Big Policy Canvas

D3.1 Needs and Trends in Public Administrations

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Lead Participant	Fraunhofer FOKUS	**Lead Author**	Juliane Schmeling, Anja Marx
Contributors	All Partners	**Reviewers**	Yuri Glikman
			Esther Garrido Gamazo Ourania Markaki

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Document Information

List of Contributors	
Name	Partner
Juliane Schmeling	FOKUS
Anja Marx	FOKUS
Yuri Glikman	FOKUS
Esther Garrido Gamazo	Atos Spain
Ourania Markaki	NTUA

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List of Acronyms

Abbreviation / acronym	Description
AI	Artificial Intelligence
BI	Business Intelligence
Dx.y	Deliverable number and belonging to WP x
EC	European Commission
ICT	Information and Communication Technology
IoT	Internet of Things
IT	Information Technology
KPI	Key Performance Indicator
QM	Quality Management
WOS	Web of Science
WP	Work Package

Executive Summary

The deliverable reports on public administrations' needs and trends in order to deliver the basic input for further efforts and for mapping the relevant methods, tools and technologies that may heal public administration's defects or support further its advancement, as well as to derive the actions and funding decisions needed to boost technological development and innovation in the public sector.

Since the needs and trends are central issues of the present deliverable, the report consists of these two main parts. The Needs section starts with methodical fundamentals regarding the research design and process to identify and describe public administrations' needs. The needs are structured among the needs categorisation including strategical, organisational, technical, informational and legal needs. The Trends section follows the same structure including the categories technological, conceptual and societal trends.

The last chapter contains a conclusion and a discussion of further steps.

1 Introduction

1.1 Purpose of the document

The Big Policy Canvas project aims at renovating the public sector on a cross-border level by mapping the needs and trends of public administrations with methods, technologies, tools and applications from both the public and the private sector, stepping upon the power of open innovation and the rich opportunities for analysis and informed policy making generated by big data.

The overall concept of Big Policy Canvas is based on four major innovation pillars. First and foremost, the project's activities focus on the realisation of an extensive analysis of the needs and trends of EU public administrations.

The report presents the initial list of public administrations' needs and trends. It addresses both existing and emerging needs, as well as relevant multidisciplinary trends. Needs and trends are described in-depth with reflections on primary and secondary data sources.

1.2 Relation to other project work

It is the first deliverable of work package three: "Public Administrations' Needs and Trends' Identification and Assessment". The identified needs and trends constitute the starting point for further assessment through the application of the Assessment Framework, which will be published in the deliverable 3.2 (Design and Implementation of Needs and Trends Assessment Framework) and will be applied in the website's knowledge base and in the deliverable 3.3 (Needs and Trends Assessment with a multidisciplinary Big Data perspective). The identification of needs and trends does not claim to be exhaustive. It will be a continuous process during the whole project duration, which will be supported through the upcoming stakeholder workshops and the community platform activities.

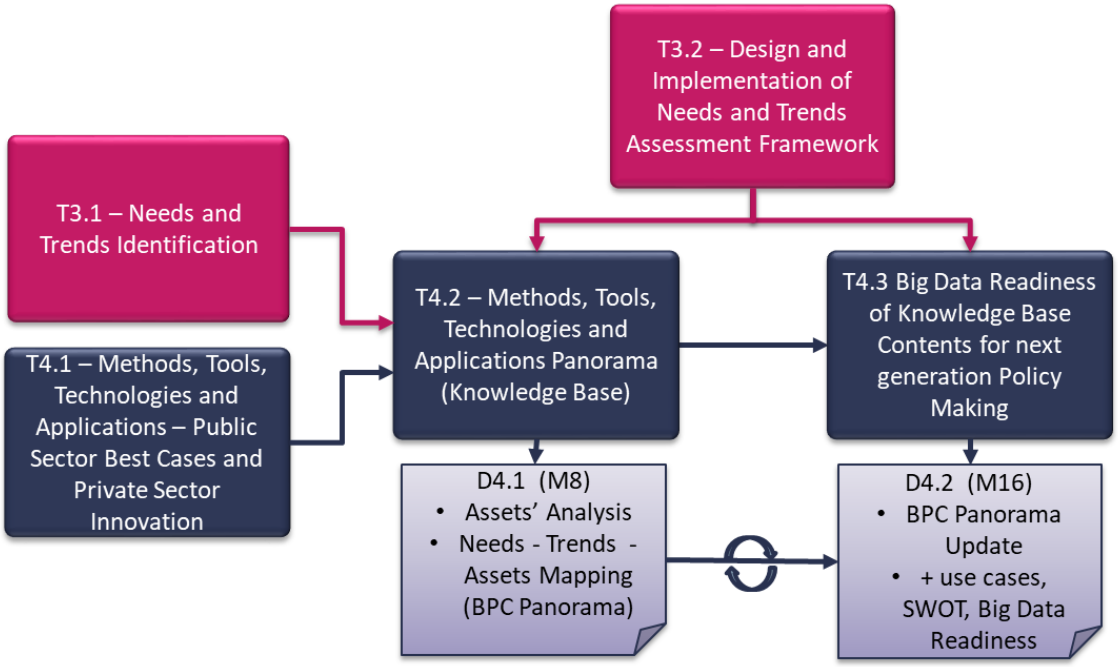


Figure 1: Relation of tasks, deliverables and work packages

1.3 Structure of the document

This document is structured in five major chapters. Chapter 2 clarifies and defines the fundamental terms "needs" and "trends". Chapter 3 presents the needs and chapter 4 presents the trends. Chapter 5 concludes with a summary.

1.4 Glossary adopted in this document

The following main terms have been considered in the description of public administrations' needs and trends:

Policy domains [1]

- Agriculture, Fisheries, Forestry & Foods
- Economy & Finance
- Education, Youth, Culture and Sport
- Employment and Social Welfare
- Environment and Energy
- Health
- Foreign Affairs and Defence
- Justice, Legal System & Public Safety
- Public Affairs

- Science & Technology
- Urban Planning & Transport
- Internal Affairs

Policy Cycle Stages [2]

- Agenda Setting:
  A problem arrives at the political agenda and needs to be analysed
- Policy Design and Analysis:
  Clarification of political targets; Discussion of alternative courses of action; Formulation of political programmes and laws
- Policy Implementation:
  Transferring political goals into concrete activities; Implementation by public administration and other institutions
- Policy Monitoring and Evaluation:
  Monitoring and evaluation of policy objectives based on implemented activities in the implementation phase

Government Levels

- Local/Municipality
- Regional/Federal State
- National
- EU

2 Definition of Public Administrations' Needs and Trends

As the former EU project SONNETS has already stated, most of the needs' frameworks, such as Maslow's "hierarchy of human needs", [3] primary focussed on individuals and thus are difficult to be generalised to organisational systems. [4]

Oxford dictionary defines a need as "Circumstances in which something is necessary; necessity. A thing that is wanted or required."[5]

The Requirements Engineering, that is widely known in the software engineering environment, operates with the term "requirement".

The Institute for Electrical and Electronics Engineers defines requirements in the IEEE610 Standard as follows:

"(1) A condition or capability needed by a user to solve a problem or achieve an objective.

(2) A condition or capability that must be met or possessed by a system or system component to satisfy a contract, standard, specification, or other formally imposed documents.

(3) A documented representation of a condition or capability as in (1) or (2)." [6]

Whereby users in software development projects are not only discussed as individuals, but rather also as systems.[7] In conclusion, for the project we adapt the definition by the IEEE and define *public administrations' needs as conditions or capabilities needed by an organisation to solve a problem or achieve an objective, since we want to focus on the organisational and not on the individual level.*

In contrast, a trend as a statistical term is clearly defined. The OECD is referencing on the Oxford dictionary of Statistical Terms to define the term "trend" as follows:

"A long-term movement in an ordered series, say a time series, which may be regarded, together with the oscillation and random component, as generating the observed values."[8]

3 Needs in European Public Administrations

The section presents the methodical approach and research design, as well as the identified existing and emerging needs in public administrations.

3.1 Needs identification and description method

The needs identification method is based on a qualitative research design including a qualitative content analysis on primary and secondary data sources.[9] The main research question is:

What do public administrations need to get more effective, efficient and precise?

The research process has four phases. The present deliverable reports the stages one to three and describes the fourth stage exemplarily.

- **Phase 1: Needs identification: Desk Research**
  In the first phase, a descriptive secondary research approach has been conducted through a literature analysis. The research focused on theoretical and practical knowledge related to existing and emerging needs as they have been defined before. Objects of the research have been various related EU-Projects, academic papers, monographs, books and studies, which will be also be added to the Big Policy Canvas Repository.

- **Phase 2: Needs Validation and further needs identification through qualitative interviews**
  In the second phase, 12 interviewees have been acquired to validate the so far identified needs. The sample includes German public administration representatives of four policy domains. The interview guidelines can be found enclosed in Annex 1. Further online and offline interviews will be conducted to gain experiences from a broader range of policy domains and countries through the planned stakeholder activities and the online community platform. The results will be considered in the deliverable 3.3 (Needs and Trends Assessment with a multidisciplinary Big Data perspective).

  The interviewees want to remain anonymous but can be characterised as shown in Table 1. With the first eight interviewees, a focus group has been conducted, with the interviewee 20180202_1 a phone interview and with the other two an in-person interview. The ID refers to the date on which the interview or focus group took place.

Table 1: Interviewee characterisation (need identification)

ID	Function	Policy Domain	Government Level	Policy Cycle Stage
20180123_1	Group leader (budget, controlling, quality management - QM)	Social Security	Local level	All stages
20180123_2	Group leader (budget, controlling, QM, fraud protection)	Social Security	Local level	Monitoring and Evaluation
20180123_3	Social reporting	Social Security	Regional level	Monitoring& Evaluation; Agenda Setting
20180123_4	Controlling, reporting social transfer expenditures	Social Security	Regional level	Monitoring& Evaluation
20180123_5	Administrative modernisation, Business process optimisation	Internal Affairs	Regional level	Implementation
20180123_6	Cost and performance accounting	Internal Affairs	Regional level	Implementation; Monitoring & Evaluation
20180123_7	Head of division administrative modernisation	Internal Affairs	Regional level	All
20180123_8	Cost and performance accounting	Social Security	Local level	Monitoring & Evaluation
20180202_1	Professor administrative science	Science & Technology	Local level	/
20180207_1	Head of division Youth Welfare Planning, IT, Budget and Finance	Education and Youth	Regional level	All stages
20180114_1	Researcher administrative science	Science & Technology	Local level	/

The content analysis applies the structuring approach in a descriptive manner by using deductively formulated categories that had to be extracted systematically from the interview transcriptions. [9]
The category system contains "compliant statements" and "real life examples" in relation to the so far identified needs and "new needs" expressed by the interviewees.
All needs have been categorised in **strategical, organisational, technical, informational and legal needs**.
Additionally, we have asked all interviewees to assess the discussed needs with respect to the affected policy domain, policy cycle stage and government level. Since it was impossible to assess every certain need during an interview duration of maximal 2 hours, we do not have achieved an assessment for every need regarding the mentioned points. For this reason, in February 2018 an online survey has been created with the open source tool "LimeSurvey" and will be spread via all communication channels of the Big Policy Canvas project. With the online survey, we intend to gather input from different countries and policy domains. At the present point, all interviewees have received an invitation to participate in the survey and we obtained five complete filled questionnaires representing the three policy domains Internal Affairs, Employment /Social Security and Science/Technology. Since the end of March 2018, the online survey is published on the project website www.bigpolicycanvas.eu.

- **Phase 3: Needs description**

  Needs are described with reference to related literature and publications as a result of the desk-based research activities. Compliant statements and real life examples, which have been extracted from the content structuring analysis, extend the descriptions.

  All needs have been verified through the following question, which was derived from the needs definition as mentioned before:

  Is the respective need a condition or capability needed by public administrations to solve a problem or achieve an objective?

  Wherever we have so far gained an assessment regarding policy domain, policy cycle stage and government level, it will be taken into account in the description of the respective need.

- **Phase 4: Transfer of identified needs to the Knowledge Base in consideration of the assessment framework**

  The present report shows exemplarily how the needs will be prepared for the validation through the assessment framework, which will be published in the deliverable 3.2 (Design and Implementation of Needs and Trends Assessment Framework).

Table 2: Exemplary knowledge base need entry – N-I-3

N-I-3: Ensure availability of (real-time) information and knowledge	
Description	Information is an asset that is constitutive to the effective and efficient supply of public services. To ensure that information meets the purposes for which it is intended, it must be accurate, accessible, valid, timely, complete and relevant (relevance especially means regional explicit information). The public administration needs information to be able to do its work efficiently and effectively, as well as to conduct analyses and evaluations.
Type	Informational
Scope	All governmental levels
Policy Cycle Stages	All stages, especially implementation
Policy Domains	All policy domains
Is Fomented By	Next Generation BI and Data Analytics Platforms; Smart Cities, Open Data, Smart Surveillance Systems, Data Philanthropy
Criticality	To be filled in at a later stage based on the Framework Application
Is Served By	To be filled in at a later stage based on the Framework Application
Is Addressed By	To be filled in at a later stage based on the Framework Application

3.2 Strategical needs

3.2.1 N-S-1: Development of domain specific target and indicator systems

Already the political economist and sociologist Max Weber once has pointed out that decision makers need to ensure the rationality of their decisions, by trying to balance out the best relation of means and ends. [10]

Consequently, policy makers need to clarify the targets that they want to reach through certain political programmes and norms. In fact, the executive bodies need quite precise targets, since they are responsible for the adoption and implementation of political and legal solutions and need to translate political solutions in concrete activities. If public administrations want to monitor political targets, they need to set up a management control system, as it is already quite common in the private sector. Nevertheless, since it is not possible to score success from insulated financial ratios, the public sector needs to observe much more complex systems in consideration of public interests. [11]

In a conducted interview with a public administration representative on the regional ministerial level in the youth welfare policy domain[1], the interviewee confirmed that there is a lack of clearly formulated goals on the political level. The interviewee further mentioned that without clear goals on a political level, executive bodies are incapable to derive operationalised goals and indicators.

A second problem he mentioned is that targets, if they are formulated, should be well balanced among each other, since it is important in the implementation phase to know which targets have priority to set up a strategic planning. For example, it is difficult to implement child day care availability for everybody and best trained childcare workers at the same time.

[1] Interviewee 20180207_1

To sum up, policy domain specific targets and indicator systems are especially relevant in the formulation, and implementation phase, but are also relevant in the monitoring and evaluation phase, since it is impossible to monitor and evaluate political targets and their derived indicators in a performance measurement system without targets.

3.2.2 N- S-2: Involvement of the public and citizens, as well as the development of citizen-centred policy making

Concerning the public, a close cooperation between public administration and citizens seems essential. Through participative democracy and public involvement, a new relationship between the citizens and the administrations can be established. The publicity becomes a valued partner to identify problems, discover new thinking and propose solutions. This can be seen as a profit for public administrations, because the experiences of the citizens can be contributed into the administration and help to improve, for example, its policy making. As the main customer of public administration, the wishes and needs of the citizens (customer satisfaction) should be involved in policy making and be automatically transferred into administrational needs. It is of big interest what the customer is thinking and what the customer wants. This can lead to improvement of efficiency and effectiveness. The changed living environment of the customers (internet, online shopping, 24-hour availability of products) raises the expectations towards the administration, which must meet these demands. Engaging the public can help to rebuild the trust of citizen and consequently lead to a stronger citizens' satisfaction. [12]

It turned out that citizens' involvement is fundamental in all stages, especially in the formulation stage.

3.2.3 N-S-3: Forward-looking strategic planning for the use of data and technologies as well as for practical implementation

The focus group[2] has shown that strategic planning is also important. For their success, long-term strategies have to be developed and adequately funded, as this is essential for the implementation of new tasks. Strategic planning becomes especially relevant in the policy formulation stage, but also in agenda setting and evaluation.

3.2.4 N-S-4: Strengthen citizens' trust in public administration

To improve public administration´s image, it is important to rebuild the trust in it. The citizens' cooperation seems essential to achieve public purposes. The lack of trust can make the formulation and implementation of policies more difficult or even impossible. Relevant factors that influence citizens' trust is the administrations´ integrity, as well as its performance. Transparency and public participation can be helpful possibilities to increase the trust in government and administration. [13][14][15]

The need could so far not be validated in the qualitative interviews, but seems to have relevance for the public sector due to the findings of the desk research. This need is a key in the formulation phase, because only with the trust of the population, problems can be understood consequently right and the necessary policies can be developed.

