Directive 1999/93/EC, national rules on electronic communication, identification and signature and electronic evidences in judicial procedures etc.

[80] M. Velicogna, et al. "D7.4 Architectural Hands on Material", *e-CODEX Deliverable,* 2014.

the General Assembly in relation to relevant topics such as rearranging tasks and budgets. The General Assembly is composed of one representative per partner with each country having one vote. It was the ultimate decision-making body of the project, although, given the large number of participants and the low frequency of its meetings,[81] its main role resulted to be the ratification of decisions and proposals from the subgroups and the Management Board.

In addition to the mentioned organization structure, during the project a number of 'self organizing' activities took place. As an example, discovering the complexity of the legal issue, which was initially underestimated as the project had been considered more as a technical endeavor, a dedicated group of legal expert was created in order to explore such complexity and to provide legal support to the more technical and political actors.

As another example, to support the testing and functioning of the installed infrastructure, and to guarantee the service provision, national contact points have been established. While initially emerging as organizational response to a coordination requirement of the testing activities carried out, these positions where then 'legally' designated as responsible for operational and technical matters related to or in connection with the functioning of the e-CODEX System in the Circle of Trust Agreement.[82]

Given the long time span of the e-CODEX project, another element that was possible to observe has been the change in the people working on it. While some people kept working in the project from the beginning to the end, many even relevant figures were reassigned by their organizations, got promoted or changed jobs. Other people arrived, in some cases to substitute previous ones, in other cases as new organizations joined the project, both as a result of the extension of the project,[83] both as the piloting phase involved actor external to the project in the e-CODEX service provision (e.g. courts, software houses etc.).

These and other components are at present still carrying out their tasks even if the project formally ended. Many of these tasks, after the end of the project are in the process of being transferred to other organizations and projects (e.g. technical evolution Gateway and Connector components to CEF, justice sector infrastructure maintenance to Me-CODEX and piloting initiatives to several EU funded projects e.g. e-SENS, CEF call, Pro-CODEX for more details see the following section on political and long term sustainability complexity). At the same time, it looks as if e-CODEX is still persisting. As an example of this, e-CODEX mailing lists are still being used for the coordination initiatives also of other projects.

While this section has focused mainly on the project organization components of the system, it should be noted that the functioning of the actual services is not limited to the infrastructure provided by the project but relies on national organisations (e.g. courts, bailiffs, tax agencies), and on local procedures and practices (e.g. notification, payment of fees).

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81 The General Assembly meets twice a year

82 e-CODEX Agreement on a Circle of Trust, Adopted by the e-CODEX General Assembly on the 20th of February 2013

83 See for example the case of the Italian InfoCamere, which joined e-CODEX during the third year of the project, in order to allow the piloting in Italy of the Interconnection of Business Registers use case (M. Velicogna, "e-CODEX and the Italian Piloting Experience", IRSIG-CNR Working Paper V. 1.0, 2015)

3.5. The piloting complexity

The system was tested through piloting with 'live cases', which refers to the use of the system by real people to deal with real cases. By the end of the project in May 2016, the project had five pilots in the live phase: the European order for Payment – EOP, live since August 2013 and providing services in 7 Member States,[84] the EU Small Claims, live since June 2015 and providing services in four Member States, [85] the Synchronous Communication applied to Business Registers, live since September 2015 and providing services in three Member States, [86] and Secure Exchange of Sensitive Data (which includes Mutual Legal Assistance for criminal law, and civil justice/ Taking of Evidence, EURegio and the Mutual Recognition of Custodial Sentences), live since November 2015 and providing services in three States,[87] and finally, the Financial Penalties, live since May 2016 and providing services in two Member States.[88] Overall, 13 Member States are involved in the piloting.[89]

The piloting stage of the e-CODEX project was carried on in waves. In the EOP case for example, the first use cases being piloted, the first wave saw the involvement of four e-CODEX partners going live in July 2013 (Austria, Germany, Estonia, and Italy), the second wave with one partner going live in March 2014 (Greece), the third wave with one partner going live in June 2015 (Poland) and the fourth wave with one partner going live in May 2016 (Malta). [90] The piloting phase has been characterized by a large number of unexpected delays and need for ad hoc redesign, as for example specific national features emerged as problematic in the testing of the systems. Also, as the actual use of the system by practitioner showed, more adaptation to the local practices and to the actual communication requirements were needed. As an example is the need for an open form not foreseen in the EOP procedure to address all communication exchange not addressed by the Forms of the EOP Regulation. While this need was initially discovered observing the work organization in one of the first waves countries, it was soon discovered that it was a common problem, even if different kind of communications were needed in different Member States. At the same time, once this new feature was introduced, national systems (i.e. lawyers and courts applications) had to adapt to include it in their functionalities.

As previously mentioned, the pilot also foresees the implementation of a new functionality in the European e-Justice Portal which is at the moment in the testing phase. The functionality will allow citizens to fill the application-form such the Form A for the European Payment Order and to submit this application directly in electronic format to the competent

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[84] Austria, Germany, Estonia, Greece, Italy, Malta and Poland, while France and the EU Commission are in the testing phase.

[85] Austria, Czech Republic, Malta and Poland, while France and the EU Commission are in the testing phase.

[86] Austria, Ireland, Italy.

[87] Germany, Spain and Netherland, while Greece is in the testing phase.

[88] France and Netherland, while Germany and Hungary are in the in the testing phase.

[89] D.B. Hvillum, et al., D3.8 WP3 Final Report, e-CODEX Deliverable, 2016, pp.17-26.

[90] D.B. Hvillum et al., supra n. 67.

N. Carboni and M. Velicogna, "Electronic data exchange within European Justice: a good opportunity?", International Journal for Court Administration (2012) 4(3), 104-120.

G. Lupo and J. Bailey, supra n. 21.

court in a Member State participating in the pilot through an account on the e-Justice Portal. Replies to the court are then notified to that account. Interesting to note is that par of the delay in the go-live of the e-Justice portal has been related to the difficulty in solving a technical problem of communication with one of the other 'live' partners, which included understanding in which of the two systems the problem was. After both parties attempted to adapt their systems (e.g. update to the same version of the gateway of the system etc.) it was discovered that the problem was related to an interaction difficulty between the e-Justice portal gateway and a third system.

While the piloting of the system showed that it could work from a technical, legal and organizational perspective, the low number of users showed that something was still missing. The system had been built focusing mainly on the creation of ICT supported versions of the paper EU cross border judicial procedures and not on the user, which found itself with a funtional but seldom useful tool.

3.6. Political and long term sustainability complexity

While e-CODEX project neared its ending and the system developed began to be deployed and interconnect with national systems to support the piloting of live services, its presence and the political discussion on the next steps has increased consistently. As a result of this process, e-CODEX began to interact more actively with its 'political' environment. A direct consequence of these initiatives was that e-CODEX sustainability was explicitly mentioned "in the Strategy on European e-Justice 2014–2018[91] and the associated Action Plan[92], both of which have been endorsed by the Council of Ministers of the European Union and the European Parliament". [93] Furthermore, the Council of the European Union (Justice and Home Affairs), in its meeting on 4 December 2014, identified and underlined the need to establish a sustainable framework for the technical solutions developed in the context of the e-CODEX project. In particular, Council (Justice and Home Affairs) "invited the Commission to finalise its internal reflections and submit to the Council solutions for the sustainability of the e-CODEX project in the short and longer terms, on the aspects concerning the future governance of e-Justice at EU level, including the possibility of using an existing EU agency".[94] The topic of e-CODEX sustainability was addressed again at the informal Justice and Home Affairs ministerial meeting on 30 January 2015. As a result of this high level EU political discourse, the Council (Justice and Home Affairs) established a permanent expert group on e-CODEX (PEG) related issues on 15 June 2015.[95]

Since then the PEG (representing the EU Member States and not just e-CODEX partners) has worked in cooperation with the e-CODEX Management Board and the Commission to find a viable solution for the e-CODEX sustainability "taking into account the principles of voluntary action, decentralisation, interoperability and independence of the judiciary, and the need to take into account the interests of those Member States not currently participating in the e-CODEX project". [96] While it was agreed that medium-term sustainability of the technical generic components could be ensured by the "Connecting

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[91] See 17006/13

[92] See 9714/14

[93] http://data.consilium.europa.eu/doc/document/ST-14208-2015-INIT/en/pdf

[94] Ibidem.