[2] Interviewees 20180123_1-8

3.2.5 N-S-5: Continuous Evaluation of Policies

Evaluation represents a separate stage in the policy cycle, but has to be pointed out as an own need in public administration. Evaluation decides whether a policy will be finished, modified and/or continued. At the same time, it can inform about results and consequences (intended and not intended). Only if policies are evaluated, potential improvement will be identified and at best implemented. In this context, it should be emphasised that a policy is never completed and is always evolving. This makes a qualitative and regular evaluation essential. The relevance of this need could also be validated in the interview with the researcher of administrative science.[3]

Although the circular form of the policy cycle indicates it, evaluation does not only take place after the implementation process. Instead, it should be considered before and after every single step all along the cycle. [16][17]

3.2.6 N-S-6: Improve and strengthen Europeanisation

Public management has to react to changes in national and global contexts. A current key driver for changes can be seen in the Europeanisation, which affects the level of member states, caused by EU integration processes. Successful administrative action in the multilevel European system requires adjustments, ensuring efficient dealing with European objectives. As a result, - despite different traditions in the member states - there is an increasing convergence in the policy making and institutional decision making structures and procedures. This point was confirmed by the questioning of the professor of administrative science.[4] Summarising, improve and strengthen Europeanisation is important in agenda setting and policy formulation. [18]

3.2.7 N-S-7: Take into account local and regional specificities

It is most important to take into account the state-specific circumstances, as well as local and regional specificities. For example, the German public administration differs fundamentally from public administration in other countries. Solutions that were identified as right and expedient for one country are not automatically useful in another. The possibilities of implementation will vary due to diverse traditions and organisational cultures. That is why "one size fits all"-policies should be avoided. [19]

The consideration of regional and local characteristics seems to have a very high relevance in the implementation phase, but is also relevant in all other stages.

3.2.8 N-S-8: Environmental Awareness and Protection

Public administration has many opportunities to protect the environment and reduce its negative impact on it. There is a lot of potential in minimising energy, paper and water consumption, as well as waste production in public institutions. Because of the administration's role model function, it is necessary to take responsibility, and in consequence, to develop and establish environmental awareness. Environmental protection is a priority topic in recent years, which also needs to be addressed by the public administration. The commitment to environmental protection can also have economic incentives. Environmental protection can lead to savings that can relieve the public coffers and be invested in other measures. One possible instrument to manifest environmental protection in the work of public administration can be seen in the EMAS (Eco-Management and Audit Scheme), which is an environmental management scheme based on the EU-Regulation 1221/2009. This

[3] Interviewee 20180114_1
[4] Interviewee 20180202_1

management instrument helps organisations to improve the environmental performance by providing guidelines and tools. [20][21]

The need to protect the environment and act appropriately seems important in all policy stages, governmental levels and policy domains, whereby the policy domain "Agriculture, Fisheries, Forestry & Foods" is particularly in demand in this case.

3.2.9 N-S-9: Cross-linked information exchange

Public sector organisations are mainly knowledge-intensive organisations, and to exploit their knowledge, effective knowledge sharing among the different departments is required. There can be great advantages if information is not only used in the own administration but is shared between hierarchies, different policy areas and levels of government. Including findings from other disciplines in respective monitoring systems (e.g. education, social, youth, and work) can create synergy and learning effects, which in turn leads to a share of benefits.

In the interview with the division head in the policy domain "Youth and Welfare" on regional level[5], it became clear, that the information exchange is a big issue in German administrations. Due to the federal structure, the data belongs to different players and cannot be easily matched. Analyses and comparisons are made more difficult, whereby valuable information is lost.

Especially in the agenda setting and implementation phase, cross-linked information exchange can bring valuable improvements.

3.3 Organisational needs

3.3.1 N-O-1: Secure organisational framework

Public administration is a strictly standardised and structured environment, which makes it calculable and predictable to a certain extent. This includes, for example, a sufficient number of qualified employees. Also for the public administration employees in our focus group, this strict organisational framework seems to be important in order to complete their work and task. On the other hand, it would be desirable that this frame allows certain freedoms within it. This (limited) flexibility can be helpful in responding to unexpected developments. For some respondents, the organisational framework was the most important point to make the administration more efficient and effective and to meet today's developments. This need refers to policy implementation, but can also be important in agenda setting and formulation phase.

3.3.2 N-O-2: Improve the process of recruiting in order to acquire suitable staff in a timely manner

A relevant but also critical factor in public management is the staff. It is important to recruit junior staff and specialists, which can manage the given challenges and have the necessary skills and technical knowledge to promote the digital transformation. Particularly in view of the demographic developments, it seems essential to recruit new staff and retain them in the long term. [22][22]

Qualified employees are, according to all respondents, one of the key points to be able to perform the tasks in the administration. Some participants in the focus group criticised the recruiting process as too

[5] Interviewee 20180207_1

lengthy and complicated. Recruiting new staff becomes highly relevant in the formulation and implementation of policies, but has significant impact in all stages of the policy cycle.

3.3.3 N-O-3: Establish target-oriented personnel development

In addition to recruiting new employees, personnel development should not be neglected. Existing personnel should be trained to help them handle the challenge of new technologies and consequently changes in organisational environment. Personnel development measures have to be established to support employees' acceptance and the acquisition of competences connected to ICT, preparing them for possible challenges.[23][24][25] One interviewee highlighted the relevance of trained and also creative staff as one of the most important factors for an efficient policy making process. In our survey, this need - together with "Deeper understanding of IT potentials and IT processes" - had the highest relevance score.

Without the employees' support, there cannot be sustainable and qualitative good changes, which makes it important to involve them in change processes and develop them, if possible, following a bottom-up approach. [26]

Considering the policy cycle, the recruitment and training of the staff is of great importance relating to the implementation of a policy. However, it influences also the other parts of the cycle.

3.3.4 N-O-4: Improved incentive structures for working in the public sector

The public sector is facing demographic changes and has to compete with the private sector for talents. Incentives like, for example, an adequate payment or the possibility of mobile working, seem important to retain young and qualified employees in the long term and to increase the job satisfaction of all employees. The interviewed public administration employees criticised a lack of appreciation of their work. Above-mentioned incentives can help to decrease the employees' turnover intention and instead increase their motivation and productivity. [27] Incentives in public administration have relevance in all policy cycle stages, especially in agenda setting, formulation and implementation.

3.3.5 N-O-5: Cooperative working between decision makers, departments, hierarchy levels

The head of the administration modernisation division on a regional level[6] confirmed that one of the most important needs of public administration is cooperative working. Hierarchy is an important part in public administration but it also represents a limitation for its work. The more complex social problems become, the more complex are the governmental answers to them. Public administrations should be more open and flexible in the cooperation between different stakeholders, partners and hierarchy levels. It is necessary to find a way, in which all partners (inside and outside the governmental sphere) can collaborate closely to achieve the best possible results and improve their performance. [28] Similarly, close collaboration between administrations can help to leverage synergies and harness the insights of other disciplines.

This need is highly relevant in evaluation, but also in all other stages.

[6] Interviewee 20180123_7

3.3.6 N-O-6: Process and resource optimisation

Public sector has to deliver services to citizens despite resource constraints and budgetary pressures. Because of this personnel and financial limitations, available resources must be used as cost saving and valuable as possible.

In this context, it is important for public management to reduce bureaucracy and make administrative processes simpler and more efficient. Therefore, any form of unnecessary costs and waste need to be avoided. In order to increase the quality of work, customer orientation, reorganisation and short decision making channels should be considered. This can be achieved, for example, through greater use of technology and automation. Less bureaucracy can lead to greater acceptance among the citizens and the private sector. [29]

Much has been discussed on this topic in our focus group. The recruiting process was presented as a very lengthy and complicated process, where there is an urgent need for optimisation. Since many different bodies are involved in this process, it takes a lot of time and in the worst case, all good candidates are already gone until the decision is made. (See also N-O-2)

The optimisation of processes and resource use particularly relevant in the implementation phase of the policy cycle, but has importance in all stages.

3.3.7 N-O-7: Standardisation of processes

Standards require a certain legal basis and binding specifications. At the same time, they must be also accepted by the target group. If standards are enforced, they offer the advantage of planning and investment protection. This provides a good basis for further digitisation of processes. [30]

As an example, interviewed employees of the administration referred to a nationwide same process for which there are different procedures in all municipalities.[7] In addition, the media interruption between the administration and external partners was criticised. Standards can optimise these processes, increase the efficiency and save time.

The standardisation of processes has the highest relevance in the implementation phase, but is also important in evaluation.

3.4 Technical needs

3.4.1 N-T-1: Cope with the production of huge volumes of data

Probably one of the biggest needs for administration is to keep up with the technical innovation. To cope with the production of huge volumes of data is a technical problem as well as a big challenge for the staff. On the one hand, there should be established technical infrastructure for new policies and the increasing number of data, on the other hand, the staff needs to be trained and able to manage data and produce “good” data.

The interviewed division head in the policy domain “Youth and Welfare” on regional level[8] stressed the importance of having enough staff who are also able to handle data.

[7] Interviewee 20180123_5
[8] Interviewee 20180207_1

To cope with the technical challenges, it is important that public administration is technical modernised and updated, which in turn requires financial investments. The automation of standardised processes could save a lot of time and resources.[31] This technical aspect becomes relevant, above all, in the implementation of new policies and can be a factor for its success or failure.

3.4.2 N-T-2: Deeper understanding of IT potential and IT processes

This need is primarily about developing an understanding of the technical processes in the administration. Technological potential has to be identified and understood, thereby reducing employees´ fears of technology and possible consequences. A basic understanding of technology in administration can help make the benefits of technology fully available.

We interviewed a professor of administrative science on this point.[9] In her opinion, administrative staff needs to get more informed about such topics and attend relevant conferences. Employees can use this information to identify trends and developments. These can then be transferred to the administration and integrated into one's own work.

In this context, the interviewed researcher[10] has called for the establishment of a data culture within the administration. For example, employees need to be made aware of potentially interesting data that can then be provided.

The conducted survey has revealed that this need is crucial for public administration. So far, it has the highest relevance among the respondents, along with the need for skilled employees. Understanding IT seems to have relevance in all stages of the policy cycle, but is most essential in the implementation phase.

3.4.3 N-T-3: Ensuring data security taking into account the protection of citizens' privacy

Concerns about insufficient security and privacy are ubiquitous when it comes to the use of new technical possibilities - especially in public management. Besides the advantages and potentials, digitisation is associated with some technical and non-technical obstacles. Data protection and information security management can help to preserve trust in government. [32]

Public administrations have to guarantee citizens´ informational self-determination, protect their sensitive personal data against unwarranted access and avoid unintended consequences (for example AI bias and identity theft). [33]

Additionally, it is necessary to ensure information security to managing sensitive information including people, processes and information systems. [34]

In this context an interviewee[11] mentioned, that it is not even possible for them to send encrypted emails at present time.

3.4.4 N-T-4: Establishment of a comprehensive technical infrastructure and IT architecture

All interviewees stated that there is room for improvement in the technical infrastructure. The used technical infrastructure is partly outdated and does not meet current requirements, a fact that consequently increases administrative costs and leads to unnecessary bureaucracy. In addition, the lack of good infrastructure makes digitalisation difficult.

[9] Interviewee 20180202_1
[10] Interviewee 20180114_1
[11] Interviewee 20180123_1

In concrete terms, interface problems must be solved and harmonised. Concrete requirements that have been addressed in the various interviews are a comprehensive data infrastructure component, centralised records management and the ability to work mobile. This technical need is particularly related to the policy implementation and formulation, but is also relevant in the other stages.

3.4.5 N-T-5: Coherent use of digital technology across policy areas

This need is directly related to the need for cross-linked information exchange. An efficient exchange of information can only take place if the used technologies are coherent and compatible with one another. Organisational arrangements, as well as uniform technical systems and software can ensure compatibility and interoperability, help to avoid media interruptions and, in consequence, make policy making more efficient, effective and sustainable. [32]

3.4.6 N-T-6: Standardisation of data management

Similar to the standardisation of processes, standardising data management can also provide significant benefits to the public administration, such as time savings and efficiency gains. It is important for the public administration to know what data is available and where it is located. For this purpose, a data monitoring should be established. The need for standardised data management was confirmed in almost all conducted interviews.

This need has a high relevance in the implementation phase of the policy cycle.

3.5 Informational needs

3.5.1 N-I-1: Link between impact, quality, performance measurements and financial information

For making administrations not only more efficient but also more effective, activities and their costs should be closely linked to strategic outcomes and broader policy objectives. A monitoring with restricted focus on financial aspects in order to assess success of public services and political programmes is not enough. To reach a holistic view on success, it is more important to consider financial ratios interlinked with quality data, impact measurements and other performance indicators. For this reason, a strategic management system requires the integration of both financial and nonfinancial performance information. [35]

This need was also validated by the focus group (policy domain “Social security”). As an example, one interviewee argued that there is missing linked information between the granted aid deliveries and the qualitative implementation by the institutions or care providers.[12]

Linking performance and outcome measurements to financial information provides information that is more relevant to decision makers. [36]

The need is especially relevant in monitoring and evaluation, but also in the agenda setting and formulation stage.

We were asking a PhD candidate[13] with the thematic priority on digitalisation in the public sector in an interview, which experiences he gained during his work on use cases in the context of smart cities. He

[12] Interviewee 20180113_2

answered, that he was deeply shocked by the fact how low the information level of public administrations is, regarding their main tasks, services and societal outcomes. This leads to the point, that public administrations, before they want to link financial and nonfinancial information, quite generally first need to collect the relevant data, which can be integrated in a holistic interlinked monitoring system.

3.5.2 N-I-2: Include scientific knowledge and expertise

Taking into account the complexities and importance of policy making, scientists and policy makers should be collaborating to improve outcomes of public administration. Insofar, policy makers and researchers have different mentalities, languages, time horizons and imperatives. Ways of bridging the gap between both of them are necessary. Organisational changes, knowledge sharing and new platforms for cooperation can be helpful to close the gap and support collaboration between science and administration. Engaging scientific experts is needed both to help develop policies and to evaluate policies. [37]

Addressing the increasing complexity of public issues, it is also necessary to involve experts and analysts from other disciplines than law: especially Public Administration (concentrates on the internal functioning of executive government institutions), Political Science (focuses on political context), Economics (studies behaviour under resource constraints), Sociology (gains an understanding of individuals in their communal setting), Information technology (use of information and communications technology (ICT) and digitisation). [38]

The interviewed professor of administrative science[14] stated, that it is desirable for administrative staff to regularly review the latest scientific findings (through conferences or workshops) and make potential transfers in their area of work. A multidisciplinary approach, which broadens the horizon, opens up new perspectives and helps to identify new trends, is valuable in every step of the policy cycle but has special relevance in the agenda-setting phase.

3.5.3 N-I-3: Ensure availability of (real-time) information and knowledge

Information is an asset that is constitutive to the effective and efficient supply of public services. To ensure that information meets the purposes for which it is intended, it must be accurate, accessible, valid, timely, complete and relevant (relevance especially means regional explicit information). [39]

In all the interviews conducted, it has become very clear and verified that information plays a very important role in policy making processes.

According to the interviewed researcher in the field of administrative science[15], real-time data becomes relevant especially for the operative administration on the local level, for example, in the field of infrastructure. Information also plays an important role in economic policy. Up to now, current economic policy is based on very precise but outdated data. However, in such a dynamic environment, having up-to-date information is of great relevance.

The interviewed division head in the policy domain “Youth and Welfare[16] emphasised that a good information situation, which means a certain amount of information in a good quality, is a precondition for further analyses and evaluations. In areas where there is already many data, initial success has been achieved. Nevertheless, there is still room for improvement here. However, it has

[13] Interviewee 20180114_1
[14] Interviewee 20180202_1
[15] Interviewee 20180114_1
[16] Interviewee 20180207_1

been restricted that more than information is needed to positively change the policy process. Organisational conditions must be established to use this information adequately. For example, employees need to be able to understand and to use this information as well as to find creative solutions. This need seems to be closely connected with other needs, such as N-I-4, N-T-2 and N-O-3.

The availability of information is particularly important in the stage of implementation but has also high relevance for all other stages of the policy cycle.

3.5.4 N-I-4: Comprehensive knowledge and information management

Knowledge management affects the organisation´s technical assets as well as the employees' willingness to share knowledge. Knowledge is an essential resource in public administration and has to be stored in order to not get lost for the organisation. As a main reason for the loss of knowledge, the participants of the focus group named the retirement of employees. That is why it is important to build up a learning culture, to ensure and promote knowledge transfer within the organisation, as well as with relevant stakeholders. Knowledge management is cofounded with (new) information technologies, which provide an opportunity for administrations to become more efficient. [39][40]

It is therefore necessary to establish a centralised knowledge base, where the organisation's knowledge is stored and saved. This can make public administration work more effective and improve its performance. At the same time, knowledge management can have positive impact in many spheres, for example, policy making and citizens' engagement. It could be said, that this is a need, which also addresses other needs in public administration.

A comprehensive knowledge management plays an important role on the implementation phase of the policy cycle, but can also have positive impact on the policy formulation and evaluation. [41]

3.6 Legal needs

3.6.1 N-L-1: Better quality standards in the formulation and evaluation of norms

Regulation is an essential instrument to attain policy objectives. Better regulation is about achieving administration's objectives by rules, laws, institutions and processes to deliver better, more effective and more efficient outcomes. Therefore, certain quality standards in the formulation and evaluation of norms have to be established. Enhancing regulatory quality requires multilevel ex ante and ex post evaluation systems. To achieve better regulation, it can be helpful to assign political roles to people with specific expertise in the relevant domain. [42]

On the national level, Germany has established a National Regulatory Control Council, an institution responsible for regulatory impact measurements with respect to compliance costs of legislation for decision makers in government and parliament. [43]

The focus group in the policy domain social security confirmed that they would wish more support by politicians in questions of government transfer expenditure use and allocation.

Better regulation becomes particularly important in the context monitoring and evaluation, but also in the formulation and implementation process.

3.6.2 N-L-2: Secure legal framework

Stable rules enable continuous and reliable control of public administration, which acts within a legal framework. Therefore, public administrations' work requires stability, consistency, precision and unambiguity of legal regulation. [44]

The interviewed division head in the policy domain „Youth and Welfare"[17] emphasised the legal aspect in particular. The legal foundations are very complex. On the one hand, they must offer protection; on the other hand, it should not make technical innovations completely impossible. Therefore, the legal standards need to be adjusted because of increased administrative IT penetration.

Such a security is fundamentally important in the formulation phase, but plays also a relevant role in the evaluation and monitoring process.

3.7 Conclusion of section "Needs in European Public Administrations"

The needs identification method is based on a qualitative research design including a qualitative content analysis on primary and secondary data sources.

The conducted interviews have revealed manifold compliant statements and real life examples.

We gained at large nine strategical needs, seven organisational needs, six technical needs, four informational needs, and two legal needs.

Summarising, the needs related to human resource management, such as the improvement of the recruiting process, the personnel development, and the improvement of incentive structures are together with the need to a better understand IT potentials and processes, and assurance of the availability of information, the most important and relevant needs. They have gained the most compliant statements and were highest rated in the online survey.

The list of needs does not claim to be exhaustive. It will be a continuous process during the whole project duration to identify and assess further needs.

However, all needs are interconnected, which leads to the conclusion that a holistic approach needs to be applied in order to reach an overall view on public administrations' needs.

[17] Interviewee 20180207_1

4 Trends in European Public Administrations

The section includes seven subsections. Section 4.1 introduces the methodical approach of the trends identification and description method. Section 4.2 presents findings from the Web of Science and Twitter analysis. Section 4.3 provides an overview of frequencies for each trend based on related records in the Web of Science database. Subsections 4.4 to 4.6 present the identified multidisciplinary trends in European public administrations structured among the trends categorisation. Section 4.7 summarises the overall trends section.

4.1 Trends identification and description method

The trends identification method is based on a mixed-method-design consisting of qualitative and quantitative research approaches. The research process is decomposed into six research phases.

- **Phase 1: Trends identification: desk research**
  In the first phase, a descriptive secondary research approach has been conducted through a literature analysis focused on theoretical and practical knowledge related to multidisciplinary trends. Objects of the research have been various related EU-projects, academic papers, monographs, books, and studies, which will be added to the Big Policy Canvas Repository.

- **Phase 2: Trends identification - qualitative interviews**
  In the second phase, two public administration experts have been interviewed to identify further trends. The interview guidelines can be found in Annex 2. Further online and offline interviews will be conducted to gain experiences from a broader range of experts and countries through the planned stakeholder activities and the online community platform. The results will be considered in the deliverable 3.3 (Needs and Trends Assessment with a multidisciplinary Big Data perspective).

  The interviewees want to remain anonymous but can be characterised as shown in Table 3. A phone interview has been conducted with the interviewee 20180202_1 whereas, with the other interviewee, it was an in-person one.

Table 3: Interviewee characterisation (trends identification)

ID	Function	Policy Domain	Government Level	Policy Cycle Stage
20180202_1	Professor administrative science	Science & Technology	Local level	/
20180114_1	Researcher administrative science	Science & Technology	Local level	/

The content analysis applies the structuring approach in a descriptive manner by using deductively formulated categories that had to be extracted systematically from the interview transcriptions. [9]

The category system contains “conceptual trends”, “societal trends” and “technical trends”.

- **Phase 3: Trends identification: Frequencies in the database Web of Science and Twitter**

  In a third step, trends have been identified by two-word and three-word-combination-queries in the Web of Science (WOS) Core collection and in the social network Twitter. We use the Web of Science database, since it is a main multidisciplinary academic literature collection, human-curated, has complex search functions and the results can be exported for further analysis. The database includes a wide range of fully indexed references (1.4 billion) and Journals (20000+). [45]

  To generate a ranking of the most used two-word and three-word combinations we applied the following query: ("policy" OR "policies") AND ("big data" OR "open data" OR "data analytics") AND ("public")

  Time: 2012 to 2018

  The summary of the results is described in section 4.2. The complete list of the results can be found in Annex 4 and Annex 5.

- **Phase 4: Quantitative analysis on identified trends**

  The trend tendency has been derived through respective WOS database queries. The results have been exported to create trend visualisations in the open source data analysis software “R Studio” with respect to the relative frequency, time line and WOS categories. The fact that it is possible to export the results to run further analysis with the programming language R for statistical computing, is a big benefit.

  We observed in all trend queries a decrease in 2017. This follows probably from the fact, that the Web of Science records collection and curating process has still not been completed for 2017. For this reason, we focus on the relative trend frequency and not on the absolute frequencies in the time span between 2008 and 2017. The relative frequency is the proportion of the trend records quantity in relation to the total quantity of all records.

$$\text{relative trend frequency } X_i = \frac{\text{absolute frequency of } X_i}{\text{absolute total records quantity}}$$

To achieve a specific view on public sector relevant trends, we refined the results in a next step by applying the filter categories “public administration” and “political science”. All refined trend queries are referred as “limited category selection”. As a result, trends are represented with focus on the general tendency in comparison to the tendency of the limited filter category selection. Of course, the total amount of tagged records in the limited category selection is significantly lower, but shows direct impact of a respective trend on publications in the public sector.

- **Phase 5: Trend description**

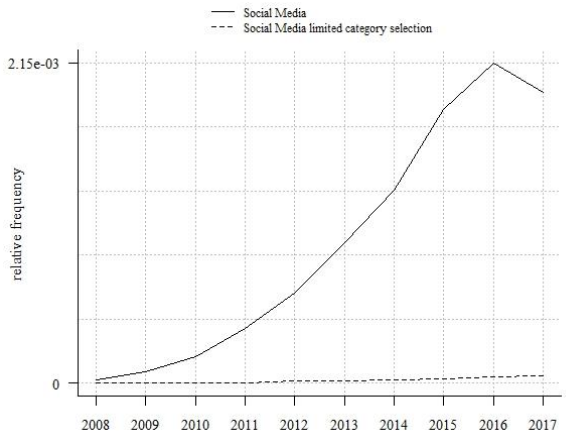
  Every trend description encompasses three subsections. First subsection is named "Trend Description" and contains a secondary research based description of the trend. The second subsection is named "Trend Tendency and Applications" and contains an evaluation of the quantitative gained results with respect to the trend development in general and in comparison to the trend development of the limited filter category result. Furthermore, the subsection presents the distribution on all WOS filter categories. The third subsection presents the relation and its potential impact on other identified needs and trends.

  If a trend description does not contain the second subsection, this follows from the fact, that no search results have been occurred in the respective search query.

- **Phase 6: Transfer of identified trends to the knowledge base with respect to the assessment framework**

  The present report shows an example of how the trends will be prepared for the validation through the assessment framework, which will be published in the deliverable 3.2 (Design and Implementation of Needs and Trends Assessment Framework).

Table 4: Exemplary knowledge base trend entry – T-T-1

T-T-1: Social Media	
Description	By using social media in governmental context, a new form of interaction between citizens and government can be established. The social media data can be used to collect useful information about citizens' needs and opinions, as well as integrate citizens directly in the decision making process. Some governmental institutions also use their own social media accounts and post content online.
Trend Tendency	
Type	Technological trend
Scope	All governmental levels

Policy Cycle Stages	All stages, in particular agenda Setting and formulation phase
Policy Domains	Public Affairs; Education, Youth, Culture and Sport
Intensity	To be filled in at a later stage based on the Framework Application
Foments	Strengthen citizens' trust in public administrations (N-S-4); Involve public and citizen in the manner of conducting a citizen-centred policy making process (N-S-2)
Is Promoted By	To be filled in at a later stage based on the Framework Application

4.2 Findings from WOS- and Twitter-Trend-Identification

The WOS and Twitter queries ("policy" OR "policies") AND ("big data" OR "open data" OR "data analytics") AND ("public") have been carried out to identify trends in terms of the policy making process in the face of data analytics innovation developments.

The two-word-combinations of the WOS query have led to most records, with a total amount of 4614 records and altogether 2000 word combinations. (Annex 4) Noticeable is the fact that the health domain turns out to be most affected by data analytics innovations since it is the first two-word-combination in the ranking without terms that have been used in the search query. In total, 63 (1.37 %) records are related to the term health. On the second position in this question ranks the term social media, which has 27 (0.59 %) related records. However, the percentage shares and the altogether 2000 two-word-combinations are showing, that most of the gained terms are multifarious terms with only one or two mentions.

The Twitter-ranking of two-word-combinations has on its first positions primary terms that have been used in the search query as well. On position four ranks the term "change_public" with 527 mentions (19 %) (Annex 5). It points on the transformation process in terms of data analytic strategies that is going on in the public sector. The terms social media and health are also high rated on the position 14 and 17. Noteworthy is furthermore, that 424 of 2771 (15.3 %) tweets are related to the term "dehumanizing", which indicates a controversial discussion regarding the use of data analytics technologies in the public sector.

4.3 Overview of absolute record frequencies per trend

Figure 2 depicts the comparison of absolute frequencies per trend. The trends are shown on the horizontal axis. The frequency with respect to the trend related records in general is shown on the left vertical axis. The bars depict how many records are related to the respective trend. It can be stated, that Machine Learning, Cloud Computing and Social Media count the most related records.

The second variable is depicted in the frequency curve. The frequency curve displays the absolute frequencies of records in a limited filter category selection. The limited category selection includes the Web of Science filter categories "public administration" and "political science". The frequency with respect to the trend related records in the limited category selection is shown on the left vertical axis.

In fact, the total amount of tagged records in the limited category selection is significantly lower, but depicts the direct impact of respective trends on publications in the public sector.

In the WOS database, Social Media, Performance Measurement and Big Data turn out to be most affected trends in the public sector.

Whereas primarily technological trends are highest rated over all categories, in the limited category selection a conceptual trend emerges among the top three trends.

However, there are a relevant number of trends that are significantly lower rated, which does not mean, that these trends have no impact on a more efficient, effective and precise policy making process and structure. For this reason, the trend tendency provides just one perspective and need to be considered in relation to the literature based trend description.

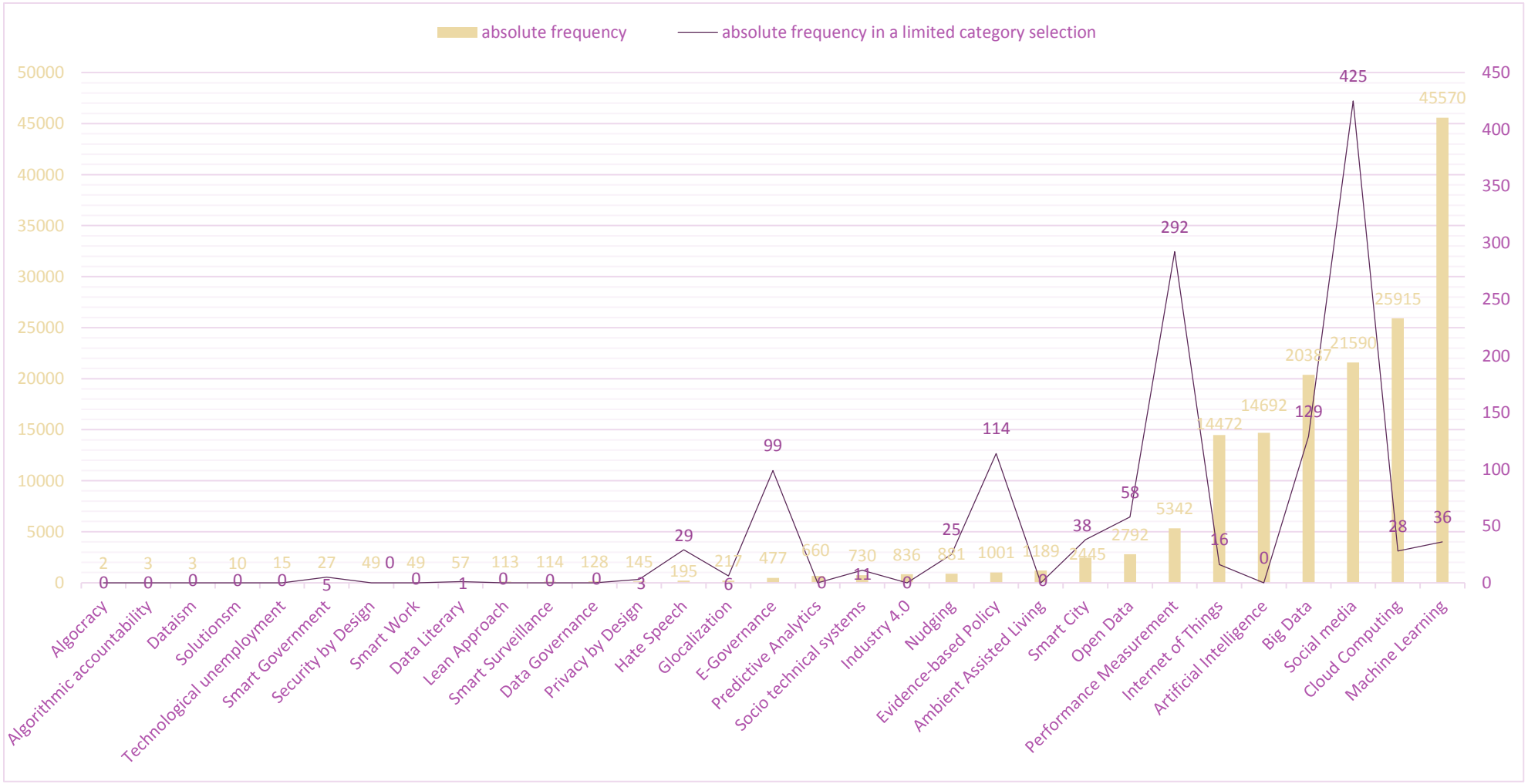


Figure 2: Overview of absolute frequencies over all categories and in limited category selection per trend

4.4 Technological Trends

4.4.1 T-T-1: Social Media

4.4.1.1 Social Media Trend Description

By using social media in governmental context, a new form of interaction between citizens and government can be established. The social media data can be used to collect useful information about citizens' needs and opinions, as well as integrate citizens directly in the decision making process. Some governmental institutions also use their own social media accounts and post content online. [46][47]

The trend identification research, as mentioned in section 4.2, has shown that social media is an important aspect of public sector data analytics strategies.

The trend emphasizes the migration of social and economic activities to the internet, which indicates the relocation of social, economic and governmental activities from the "real-world" to the internet. Examples for such a migration can be seen in social networks and the adoption of E-services, such as E-health and E-government, which change traditional communication channels and generate many data. [48]

4.4.1.2 Social Media Trend Tendency and Applications

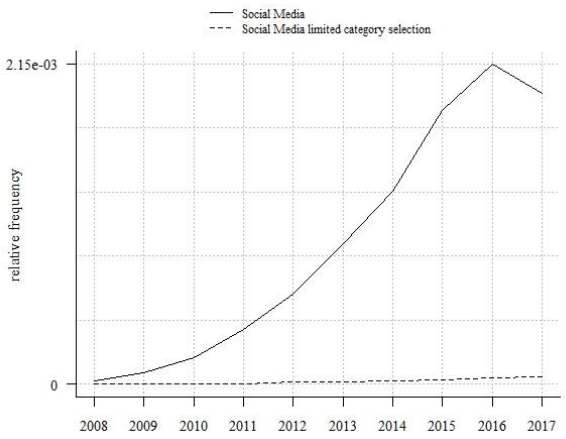


Figure 3: Social Media Trend (1)

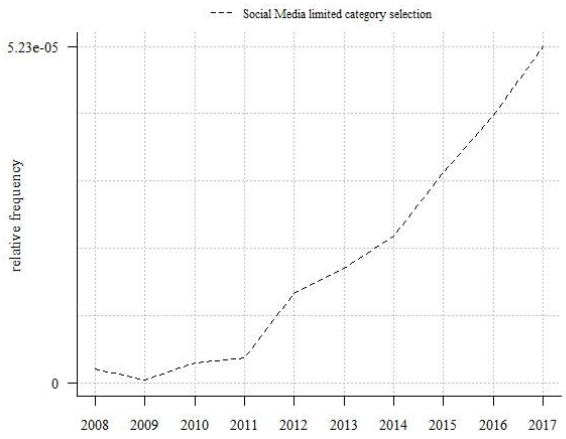


Figure 4: Social Media Trend (2)

Figure 3 shows that social media has a strong increase of related WOS research publications since 2008 and a decrease in 2017. The total amount of records in the limited category selection applying the filter categories "public administration" and "political science" is significantly lower (see Figure 2), but shows a constantly strong rise since 2012 including 2017 (Figure 4). The continuing rise in 2017 demonstrates the still growing importance of social media in the public sector.