[95] Ibidem.

[96] http://register.consilium.europa.eu/doc/srv?l=EN&f=ST%2015774%202014%20INIT p.6

Europe Facility" (CEF), the e-CODEX system was recognized as more than just the sum of the technical parts. It is an essential element in the future of European Justice. To that end the e-CODEX partners and the Member States decided to evaluate distinct options to ensure long term sustainability of e-CODEX. In particular, three solutions were discussed for the long term: [97]

1. A first option, the Commission could be invited to assume responsibility for the continued maintenance of the e-CODEX solution. However, the Commission may not be optimally equipped for such a form of operational management.
2. A second option could be to assign these responsibilities to one or more Member States. Comparable experiences have, however, shown that this can create structural, organisational and technical difficulties (e.g. the Schengen Information System). Therefore such an approach might not be a viable solution.
3. A third option would be to entrust an existing agency with these tasks. For this purpose, three agencies were identified as possible candidates, eu-LISA, ENISA and INEA.

The PEG and the e-CODEX Management Board have worked to identify criteria for involving an existing European agency for the purpose of sustaining and maintaining e-CODEX components. As it has already emerged, the entrusting of the maintenance and long term sustainability of e-CODEX solution to one or more organizations has implications which go beyond those one would expect if the object was simply a support tool. In addition to technical capabilities, it is important that the governance of the agency respected and ensured the independence of the judiciary. Accordingly, the "Management Board of e-CODEX has approached eu-LISA, ENISA and INEA to check their respective interest, willingness and approach towards acting as a partner for the sustainability of e-CODEX". [98] At the same time, it was also recognised that "if an EU agency is made responsible for the full lifecycle of development and operational management of the e-CODEX solutions in the short term and, after due consideration, for the full lifecycle of development and operational management of the interoperability of decentralised IT systems in the area of e-Justice in general in the long term, a specific legislative instrument to be submitted by the Commission will be necessary". [99] This imply therefor the adaptation of the Agency and of the legal instruments regulating it to respond to the features of e-CODEX and of the Justice domain.

As a result of this process, PEG recommended that the "Management Board of e-CODEX start contact with eu-LISA, in full cooperation with the Commission, with a view to it taking care of the maintenance of e-CODEX at a date to be agreed between all parties, though preferably no later than 1 August 2018". [100] It further stressed that "between the end of the e-CODEX project and the uptake by a European agency the maintenance of the e-CODEX assets have to be ensured", [101] and it underlined that "A first step in this direction was taken by the Commission in its latest call for proposals for an Action Grant on e-Justice". [102] In its meeting on 3-4 December 2015, the Council of the European Union (Justice and

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[97] http://data.consilium.europa.eu/doc/document/ST-14208-2015-INIT/en/pdf pp. 7-8

[98] http://data.consilium.europa.eu/doc/document/ST-14208-2015-INIT/en/pdf p.8

[99] http://register.consilium.europa.eu/doc/srv?l=EN&f=ST%2015774%202014%20INIT p.5

[100] http://data.consilium.europa.eu/doc/document/ST-14208-2015-INIT/en/pdf p.9

[101] Ibidem, p.9

[102] Ibidem, p.9

Home Affairs), adopted the roadmap on the sustainability of e-CODEX and "confirmed the importance of a new co-financed project covering the maintenance of the e-CODEX assets".[103]