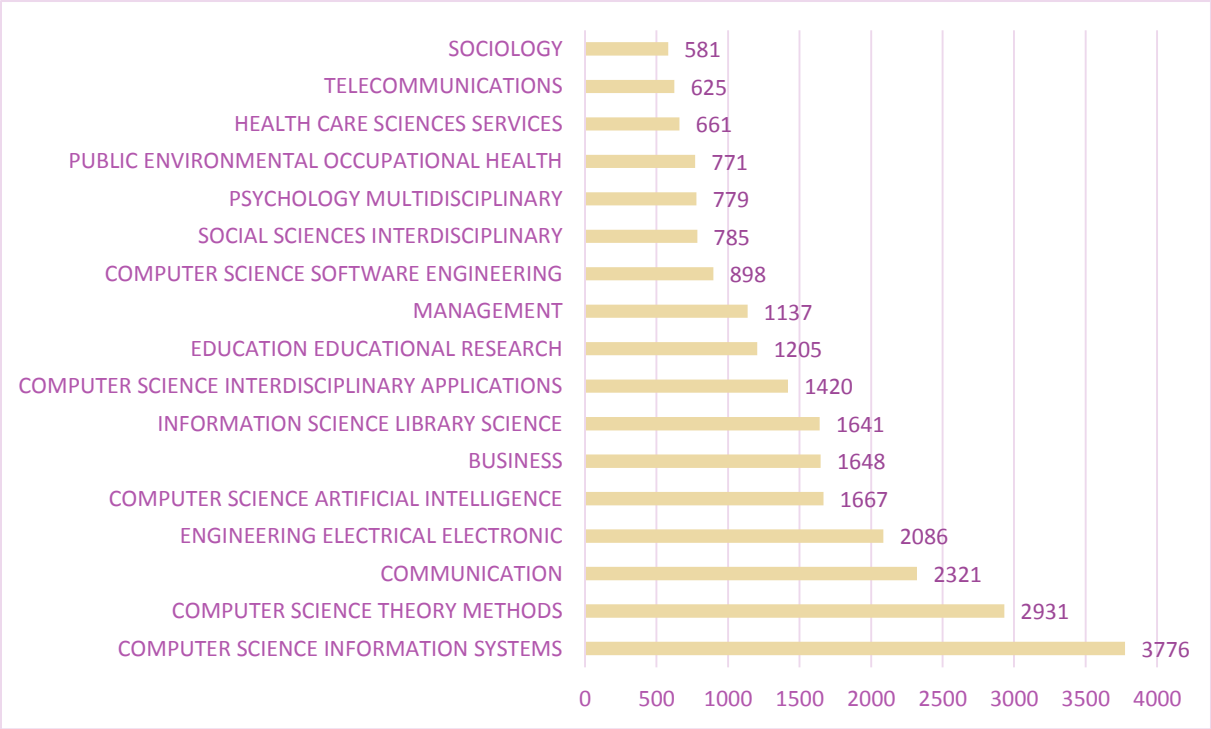


Figure 5: Social Media – amount of tagged records per WOS category

The WOS category distribution of all social media linked records shows, that there is a strong relation to the application field "Computer Science" (the first two positions) but also to communication (third position). The latter indicates a high relevance for the public affairs policy domain, since communication is a central issue e.g. in terms of lobbying activities or exchange with interest groups. Also interesting is the assignment to the category educational research, which implies relevance for the policy domain education, youth, culture and sport.

4.4.1.3 Social Media related Needs and Trends

Due to quite new possibilities of interaction between citizens and public administrations, the trend has potential impact on the need to strengthen citizens' trust in public administrations (N-S-4) and to involve public and citizen in the manner of conducting a citizen-centred policy making process (N-S-2). On the other hand, social media is facing trends like hate speech (T-S-3) that need to be considered as potentially risky in questions of political communication and public affairs.

4.4.2 T-T-2: Big Data

4.4.2.1 Big Data Trend Description

In 2001, the industry analyst Douglas Laney at Gartner described data management challenges along the three dimensions volumes, velocity and variety in the E-commerce branch. Volumes stands for the quite huge increase of volumes of data, Velocity for increased point-of-interaction speed and the pace of data generated by interactions and used to support interactions. Data Variety means variety of

incompatible data formats, non-aligned data structures and inconsistent data semantics. This 3-V-model has been widely used attempting to define big data since this publication in 2001. [49]

The Oxford dictionary has defined the term Big Data as "extremely large data sets that may be analysed computationally to reveal patterns, trends, and associations, especially relating to human behaviour and interactions". [50]

Viktor Mayer-Schönberger and Kenneth Cukier point to what can be done with the data and why its size matters in the way that it is "the ability of society to harness information in novel ways to produce useful insights or goods and services of significant value". Nevertheless, they focus on potential risks e.g. in terms of privacy, predictions to punish people even before they acted or the abuse of data by people with bad intentions. [51]

4.4.2.2 Big Data Trend Tendency and Applications

Figure 6 shows the strong increase of related publications since 2011, when Douglas Laney has defined its main challenges. The limited category selection in Figure 7 shows an increase, and as well a peak in 2014, but it is far away to be affected in a relevant manner (see Figure 2).

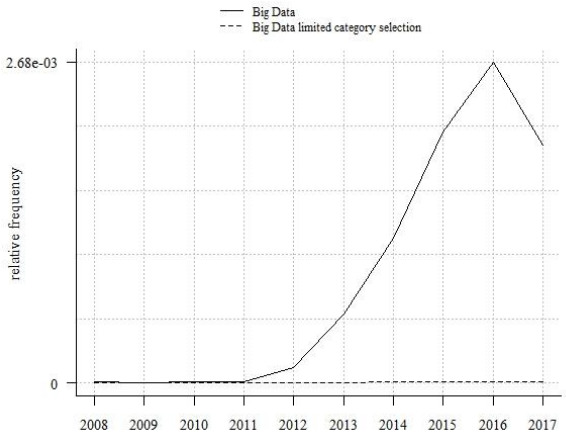


Figure 6: Big Data Trend (1)

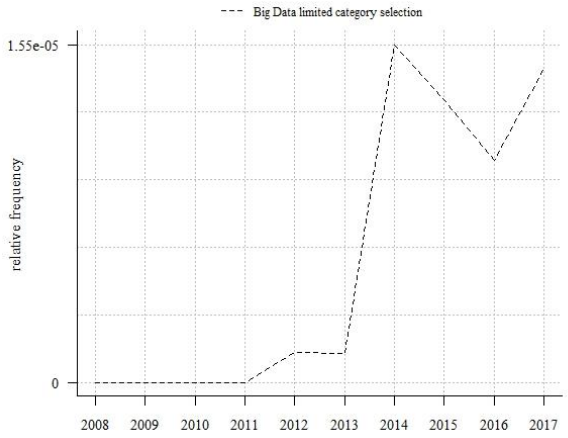


Figure 7: Big Data Trend (2)

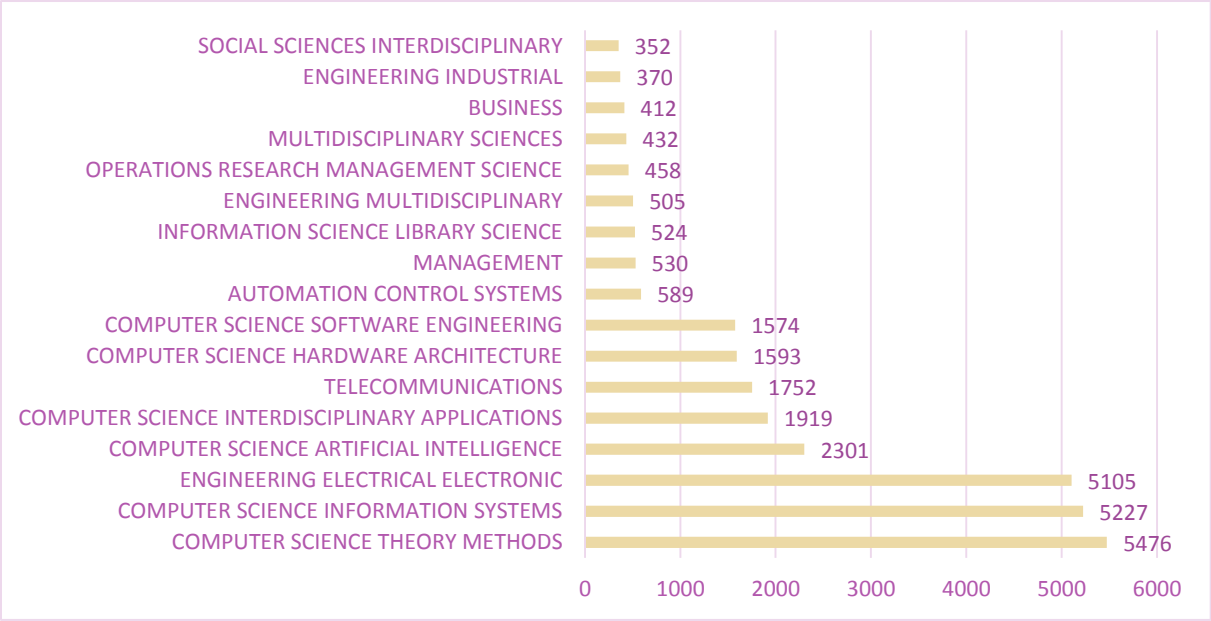


Figure 8: Big Data – amount of tagged records per WOS category

The records allocation of WOS-categories in Figure 8 shows a high relevance for various computer science disciplines. The first category in the list with relation to an application field is "Management" which underlines the management aspect of big data.

4.4.2.3 Big Data related Needs and Trends

The trend primarily addresses the informational needs as they are formulated in section 3.5, since big data is dealing with the processing of information. In addition, also the technical needs N-T-1 (Cope with the production of huge volumes of data) and N-T-5 (Coherent use of digital technology across policy areas) are related in the way that they are familiar with Laney's data management challenges volume and variety.

The large relevance for the management category indicates a strong relation to conceptual and management related trends like Smart City (T-S-1), E-Policy (T-C-11) and E-Governance (T-C-7).

4.4.3 T-T-3: Artificial Intelligence

4.4.3.1 Artificial Intelligence Trend Description

Artificial Intelligence (AI) is a possibility to improve policy and decision making and can be understood as the automation of intelligent and human-like behaviour. The most important techniques to support specific cases of indeed high complex policy making processes are decision support and optimisation techniques, game theory, data and opinion mining, agent-based simulation and visual scenario based evaluations. [52]

Several ethical issues have to be considered when talking about AI. Preventing mistakes in cases of untrained application cases, eliminating bias or protecting from adversaries and unintended consequences are only a few potential dangers. The world economic forum further asks in a big picture

how to distribute wealth created by machines and how to deal with unemployment caused by artificial intelligence. [53]

4.4.3.2 Artificial Intelligence Trend Tendency and Applications

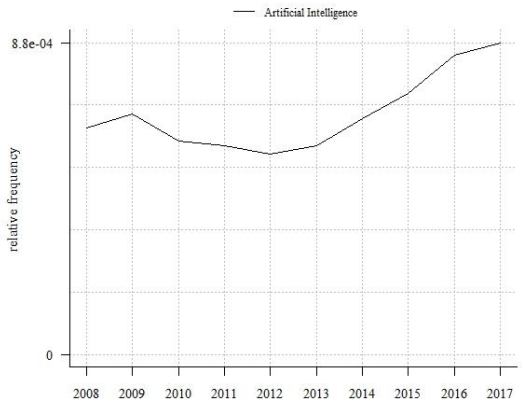


Figure 9: Artificial Intelligence Trend

The trend curve demonstrates a continuing increase with a peak in 2017. The WOS categories „political science" and "public administration" are not affected by the trend. Instead, Computer Science related categories are primarily tagged (Figure 10).

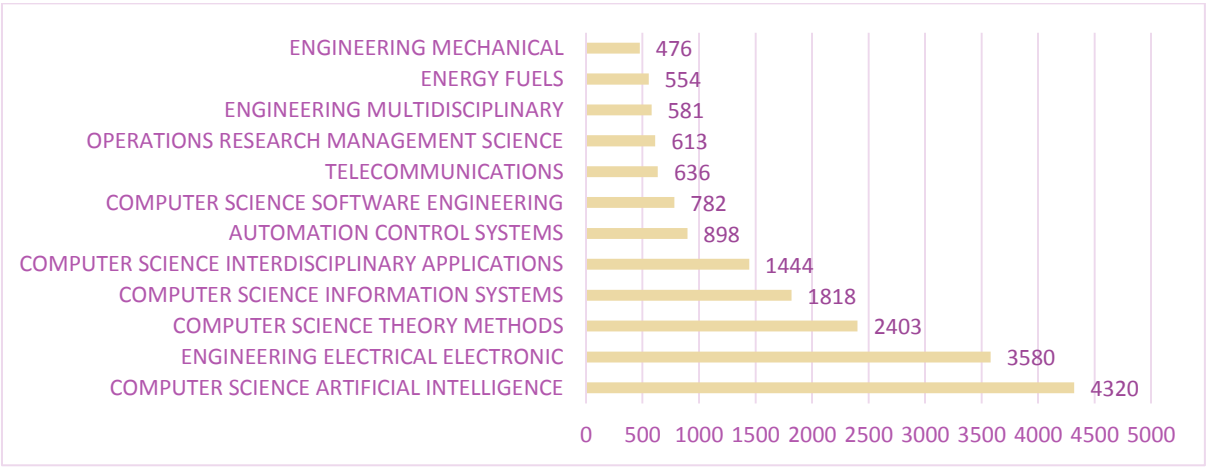


Figure 10: Artificial Intelligence - amount of tagged records per WOS category

4.4.3.3 Artificial Intelligence related Needs and Trends

If AI is applied to improve policy making and decision processes, it will address the need of continuous evaluation (N-S-5) and the development of domain specific target and indicator systems (N-S-1), since it can improve the planning, analysis and evaluation activities through the application of the mentioned AI techniques. The use of AI techniques in the policy making process also refers to the conceptual trend E-Policy (T-C-11).

The ethical issues are leading to a strong relation with other in particular social trends such as technological unemployment (T-S-2), algorithmic regulation (T-S-5) or nudging (T-S-7), as well as to some conceptual trends like privacy by design (T-C-4) or security by design (T-C-5).

There are also a growing number of scenarios and experiments regarding the potential application of artificial intelligence in public administrations in particular for routine tasks. For instance, AI can support welfare payments, immigrations decisions, detect fraud or answer citizens' questions. [54]

These application cases primarily meet the need of public administrations to optimise processes and resources (N-O-6).

4.4.4 T-T-4: Machine Learning

4.4.4.1 Machine Learning Trend Description

By now, the most promising application of artificial intelligence is the use of machine learning as a subfield of AI. The Encyclopaedia Britannica states that machine learning is concerned with the implementation of computer software that can learn autonomously. [55]

Expert systems and data mining programs are the most common applications. For instance, a computer program learns and improves its own answers to a question by creating and integrating algorithms from a collection of data. New knowledge is generated through experiences and is not programmed. Among the most common approaches are the use of artificial neural networks (weighted decision paths) and genetic algorithms (symbols "bred" and culled by algorithms to produce successively fitter programs).

Tom M. Mitchell established the more formal definition: "A computer program is said to learn from experience E with respect to some class of tasks T and performance measure P if its performance at tasks in T, as measured by P, improves with experience E." [56]

Since machine learning is a subfield of the discipline artificial intelligence, the ethical questions that were discussed among this topic are the same.

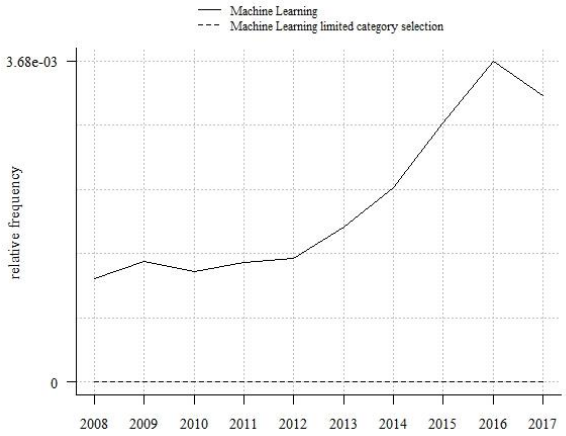


Figure 11: Machine Learning Trend

Figure 11 demonstrates that machine leaning has a low impact on the limited categories selection "political science" and "public administration" (see also Figure 2, 36 category related records, total amount 45570 records). Apart from the high relevance for computer science disciplines (with remarkable absolute frequencies up to 12801 tagged records per category, see Figure 12), machine learning seems to have a high impact on medical research disciplines, like medical imaging, medical informatics or biomedical engineering, which indicates, that machine learning has an impact on the health policy domain.

4.4.4.2 Machine Learning Trend Tendency and Application

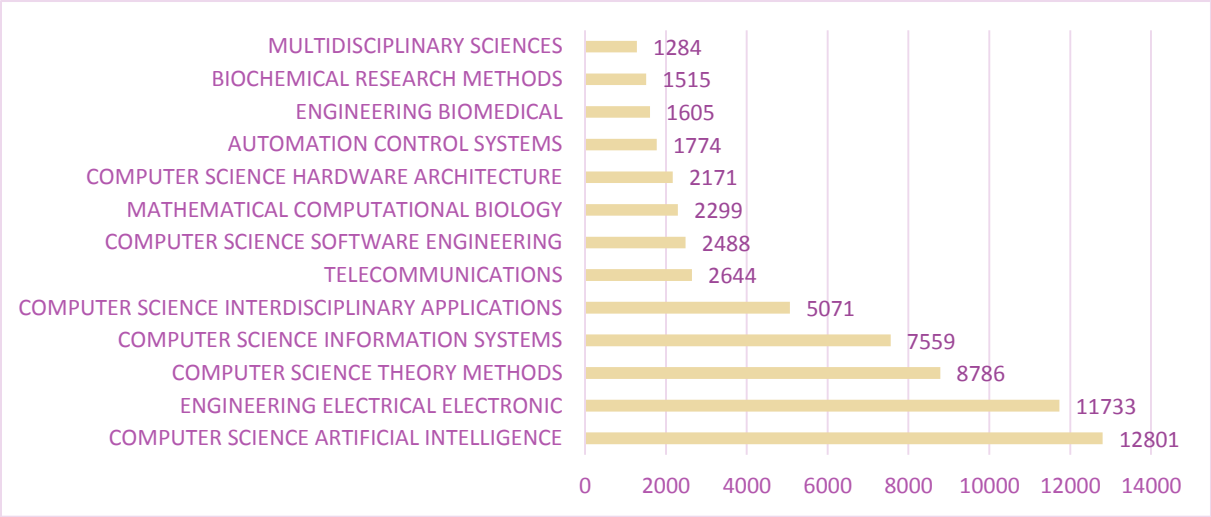


Figure 12: Machine Learning – amount of tagged records per WOS category

4.4.4.3 Machine Learning related Needs and Trends

Following the fact that machine learning is able to substitute various routine tasks in public administrations (see artificial intelligence T-T-3), the trend supports the need to optimise processes and resources (N-O-6).

4.4.5 T-T-5: Next Generation of BI and Data Analytics platforms

4.4.5.1 Next Generation BI and Analytics Platform Trend Description

Gartner assumes that by 2020 modern BI and analytics platform components will deliver smart, governed, search- and visual-based data discovery capabilities. Natural-language generation and artificial intelligence will be a standard feature of 90% of modern BI platforms and organisations that offer users access to a curated catalogue of internal and external data will realise twice the business value from analytics investments than those that do not. Gartner outlined fifteen critical capabilities by a BI and Analytics Platform [57]:

1. BI Platform Administration, Security and Architecture.
2. Cloud BI. (Platform-as-a-service and analytic-application-as-a-service capabilities)
3. Data Source Connectivity and Ingestion.
4. Metadata Management.
5. Self-Contained Extraction, Transformation and Loading (ETL) and Data Storage.
6. Self-Service Data Preparation.
7. Embedded Advanced Analytics.
8. Analytic Dashboards.
9. Interactive Visual Exploration.
10. Smart Data Discovery: Automatically finds, visualises and narrates important findings
11. Mobile Exploration and Authoring.

12. Embedding Analytic Content.
13. Publish, Share and Collaborate on Analytic Content.
14. Platform Capabilities and Workflow.
15. Ease of Use and Visual Appeal.

4.4.5.2 Next Generation BI and Analytics Platform related Needs and Trends

Data analytics platforms are addressing the need to establish a comprehensive technical infrastructure (N-T-4) in order to link several organisational data (N-I-1 Link between impact, quality, performance measurements and financial information). It ensures the availability of information (N-I-3) and enables a comprehensive knowledge and information management (N-I-4).

4.4.6 T-T-6: Predictive Analytics

4.4.6.1 Predictive Analytics Trend Description

Predictive analytics brings together advanced analytics capabilities. It extracts information from existing data sets in order to determine patterns and predict future impacts and trends. It forecasts what might happen in the future with an acceptable level of reliability, and includes what-if scenarios and risk assessments.[58]

Data analytics encompasses techniques such as regression analysis, pattern matching, forecasting, multivariate statistics, predictive modelling and forecasting. [59]

Augmented analytics is a next-generation data and analytics paradigm that uses machine learning to automate data preparation, insight discovery and insight sharing for a broad range of business users, operational workers and citizen data scientists. Providers now offer augmented analytics capabilities that could disrupt business intelligence (BI) and analytics, data science, data integration and embedded analytic application vendors. [60]

4.4.6.2 Predictive Analytics Trend Tendency and Applications

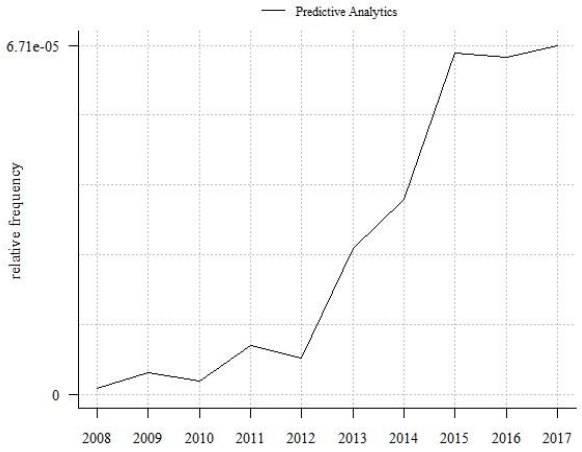


Figure 13: Predictive Analytics Trend

Noticeably the WOS query revealed no assigned records to political science and public administration categories. Nevertheless, Figure 13 determines a remarkable and continuously increase of predictive analytics related records in general.

The absolute frequencies in Figure 14 are nowhere near from e.g. machine learning frequencies. However, it can be stated that there is a high impact on computer science disciplines and management. A further application field can be found in the criminology. The more applied key word in this context is “predictive policing”.

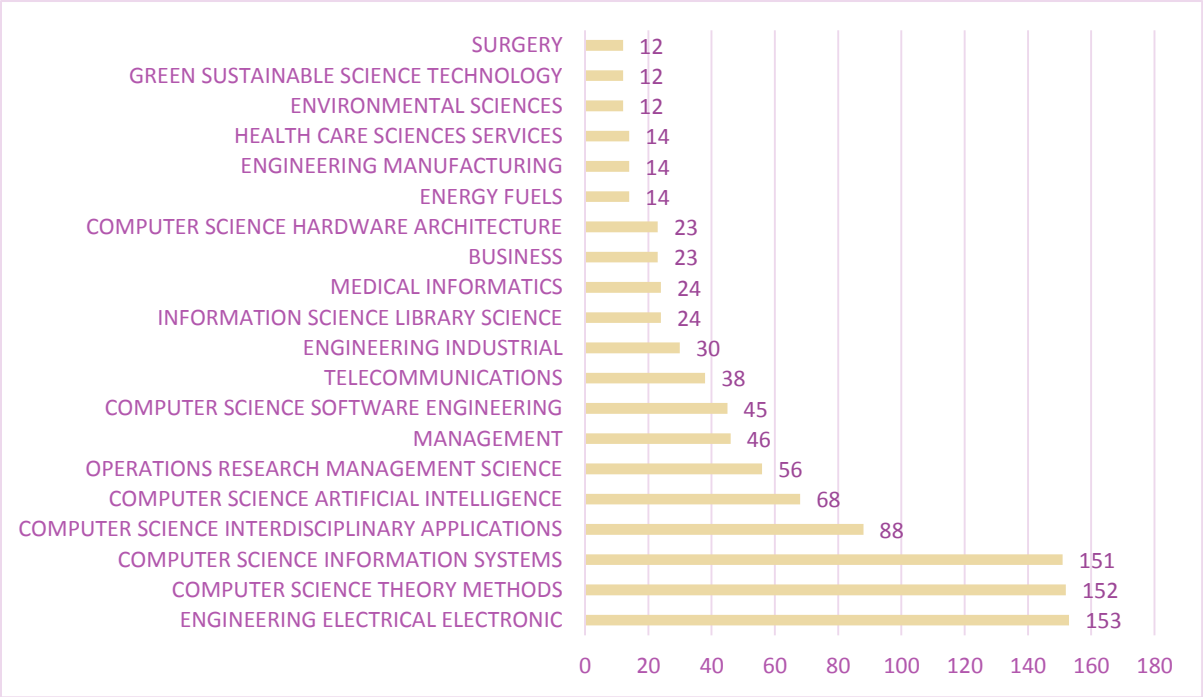


Figure 14: Predictive Analytics – amount of tagged records per WOS category

4.4.6.3 Predictive Analytics related Needs and Trends

Predictive analytics meets the requirement of forward looking strategic planning in the public sector (N-S-3) in order to anticipate future needs and to prevent potential problems.

4.4.7 T-T-7: Cloud Computing

4.4.7.1 Cloud Computing Trend Description

Cloud computing is a model that enables ubiquitous access to a shared pool of configurable technological assets available on-demand in a virtualised environment. Cloud services are remotely managed by cloud service providers and can be rapidly provisioned and released with minimal effort or service provider interaction. It can potentially achieve coherence and economies of scale.

The cloud model encompasses the four deployment models Public, Private, Hybrid and Community and the following three delivery models [61]:

Software as a Service:

The provider delivers software based on one set of common code and data definitions, which is running on a cloud infrastructure. It is consumed in a one-to-many model by all contracted customers at any time on a pay-for-use basis or as a subscription based on use metrics. The applications are accessible from various devises through a thin client interface. [62]

Platform as a Service:

Platform services provide a virtual environment for software developers to build applications and services using tools (e.g. operating systems, database management systems or server software) supplied by the provider. It can be accessed by users via their web browsers. [61]

Infrastructure as a Service:

Infrastructure services provide specifically virtualized computing infrastructure such as virtual server space, IP addresses, network connections or bandwidth. [61]

Security and confidentiality are well known as the most serious obstacles to cloud adoption in the public sector. For this reason, there is a demand for trusted cloud services that constitute public administration business processes. [63]

4.4.7.2 Cloud Computing Trend Tendency and Applications

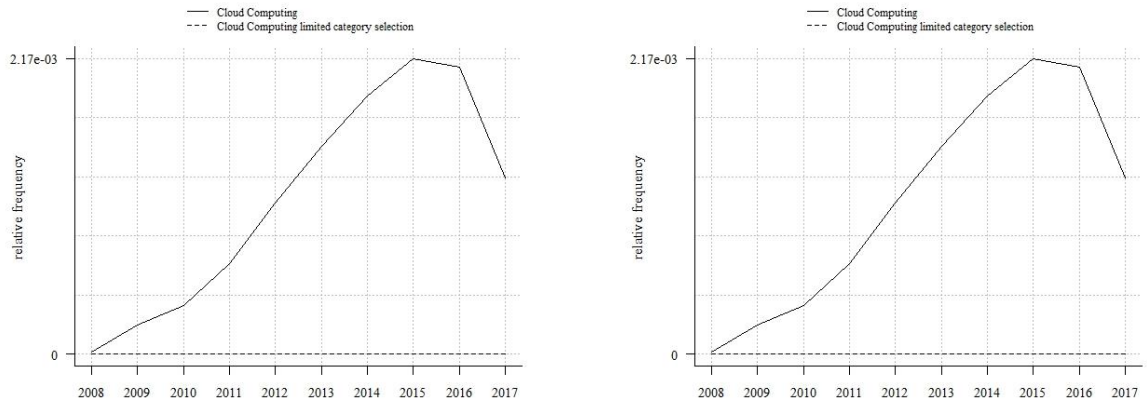


Figure 15: Cloud Computing Trend

¡Error! No se encuentra el origen de la referencia. demonstrates that cloud computing has a heavily ncrease since 2008 and a low share on records tagged by the limited categories selection comprising "political science" and "public administration" (see also Figure 2, 28 limited category related records, total amount 25915 records). Apart from the high relevance for computer science disciplines (with remarkable absolute frequencies up to 10479 linked records per category, cf. Figure 16), cloud computing seems to have an impact on electronic engineering disciplines, educational research and management research.

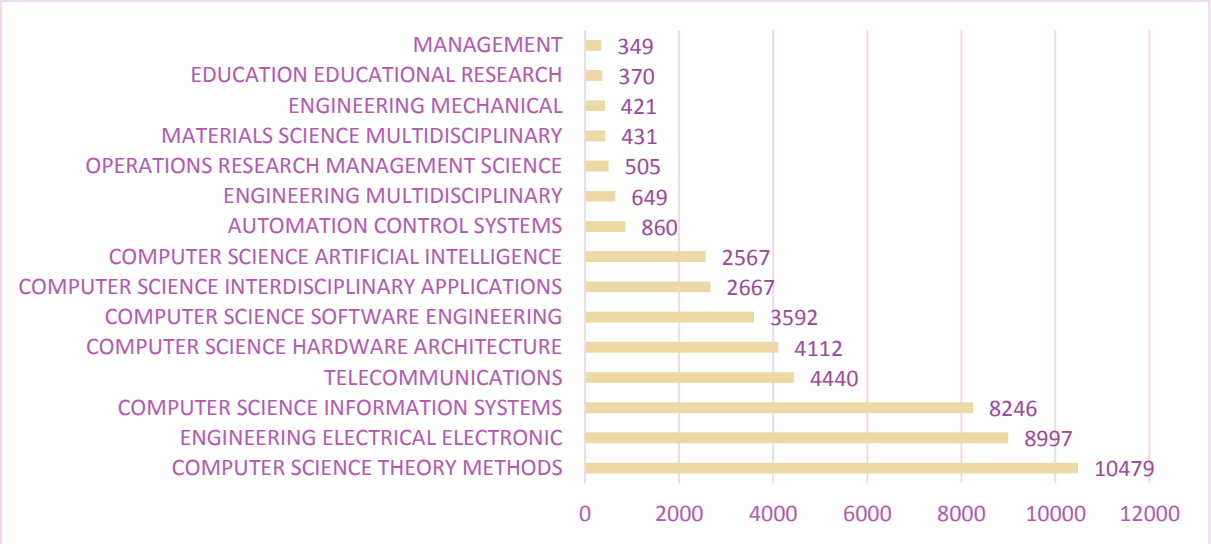


Figure 16: Cloud Computing – amount of tagged records per WOS category

4.4.7.3 Cloud Computing related Needs and Trends

The trend should be considered within the establishment of a comprehensive technical infrastructure and IT architecture (N-T-4). Cloud computing also has potential impact on the need to standardise data management (N-T-6), if data analytics cloud solutions are purchased for example in a virtual environment of public IT service providers.

4.4.8 T-T-8: Internet of Things (IoT)

4.4.8.1 IoT Trend Description

There are various definitions of the Internet of Things (IoT). The Internet Engineering Task Force says Internet of Things' basic idea is to connect electronical and non-electronical objects to provide seamless communication and contextual services by them through e.g. RFID tags, sensors, actuators or mobile phone. The latter is related to the term "things". The term "Internet" considers the TCP/IP suite and non-TCP/IP suite at the same time. [64]

Driven by the internet of things, a new computing model – edge-cloud computing – is currently evolving, which involves extending data processing to the edge of a network in addition to computing in a cloud or a central data centre. [65]

On a local level, physical objects are cross-linked through an edge computing layer, which ensures user data privacy. On a global level, edge computing services and applications are networked on a cloud computing layer. Edge computing and cloud computing constitute the logical levels on which digital services and applications in context of the Internet of Things could be implemented. [66]

Furthermore, IoT is closely linked with the term "Industry 4.0", which was first used in Germany in 2016 to describe the next level of industrial production and uses smart objects and cyber physical systems within the Internet of Things. 4.0 can thus be seen as the next wave of industrial revolution. The graph in Figure 17 confirms the trend with a rapid increase of Industry 4.0 related records from 2015 to 2016, which obviously seems to be still continuing. [66] [66]

4.4.8.2 IoT Trend Tendency and Application

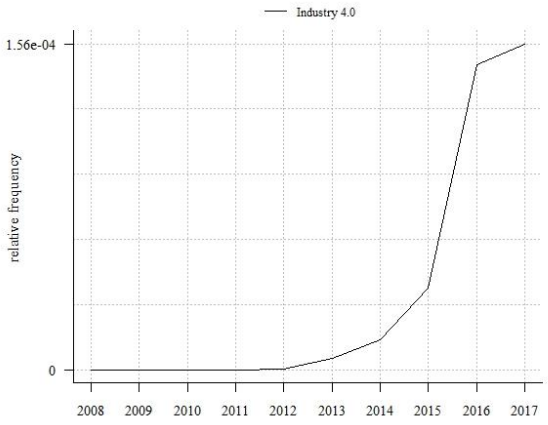


Figure 17: Industry 4.0 Trend

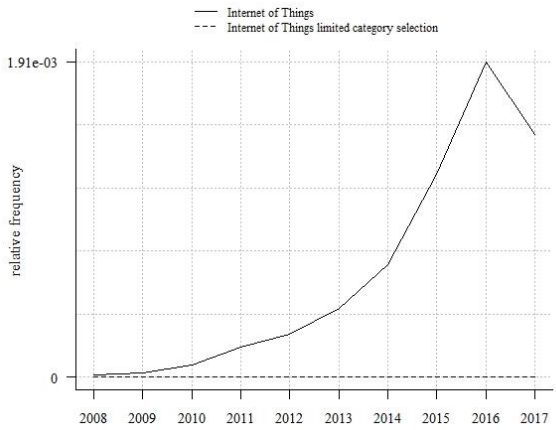


Figure 18: Internet of Things Trend

Figure 18 illustrates a large rise of "Internet of Things" related publications in the WOS database. The term seems to have no big influence on the limited category selection, since the graph remains close to zero.