Following this lead, a group of e-CODEX leading Member States used the e-Justice call to apply for funding with a proposal for a new project called Me-CODEX (Maintenance of e-CODEX) covering the maintenance of the e-CODEX assets specifically related to the e-Justice service provision. The overall goal of Me-CODEX is to ensure a swift and sustainable transition of the e-CODEX project towards long term sustainability. It is intended as a bridge between the closure of e-CODEX and the handover to a potential agency that will take responsibility for the daily maintenance of the solutions, on-going development and support to EU Member States and associated countries. [104] The expected result of Me-CODEX is therefore to outline the necessary requirements to an agency that will be charged of ensuring the long term sustainability of the e-Justice solutions that have been developed by e-CODEX. While the project in theory the starting date of the project is the 1 September 2016, unexpected events have already taken place, including the Brexit referendum impact on the UK participation, and the effects of the new digital platform[105] adopted by DG Justice for manage project documents, communications and signature. This platform is generating more than one problem for several partners that needs to appoint the Legal Entity Appointed Representative in order to electronically sign the project documents. As a consequence, the Grant Agreement has not been signed by the end of September 2016.

To ensure the approach undertaken by Me-CODEX to maintain e-CODEX is viable, the consortium will work in collaboration with a number of on-going initiatives. In particular, close collaboration with the Connecting Europe Facility (CEF) should ensure that all the necessary technical components used within e-CODEX are maintained and enhanced where possible. Furthermore, Me-CODEX plans to benefit from its current links with the CEF team of DIGIT and DG CONNECT to position the sustainability needs of Me-CODEX and take part in discussions regarding the future sustainability of all digital service infrastructures and building blocks. This alignment will be key in ensuring a viable and sustainable long term solution for the maintenance of all e-CODEX solutions and beyond. [106] Furthermore, due to the e-Justice Portal role in providing an entry point for the citizens of most of the Member States, [107] the involvement of DG JUSTICE in the activities related to e-CODEX solutions maintenance and evolution seems also to be needed.

While the area of influence of e-CODEX has extended, a constellation of activities in the e-justice domain have spurred on from the e-CODEX achievements. To cite four initiatives that started in the first half of 2016:

1. The CCBE, within a EU co-funded project, is planning to connect Find a Lawyer 2 (a tool that allows lawyers to verify e-ID in cross border procedures) to e-CODEX. "Within the framework of e-CODEX, FAL 2 will provide the necessary solution to ensure that the person claiming to be a lawyer is indeed a qualified lawyer in his/her

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[103] http://www.statewatch.org/news/2015/dec/eu-jha-council-3-4-dec-prel.pdf p.13

[104] Exact geographic scope to be defined in the future legal act.

[105] The Participant Portal originally developed for the Horizon 2020 Research Programme

[106] Natalie Nickel et al. (2016) e-CODEX Deliverable D1.16 Final sustainability report and recommendations (Update of D1.12 Sustainability Plan)

[107] Rödlich F., González M. (2016) e-CODEX Deliverable D5.13 WP5 Final Report

home jurisdiction and is, thus, able to fill in claims on behalf of the client through e-Justice procedures available, for instance, under e-CODEX".[108] More concretely, a use case on Lawyer2Court communication consisting in testing the participation of lawyers in EPO via the European e-Justice Portal using the outcome of the projects FAL2 and FAL3 has been initiated and will be finalised in the context of the expected Me-CODEX project.[109]

2. Pro-CODEX (Connecting legal practitioners national applications with e-CODEX infrastructure), a EU co-funded project, that has begun to investigate the possibilities and create conditions to make e-CODEX and the applications used by legal professionals (lawyers and notaries) at national level interoperable. e-CODEX has been designed to provide general solutions and is well tailored on meeting national courts' needs, while the e-Justice Portal should provide a solution for non-repetitive players. At the same time, with exceptions, these solutions are not integrated with the applications that legal practitioners use to manage their business in different member states. At present, private companies providing these systems do not seem interested in developing e-CODEX interfaces due to the limited number of users. In this perspective, Pro-CODEX will provide the means to extend the user bases of e-CODEX investigating the issues related to the connection of legal professionals applications to e-CODEX infrastructure and develop running pilots in a limited number of countries.

3. The 'API for Justice' EU co-funded project, coordinated by the Dutch Ministry of Justice aims to open up the infrastructure for cross border legal services provided by e-CODEX and the European e-Justice portal, by means of an API (Application Programming Interface). This would make it possible for third parties to build applications which use the e-CODEX services. The project is also attempting to develop a user centric approach for the further development of e-CODEX.