The category allocation in Figure 19 displays a strong relevance for the research field electronic engineering, as well as for several computer science disciplines, which implicates a relevant impact on the overall industrial sector.

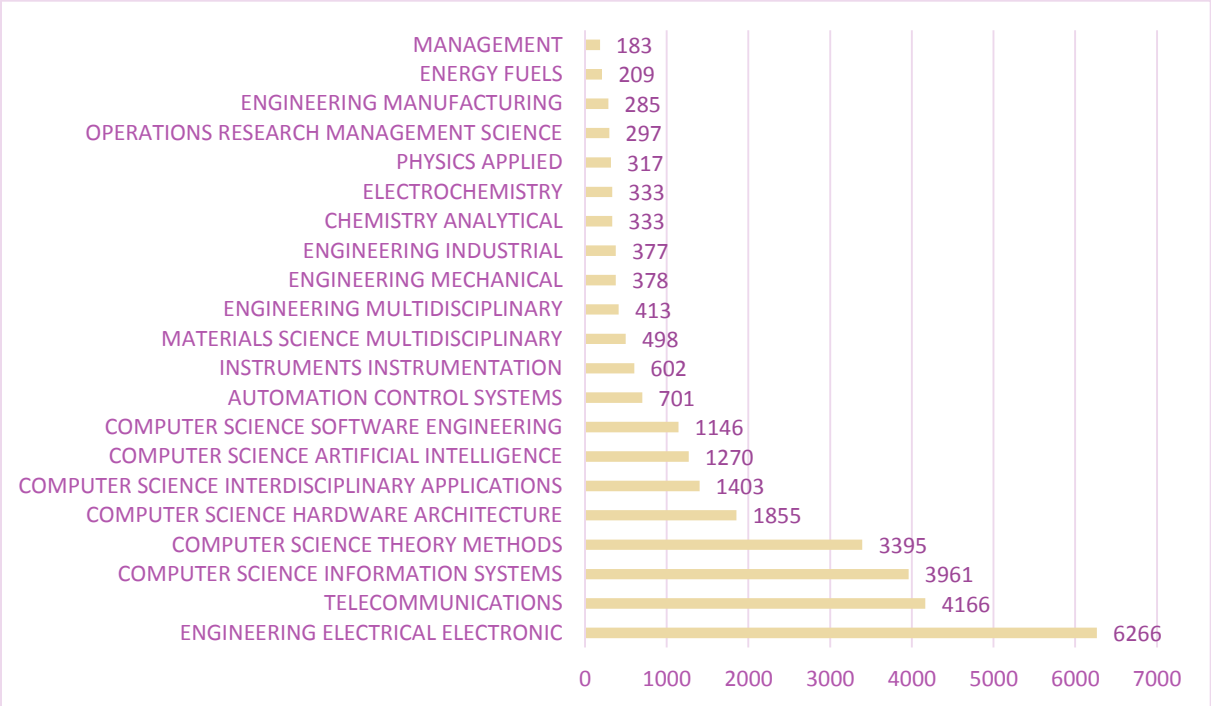


Figure 19: Internet of Things – amount of tagged records per WOS category

4.4.8.3 IoT related Needs and Trends

IoT addresses the need to optimise processes and resources (N-O-6) and is closely linked to the smart city trend (T-C-1), that fosters the intelligent connection of processes, people and machines. Due to a highly interconnected infrastructure, also local and regional specificities and demands on e.g. natural resources can be taken into account (N-S-7). The edge computing layer meets the need of citizens' data privacy, since data remains on the local level.

4.5 Conceptual Trends

4.5.1 T-C-1: Smart City / Smart Government

4.5.1.1 Smart City Trend Description

The pressure to redesign city infrastructures is strong, since climate change and the problem of allocation are defining new requirements, which will not be met through cosmetic and maintenance repairs. In particular, energy infrastructures like water, waste or recycling are affected by this issue.

The following description draws a picture for future smart cities.

Innovative infrastructures will be characterised through digital management systems based on real time data processing. Infrastructure components and communal rooms are interconnected due to innovative communications systems. Decentralised systems are connected with central networks and buildings will produce energy as decentralised energy providers. Traffic will be resource saving through emission-free individual, economical and public transport and new mobility concepts will be established. The public administration will be evolved to an open government, which provides open data and services and develops new governance structures with respect to participative communications, stable health care structures and public safety strategies. [67]

The European Innovation Partnership on Smart Cities and Communities has identified the need for an approach of more integrated infrastructures, which have led to the creation of a reference architecture with the view to provide a vendor agnostic, interoperable, and standards-based orientation for an open urban platform to cities and communities. [68]

In a broader context, the term Smart Government has been arisen to address not only the local level, but rather all levels of government. In accordance to smart cities, it addresses an intelligently networked governance, which uses the opportunities of interconnected smart objects and cyber physical systems for the efficient and effective performance of public tasks. [69]

4.5.1.2 Smart City Trend Tendency and Applications

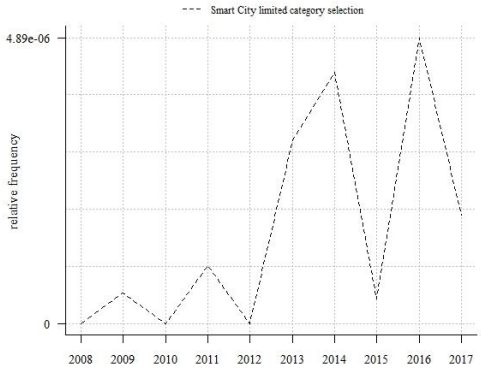


Figure 20: Smart City Trend (1)

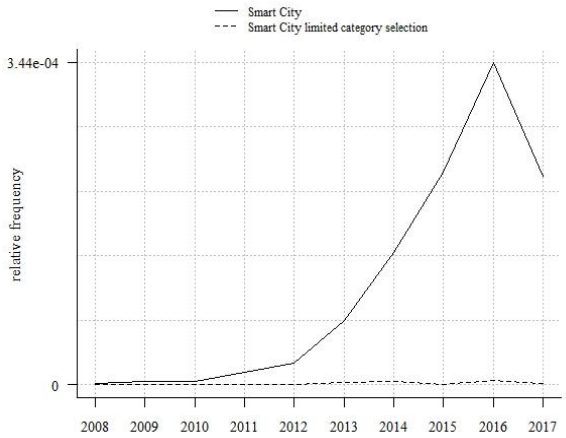


Figure 21: Smart City Trend (2)

Figure 20 shows a rapid rise of Smart City related records in the Web of Science database until 2016, whereas the selected category result has far less tagged records. Figure 21 shows a volatile trend line since 2008 and a peak in 2016 in the limited category selection.

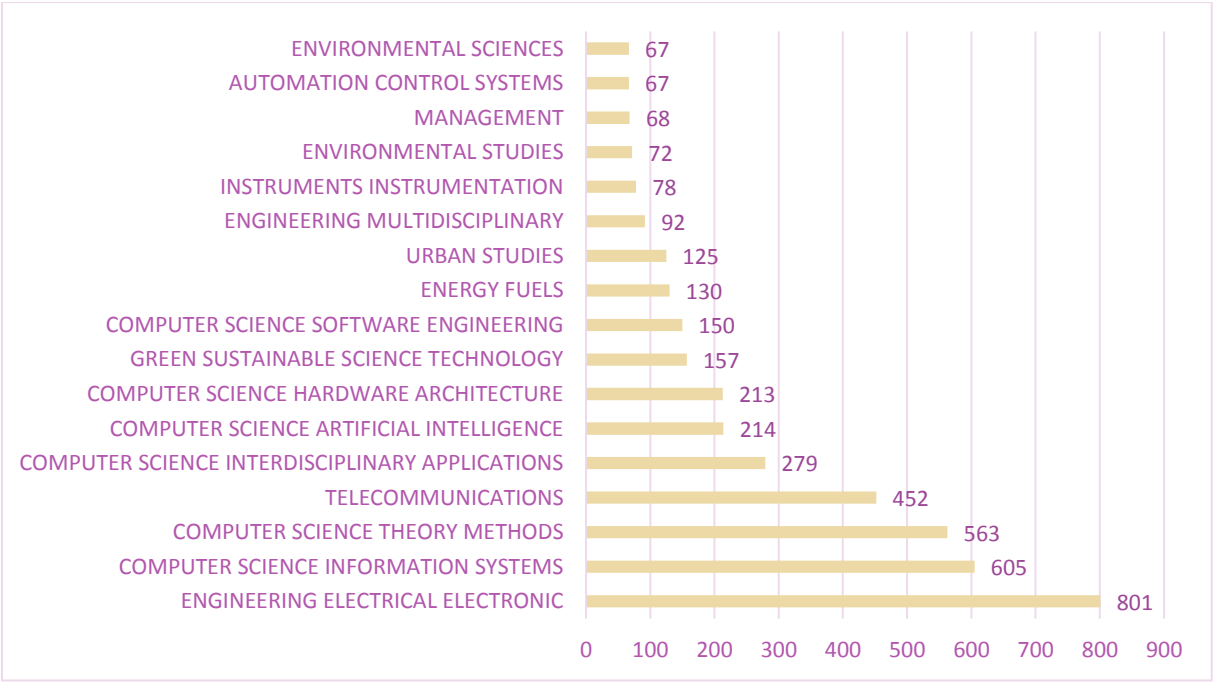


Figure 22: Smart City – amount of tagged records per WOS category

Since the Smart City trend is closely linked with the IoT trend, we can see in Figure 22 again a high relevance for the electronic engineering discipline.

4.5.1.3 Smart City related Needs and Trends

Due to smart city/government key characteristic of connecting things, people, infrastructure, processes and services, this trend is quite strong influenced by many other trends such as IoT, cloud computing, open data, big data and actually all other technical trends, mentioned in section 4.4.

In this sense, also some key needs are affected by the smart city trend such as environmental awareness and protection (N-S-8), cross-linked information exchange (N-S-9), local and regional specificities (N-S-7), the establishment of comprehensive technical infrastructure and IT architecture (N-T-4) and the ensuring of the availability of (real-time) data (N-I-3).

4.5.2 T-C-2: Open Data

4.5.2.1 Open Data Trend Description

The term Open Data means that data and content can be freely used, modified and shared by anyone for any purpose. Open data is accessible for everyone and useable without any restrictions. [70]

Open Government Data refers to the wide range of information that public sector bodies collect, produce, reproduce and disseminate while accomplishing their institutional tasks. [71]

There are several governmental open data initiatives with the aim to publish different kinds of data, (geographic, financial, statistics, election results, legal acts, data on health, transportation and so on) in order to increase transparency and collaboration among sectorial and departmental boundaries. The European Open Data Portal, for instance, is available since 2016, harvesting the metadata available on public data and geospatial portal across European countries. [72]

4.5.2.2 Open Data Trend Tendency and Applications

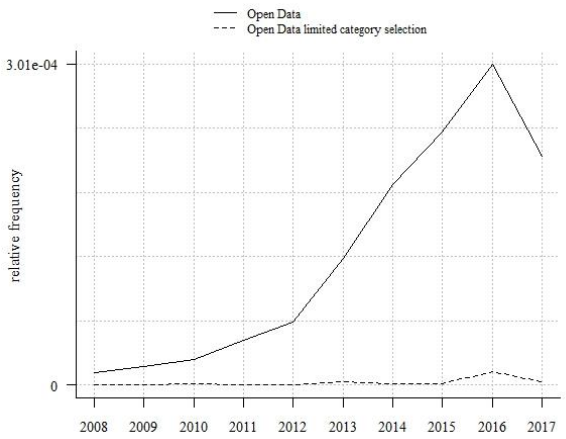


Figure 23: Open Data Trend (1)

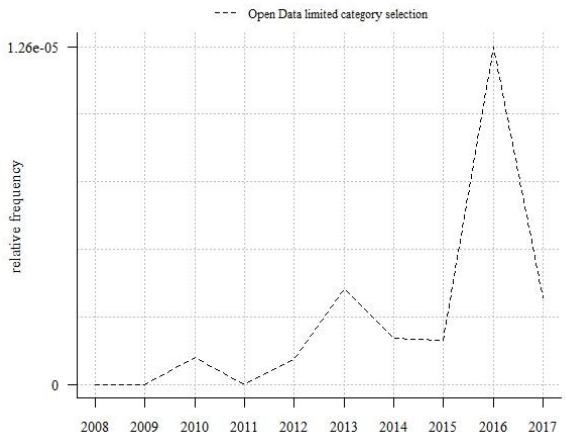


Figure 24: Open Data Trend (2)

Figure 23 illustrates that open data had a rapid increasing trend until 2016 (with 739 related records in 2016) which also corresponds with the trend tendency of the limited category selection but with far less related records. Figure 24 shows a peak in 2016 within the categories public administration and political science. Figure 25 underlines primarily the relevance for computer science disciplines.

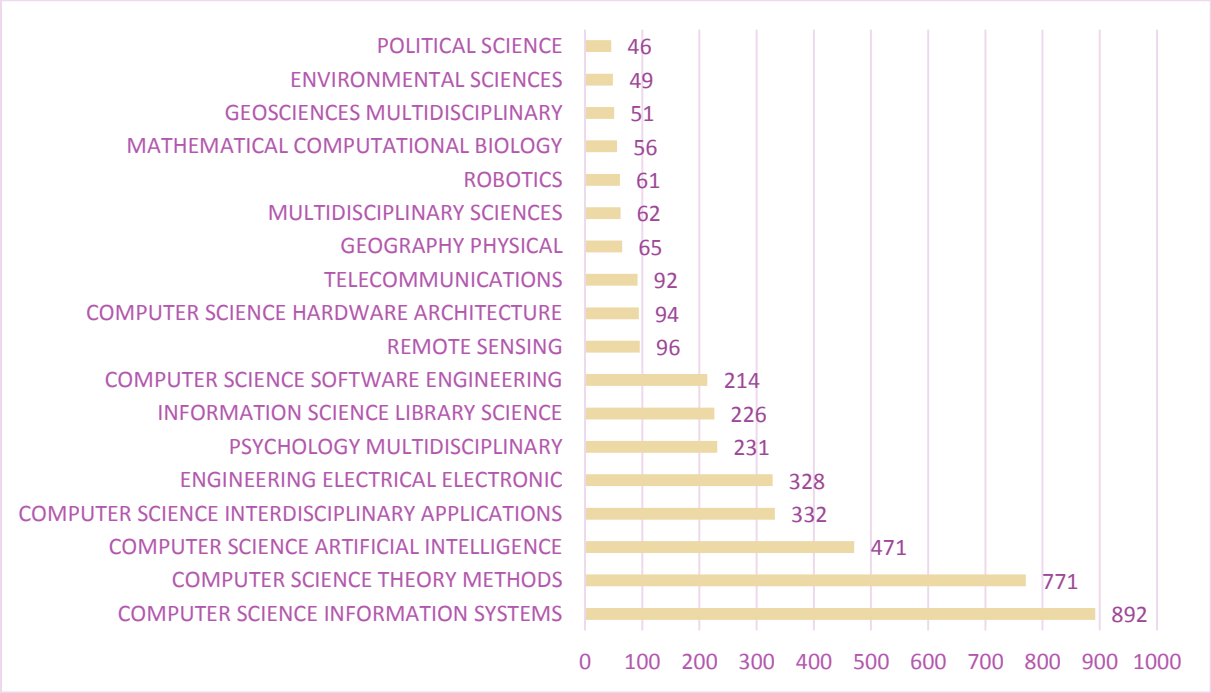


Figure 25: Open Data – amount of tagged records per WOS category

4.5.2.3 Open Data related Needs and Trends

Open data stands for open information, which can be used to include scientific knowledge and expertise in the policy making process (N-I-2).

More particularly, Open Government Data meets the requirement of public administrations to ensure the availability of data (N-I-3) through cross-linked information exchange (N-S-9). It standardises the data management (N-T-6) through a consistent, transparent and centralised overview of data availabilities. It is also a data source in order to run further analysis on externalities and environmental factors that influences internal service production and costs (N-I-1).

4.5.3 T-C-3: Performance Measurement

4.5.3.1 Performance Measurement Trend Description

Key Performance Indicators (KPIs) are an integral component of public administrations performance measurement systems. In general, KPIs are assessment criteria that refer to the assessment dimensions Input, Process, Output, Impact and Outcome. [73]

These assessment dimensions are associated in a logic model, which refers to the production process of public services. Through an input such as personnel resources, activities can be undertaken to perform public tasks, which leads to direct outputs in form of products and services that then again can

have different consequences, which are generally named as effects, impact and outcomes that distinguish between short-term, medium-term and long-term perspectives.

The three key performance indicators Economy, Effectiveness and Efficiency need to be applied to grade performance on these different assessment dimensions. [74]

KPIs cannot be established without targets. A KPI system needs to refer to respective targets that need to be discussed and finely balanced first. Further, the KPI system needs to be domain specific, which requires a domain specific target and indicator planning for every respective policy domain. [75][76]

The trend can be applied by several application fields within the policy making process, but the production of data takes place in the policy implementation process.