4. e-CODEX 2.0, a research initiative funded by the Research Institute on Judicial System of the National Research Council of Italy (IRSIG-CNR), which participated in the e-CODEX project, to investigate through a multidisciplinary approach e-CODEX project developments and to follow its long term sustainability path.

4. Reflecting on e-CODEX complexity features

The design and implementation of e-CODEX has shown a plurality of complexity factors which can be investigated and explained through the Complexity Theory and CAS lenses:

e-CODEX complexity is the result of its multi-domain nature: technological, legal, organizational and political dimensions are intertwined and interdependent. While for descriptive purposes such dimensions have been separated, cross domain relationships, influences and interactions between components has emerged in a number of examples.

e-CODEX complexity is also the result of its multi level nature: the system (and its components) are influenced developments and initiatives at EU level, but also on developments in the Member States (like changes in legislation with an impact on competences of legal authorities or legal professionals; or like changes in IT systems).

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[108] http://www.ccbe.eu/fileadmin/user_upload/NTCdocument/FAL2_page_EN_webpdf1_1366020243.pdf

[109] As the work to link FAL2 with e-CODEX will take more time than first expected, the work on FAL3 needs to be postponed. This means that the testing of the Lawyer2Court use case will be done after the end of e-CODEX Source: e-CODEX Deliverable D3.13 Update of D3.4 Test Findings of Tests.

While e-CODEX is the result of the interconnection of its organizational, legal and technological components, such components are not frozen, but they tend to evolve in their 'local environment', and are only partially influenced by the developments at e-CODEX level. At the same time, an unforeseen change in national law or in a national technological component may result in serious consequences for the service provision through e-CODEX infrastructure in that Member State. It must be stressed that components have shown to follow independent not always convergent evolution paths. Objectives of the system and of its components evolved over time as the results from multiple interactions of a plurality of actors (and components) distributed through several localized times/places/events (e.g. for e-CODEX as a system, objectives shifted over time from the development of technical infrastructure, to achieve live piloting, to reach a critical mass of users and use cases, to ensure the system long term sustainability). Stable/performative configurations have been achieved (only) on a temporary basis, as components keep evolving and external environment change (e.g. Circle of Trust, introduction of e-IDAS).

The design of the gateway system is in itself a way to recognize the path dependence of national e-Justice systems. Moreover, the process of e-CODEX design resulted in the adoption of a mechanism of discovery and adaptation, basing it on the idea of use case and prototype solution which has enough flexibility to allow the building on an only partially, locally known and evolving installed base. Laws and their interpretations, national e-justice applications, organizations involved and people continuously change during the project. While the understanding of the various domains and knowledge available to the various actors increases during the project, both are always partial and time bounded.

Development and use reinforced the stability of the system as a whole, as components tended to co-evolve and co-adapt one another and influence the external environment to ensure long term sustainability. The stability of the system is therefore dynamic and not static, related to its capability to adapt in spite of emerging potentially disruptive events, which are addressed both through coordinated efforts, both through local initiative and self-organization.

While the case has been discussed, a single definition of e-CODEX has not been provided, neither the borders of the system have been clearly defined. Often the components (organizations, laws, technologies) of a system are large systems themselves, only marginally involved in the system being development, implemented and maintained (e.g. the Italian PCT is a service provider within the e-CODEX system but e-CODEX is just a very limited part of the PCT)

5. Concluding remarks

As it emerges from this paper, the Complexity Theory and CAS address issues that are at the heart of e-justice systems development and evolution. The story of e-CODEX speaks of the struggle to move away from an unmanageable reductionist strategy based on engineering and software development models, and business process modeling addressing only the technological part of the problem of cross-border e-justice interoperability.[110] The system needed to provide cross-border e-Justice communication infrastructure capable of interacting with existing national systems and provide legally valid

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[110] Velicogna, M., and G. Lupo, *Developing e-Justice technology for use: the e-CODEX experience*, EGPA Conference, 26-28 August 2015, Toulouse, France

and semantically meaningful cross-border communications. While part of the problem is of technical nature, part of it is legal (EU and national technical and procedural regulations), and part of it is organizational (institutional configurations, different national organization of justice service provision, existing practices). Faced with the impossibility to find ex-ante all the requirements to design a technical tool that could be applied to all cross-border situations, the project ended up in creating a core working system, a prototype to be piloted in a simple procedure, but that could be easily adapted to include features emerging as relevant during its testing and piloting. Furthermore, the prototype worked as a reflective tool, capable of exposing the otherwise unpredictable behavior and relevance of a plurality of large number of dispersed components.[111] The result is a system of growing complexity, whose components exist and evolve in different domains (technical, legal, organizational, social and political), each providing different logics, objectives and evaluation standards.

e-CODEX infrastructure has been successfully deployed and a working methodology used to achieve this objective. This process has been emergent and unpredictable, resulting from improvisation, unplanned interactions and on-going discoveries, "full of ambiguities and discontinuities, [… which] sometimes may even look like random, erratic wanderings apparently leading nowhere".[112] At the same time, the working methodology and actual process followed is visible only through "close-to-action observation"[113] and does not emerge in the high level discourse or official representations of the project and of its results. As a consequence, traditional development and implementation approaches in use in e-Justice domain are not openly questioned. As a consequence the orderly, structured representations of complex e-Justice systems and their development process persist.

The attempt to describe the e-CODEX case through Complexity Theory lenses has allowed us to tackle some of its many elusive characteristics. This must be considered just as a first step in this direction. We still do not understand all the mechanisms and dynamics underlying the development, implementation and evolution of large scale ICT systems such as e-CODEX. We do not understand how these systems come together, how they co-evolve with the other systems which surrounds and interact with them, or what exactly constitute their environment. At the same time, concepts such as adaptation, co-evolution, non-linearity, path dependence, and the possibility to look at multi-domain interdependencies allow to reframe the way in which we can talk and envision e-justice systems, their development and their change. The "robust nature of complex systems"[114] is another aspect that emerged from the case description, as shown by the capability of the system to adapt and keep preforming in face not only of the changes taking place in its external environment, but also in the succession of key people working on it, shift in piloting priorities etc. How this robustness can be affected is indeed one interesting topic for future studies.

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[111] Lanzara, G. F. (1999). Between transient constructs and persistent structures: designing systems in action. *The Journal of Strategic Information Systems*, *8*(4), 331-349.

[112] Lanzara, G. F. (1999). Between transient constructs and persistent structures: designing systems in action. *The Journal of Strategic Information Systems*, *8*(4), p.334

[113] Lanzara, G. F. (1999). Between transient constructs and persistent structures: designing systems in action. *The Journal of Strategic Information Systems*, *8*(4), p.334

[114] Cilliers, P. (1998). Complexity and postmodernism: Understanding complex systems. New York: Routledge, p. ix

It is for the future also to see how this better understanding may help us to move from 'how these systems work' to 'what needs to be done to make them work', and which tools developed within the Complexity Theory and CAS may be applied. Simulation as a source of knowledge (Simon 1996) could be also a topic of investigation, considering the 'practical' simulation approach that has ben used by e-CODEX developing the techno-legal prototype and then addressing the emerging complexity factors in a co-adaptive fashion with the environment (e.g. proactive role in relation to ESCP revision procedure). This is also in line with the idea of bootstrapping proposed by Hanseth & Lyytinen[115] and with the idea of transient constructs of Lanzara as a mean to deal with the emergent nature of ICT systems design, where coherence, orderliness and meaning, results from ex post interpretation and sensemaking rather than from ex ante planning and implementation.[116]

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[115] Hanseth, O., & Lyytinen, K. (2004). Theorizing about the design of Information Infrastructures: design kernel theories and principles. Sprouts: Working papers on information environments, systems and organizations, 4(4), 207-241.

[116] Lanzara, G. F. (1999). Between transient constructs and persistent structures: designing systems in action. *The Journal of Strategic Information Systems*, *8*(4), 335.