Another trend that is arising in that context is the Regulatory Performance Measurement. Regulations are norms adopted by government. Evaluating or measuring regulatory performance means to ask for its impact on individual behaviour, social affairs, costs, technological innovation, economic growth and several other conditions.[77]

4.5.3.2 Performance Measurement Trend Tendency and Applications

Performance Measurement seems to be a still ongoing trend, which was not starting at zero in 2008, but maintaining a high relevance during the time until 2015. The limited category selection is not near zero but has far less related records. Figure 27 shows actually a decrease of related records in the limited category selection.

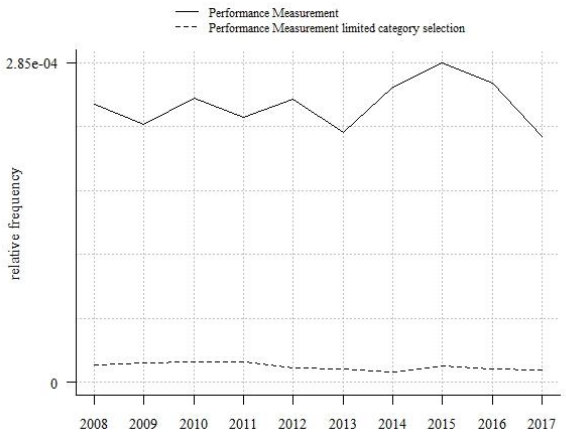


Figure 26: Performance Measurement Trend (1)

Figure 27: Performance Measurement Trend (2)

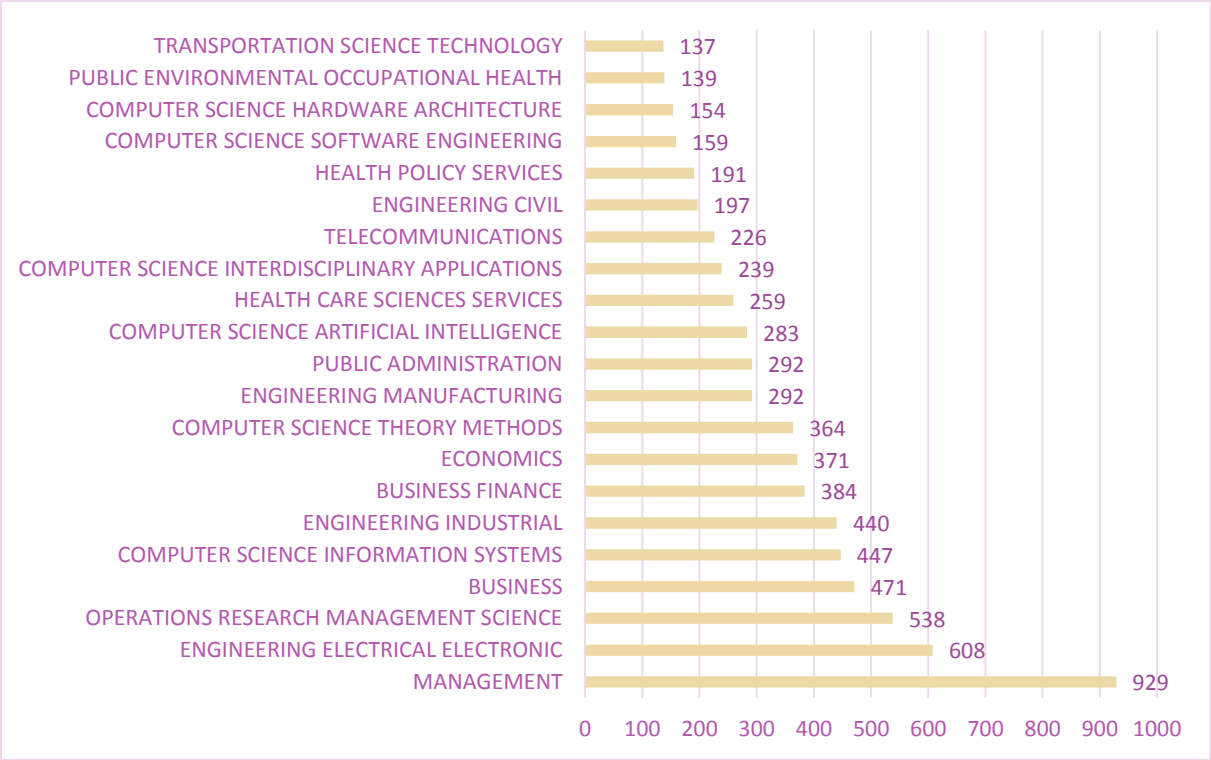


Figure 28: Performance Measurement – amount of tagged records per WOS category

The distribution on WOS categories shows a high relevance for the management research discipline as well as for the disciplines electronic engineering, business, economics and public administration. (position 11).

4.5.3.3 Performance Measurement related Needs and Trends

The trend complies with the need to develop domain specific target and indicators systems (N-S-1) and brings together information on different assessment dimension, which satisfies the need to link impact, quality, performance measurements and financial information (N-I-1). Furthermore, it supports the need of continuous evaluation of policies (N-S-5), since it delivers continuously and systematically information on public administrations' or regulatory performance (N-L-1), which is an important source for grading political policies.

4.5.4 T-C-4: Privacy by Design

4.5.4.1 Privacy by Design Trend Description

Privacy by design is an approach that promotes privacy and data protection compliance throughout the whole system engineering process. The Information & Privacy Commissioner of Ontario has taken a leading role in developing the privacy by design concept, establishing a reference framework of "Seven foundational principles of privacy by design" with respect to a proactive, transparent and user-centric engineering process. [78][79]

The 7 principles are:

- Proactive not Reactive; Preventative not Remedial
- Privacy as the Default setting
- Privacy Embedded into Design
- Full Functionality – Positive-Sum, not Zero-Sum
- End-to-End Security – Full Lifecycle Protection
- Visibility and Transparency – Keep it Open
- Respect for User Privacy – Keep it User-Centric

4.5.4.2 Privacy by Design Trend Tendency and Applications

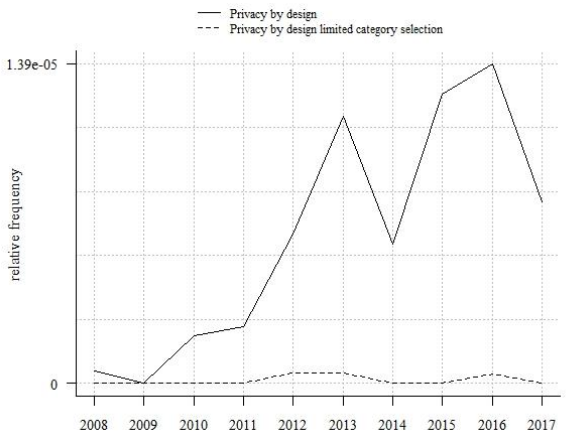


Figure 29: Privacy by Design Trend

Figure 29 shows a rapid rise of Privacy by Design related records in the Web of Science database from 2009 to 2013. In 2014 it had a fall. In 2016 the peak had been reached. The absolute frequency of 143 records (see Figure 2) shows that the trend has no big relevance. The selected category result again remains near zero.

Figure 30 illustrates most relevance for computer science disciplines, but also law, ethics and transportation are affected, which demonstrates the multi-facetted importance.

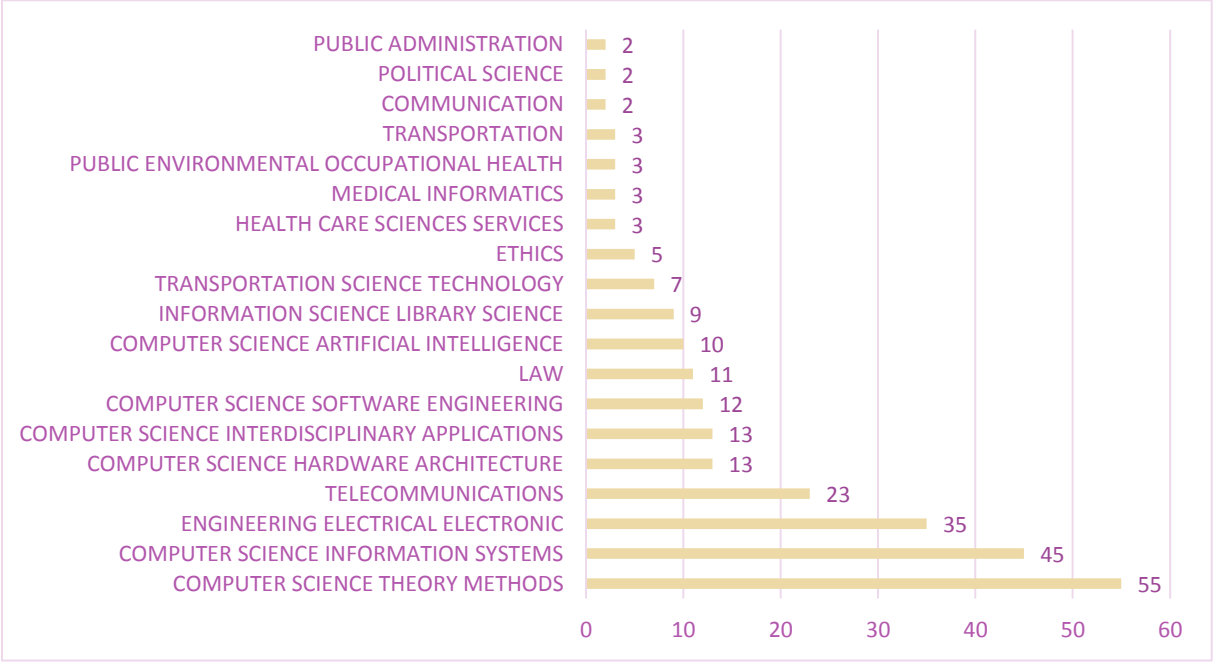


Figure 30: Privacy by Design – amount of tagged records per WOS category

4.5.4.3 Privacy by Design related Needs and Trends

Privacy by Design takes into account the protection of citizens' privacy (N-T-3) and for this reason, it has potential to strengthen citizens' trust in public administration (N-S-4).

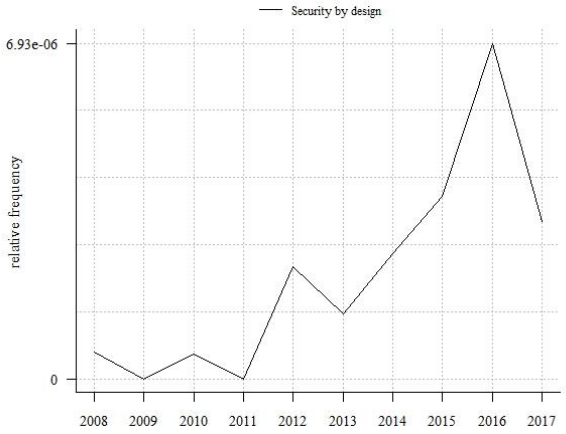
4.5.5 T-C-5: Security by Design

4.5.5.1 Security by Design Trend Description

Security by design is an approach in software engineering that promotes to design software from the ground up to be secure.

Core pillars of information security are confidentiality (only allow access to data for which the user is permitted), integrity (ensure data is not tampered or altered by unauthorized users) and availability (ensure systems and data are available to authorized users when they need it). [80]

4.5.5.2 Security by Design Trend Tendency and Applications



Security by Design has a strong increase of related records since 2011, but a heavily decrease in 2017. Total Frequencies in Figure 32 show, that it has no huge relevance in the WOS Data base.

Figure 31: Security by Design

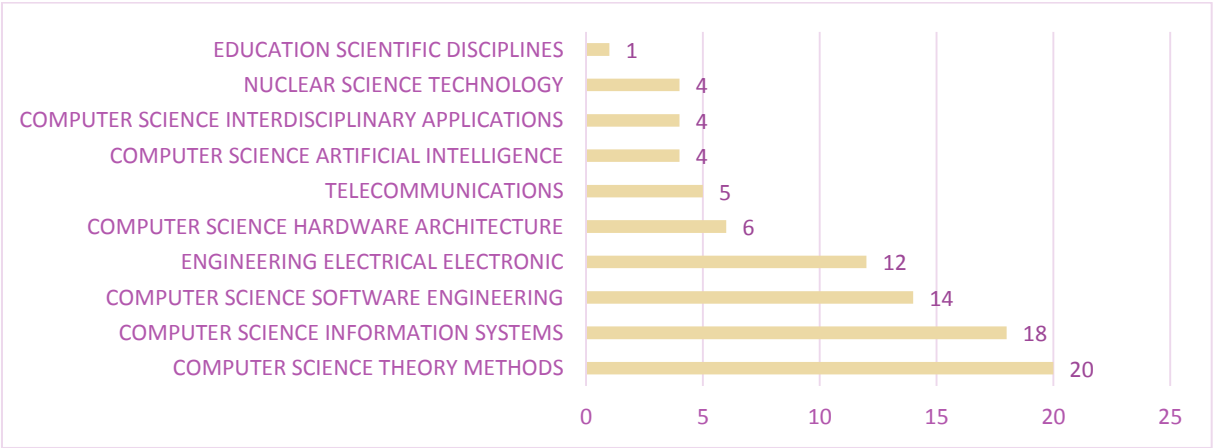


Figure 32: Security by Design – amount of tagged records per WOS category

4.5.5.3 Security by Design related Needs and Trends

Security by Design means data security by default, which meets the need ensure data security (N-T-3). For this reason, it has potential to strengthen citizens' trust in public administration (N-S-4).

4.5.6 T-C-6: Data Governance

4.5.6.1 Data Governance Trend Description

The Data Governance Institute defines Data Governance as a system of decision rights and accountabilities for information-related processes, executed according to agreed-upon models, which describe who can take what actions with what information, and when, under what circumstances, using what methods. It encompasses strategies and technologies used to make sure organisations data stays in compliance with regulatory and legal requirements.[81]

4.5.6.2 Data Governance Trend Tendency and Applications

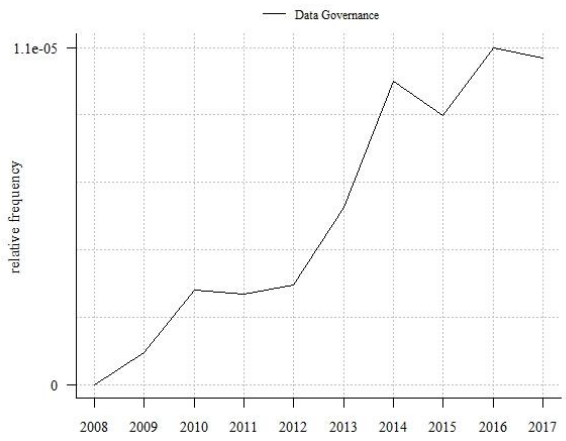


Figure 33: Data Governance

The trend tendency verifies an ongoing increase of related records with a slight decline in 2017 (

Figure 33). The absolute frequencies per category in Figure 34 are low, but showing computer science related records on the first three positions.

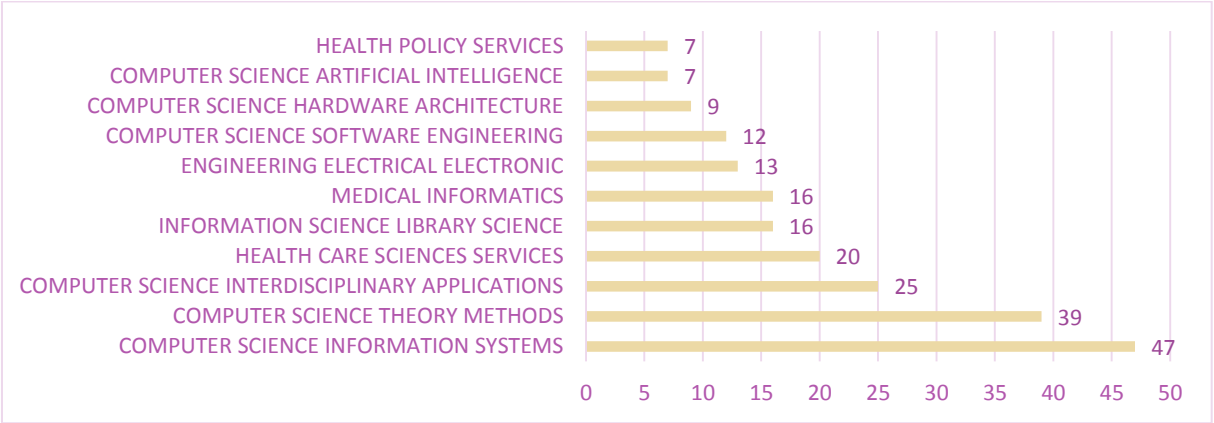


Figure 34: Data Governance – amount of tagged records per WOS category

4.5.6.3 Data Governance related Needs and Trends

The trend is associated with several other technical trends such as Cloud Computing (T-T-7), Open Data (T-C-2), Big Data (T-T-2) as well as with conceptual trends that are dealing with data processing. It addresses the need to standardise the data management (N-O-7).

4.5.7 T-C-7: E-Governance

4.5.7.1 E-Governance Trend Description

Governance is a term that has a quite broad context and means in its core to shape or design areas of life. E-Governance (Electronic Governance) is devoted to the challenges of shaping life areas in face of digital revolution and information era and affects all sectors encompassing the public, private and civil sector. It also affects communication and exchange between the sectors. Here the new availability of people, processes and data is leading to new formability of life areas and a redistribution of public, private and civic tasks, which are discussed among the term Electronic Governance.

The widely known term Electronic Government affects especially the public sector and is defined as the execution of business processes in public administrations through information and communication technology. E-Governance remains on a higher level and should shape and design E-Government strategies. [82]

4.5.7.2 E-Governance Trend Tendency and Applications

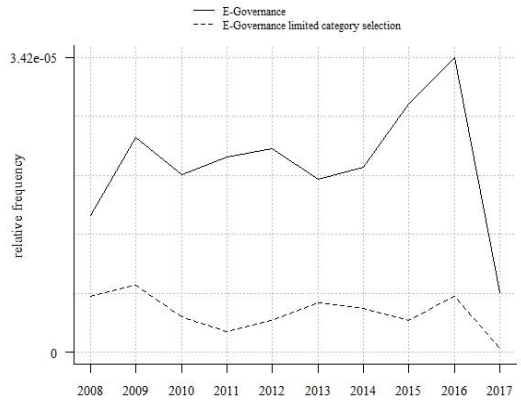


Figure 35: E-Governance (1)

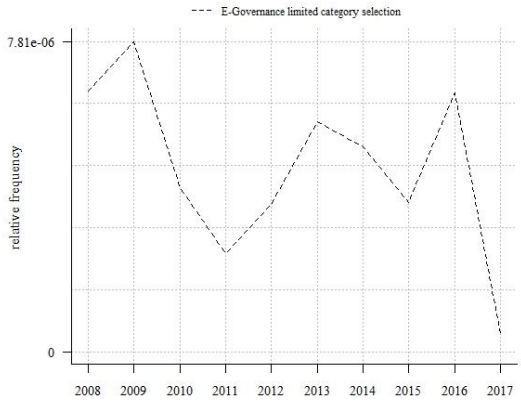


Figure 36: E-Governance (2)

E-Governance was not starting at zero in 2008 and has a continuous rise of related publications until 2016. The absolute frequencies per category in Figure 37 are also illustrating a moderate amount of publications in the WOS database. However, interesting is the fact, that this topic seems to be broader discussed in the application fields public administration (87 related records) and political science (43 related records). Nevertheless, as it becomes evident in Figure 36, the tendency of the trend seems to decrease.

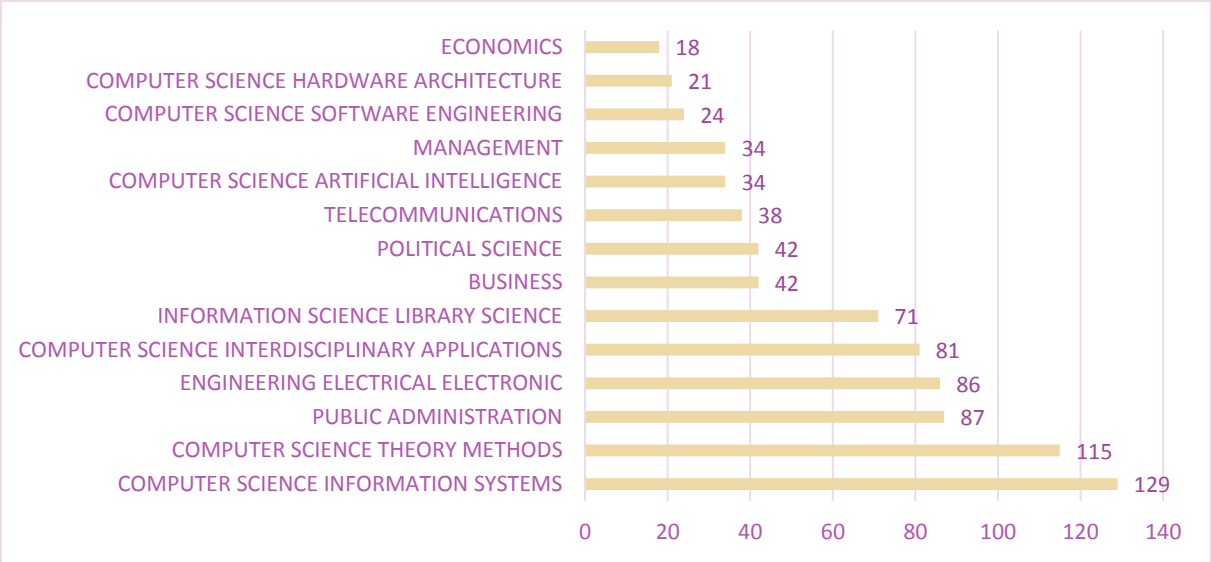


Figure 37: E-Governance – amount of tagged records per WOS category

4.5.7.3 E-Governance related Needs and Trends

The trend addresses different strategic trends, such as the development of domain specific target and indicator systems (N-S-1) and the involvement of the public and citizens (N- S-2), since in particular strategic issues are associated with E-Governance questions.

In addition, questions of cooperation and digitisation in particular are electronic governance issues, which are required by the need of cooperative working between decision makers, departments and hierarchy levels (N-O-5) and the need for process and resource optimisation (N-O-6). Strategic E-governance approaches have a heavy impact on secure organisational and legal frameworks (N-O-1; N-L-2)

4.5.8 T-C-8: Data Literacy/ Data Literacy Education

4.5.8.1 Data Literacy Trend Description

Data literacy is about the ability to handle data. It includes competences to collect, manage, evaluate and apply data in a critical manner. The public sector struggles with the growing skills gap, since data has become a central issue in our working environment, and the ability to understand and master the huge amounts of data available to the organisation is a key challenge. Key to this is establishing a culture of data literacy, meaning employees at all levels can access and have the ability to read, work, analyse and argue with data. The OECD has launched a skills model for public sector innovation that emphasises six core skills. One of it is Data Literacy, which should ensure that decisions are data-driven and that data is not an afterthought. [83]

4.5.8.2 Data Literacy Trend Tendency and Applications

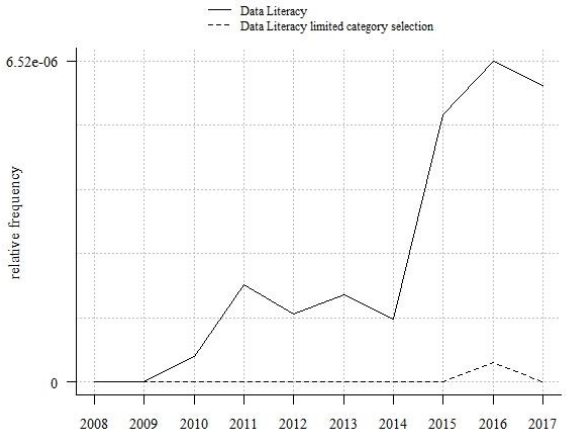


Figure 38: Data Literacy (1)

Data Literacy has started to be considered in 2009, and since then, it has a strong ongoing rise. The total amount stays moderately (57 related records, see Figure 2). Data Literacy plays almost no role in the categories "public administration" and "political science".

As Figure 39 shows, educational and informational disciplines are most affected.

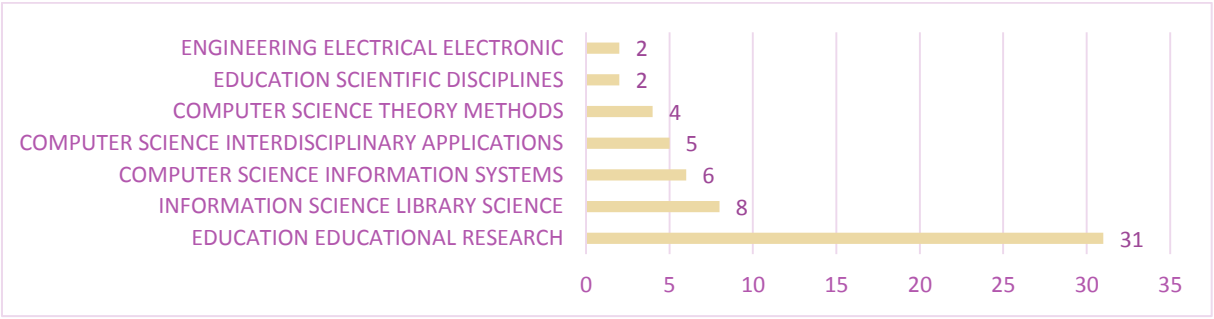


Figure 39: Data literacy – amount of tagged records per WOS category

4.5.8.3 Data Literacy related Needs and Trends

If public administrations want to cope with the production of huge volumes of data (N-T-1), to establish a comprehensive knowledge and information management (N-I-4) and to implement a continuous evaluation of policies (N-S-5), data literacy of employees is a core precondition. Data literacy should be also considered in personnel development measures (N-O-3). This is also in accordance to the need of a better understanding of IT potential and processes (N-T-2).

For this reason, data literacy is closely related to other trends such as big data (T-T-2), open data (T-C-2), performance measurement (T-C-3), IoT (T-T-8) and smart cities (T-S-1).

4.5.9 T-C-9: Glocalization

4.5.9.1 Glocalization Trend Description

Glocalization is an artificial word combining Globalization and Localization. It is a practice of conducting business according to both local and global considerations. The process allows integration of local markets into world markets in a business context. [84]

The concept can be transferred into a public sector context in the way that local levels of government need to be considered in higher-level policies.

4.5.9.2 Glocalization Trend Tendency and Applications

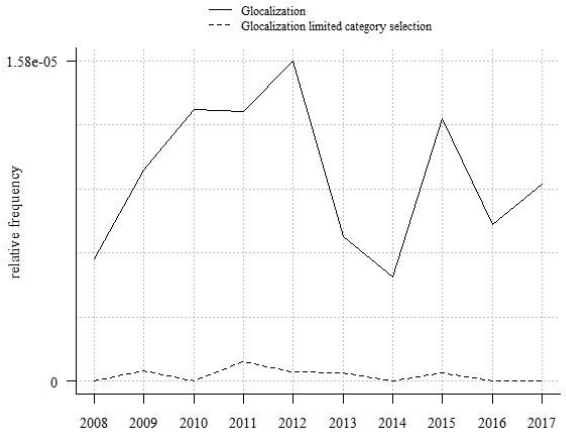


Figure 40: Glocalization Trend

Figure 40 illustrates that Glocalization had its peak in 2012 and is since then a volatile trend. However, the total amount stays moderate (217 related records, see Figure 2). In the two categories "public administration" and "political science", Glocalization plays almost no role and actually has a decreasing trend.

Figure 41 shows that business, sociology, and communication disciplines are most affected.

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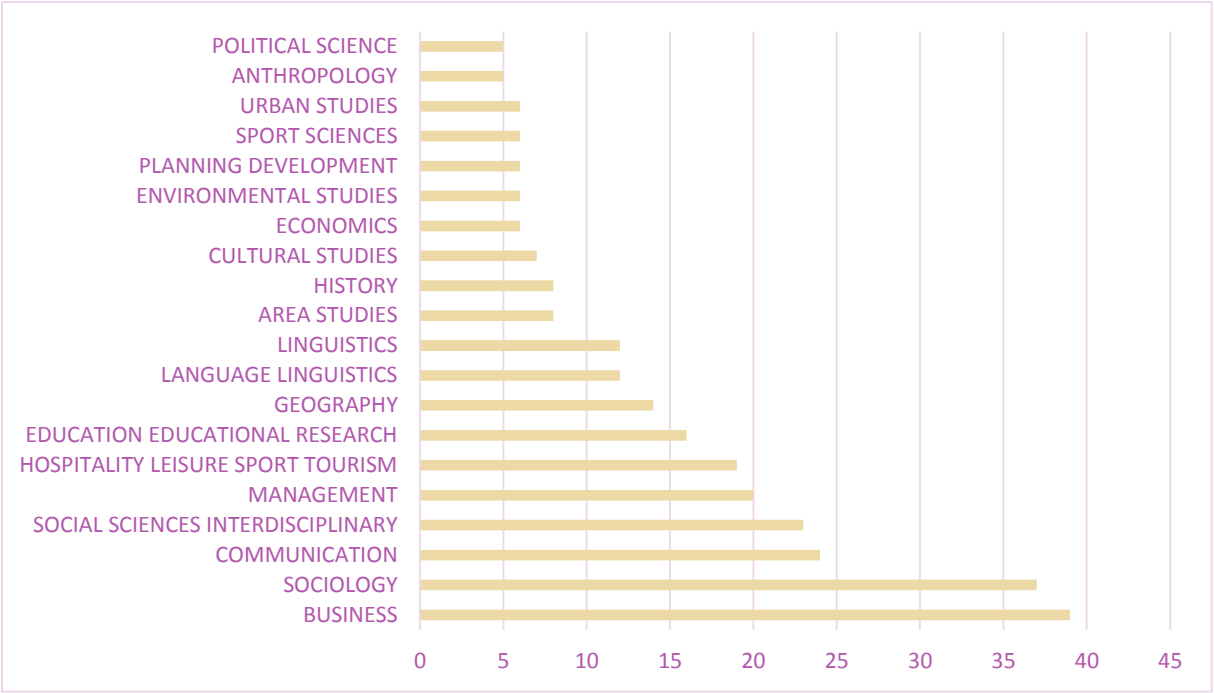


Figure 41: Glocalization – amount of tagged records per WOS category

4.5.9.3 Glocalization related Needs and Trends

Since Glocalization applies the integration of local issues into global policies it meets the need to take into account local and regional specificities (N-S-7) and if it is considered for example in European policies, it supports the improvement of Europeanisation (N-S-6).

4.5.10 T-C-10: Data Philanthropy

4.5.10.1 Data Philanthropy Trend Description

Data philanthropy is a kind of strategic partnership between private and public sector in which private companies donate data as a valuable resource for public benefit, i.e. for humanitarian, corporate, human rights, and academic use. [85]

However, there are numerous challenges to be mastered, such as competing tensions on data control and ownership, personal data protection and the lack of adequate frameworks for coordination and governance. [86]

4.5.10.2 Data Philanthropy linked Needs and Trends

Since private company data is an additional data source, data philanthropy closely relates to the need to ensure the availability of (real-time) information and knowledge (N-I-3).

Furthermore, Data Philanthropy is influenced by other trends such as E-Governance (T-C-7) or Big Data (T-T-2).

4.5.11 T-C-11: Evidence-based Policy

4.5.11.1 Evidence-based Policy Description

Evidence-based policy refers to policy decisions that are informed by objective evidence. Without evidence, policy-makers need to fall back on intuition, ideology, or conventional wisdom.

Originally, the concept has evolved in the medicine, encompassing the toolbox of quantitative experimental methods such as randomized controlled trials or quasi-experimental trials to support medical decisions.

Evidence-based policy has been adopted to drive the policy making process by analysing all available options, impacts, direct and indirect effects, as well as environmental influences. [87]

E-Policy or Policy 4.0 concepts, which base on a data-driven policy design that takes into account the contemporary rising of big data and data analytics, are one step ahead. Since big data brings along the possibility of real-time processing, evaluation results become available at the very moment data arrives. The concepts encompasses a newly shaped policy cycle in which evaluation happen continuously, rather than at the end of the process, but opening permanent possibilities of reiteration, reassessment and consideration. [88]

4.5.11.2 Evidence-based Policy Trend Tendency and Applications

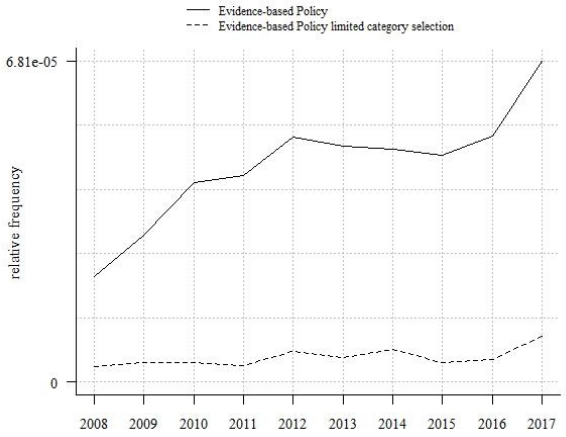


Figure 42: Evidence-based Policy (1)

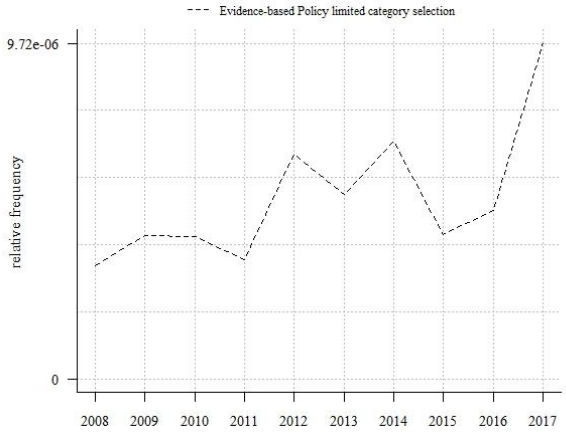


Figure 43: Evidence-based Policy (2)

Figure 42 and Figure 43 demonstrate an ongoing increasing trend in the limited category selection as well as in overall categories. 114 records are related to the limited category selection. 1001 records are related over all categories (see Figure 2). Figure 44 verifies a high relevance for public environmental occupational health, social science, and also health policy services, as well as public administration research disciplines.

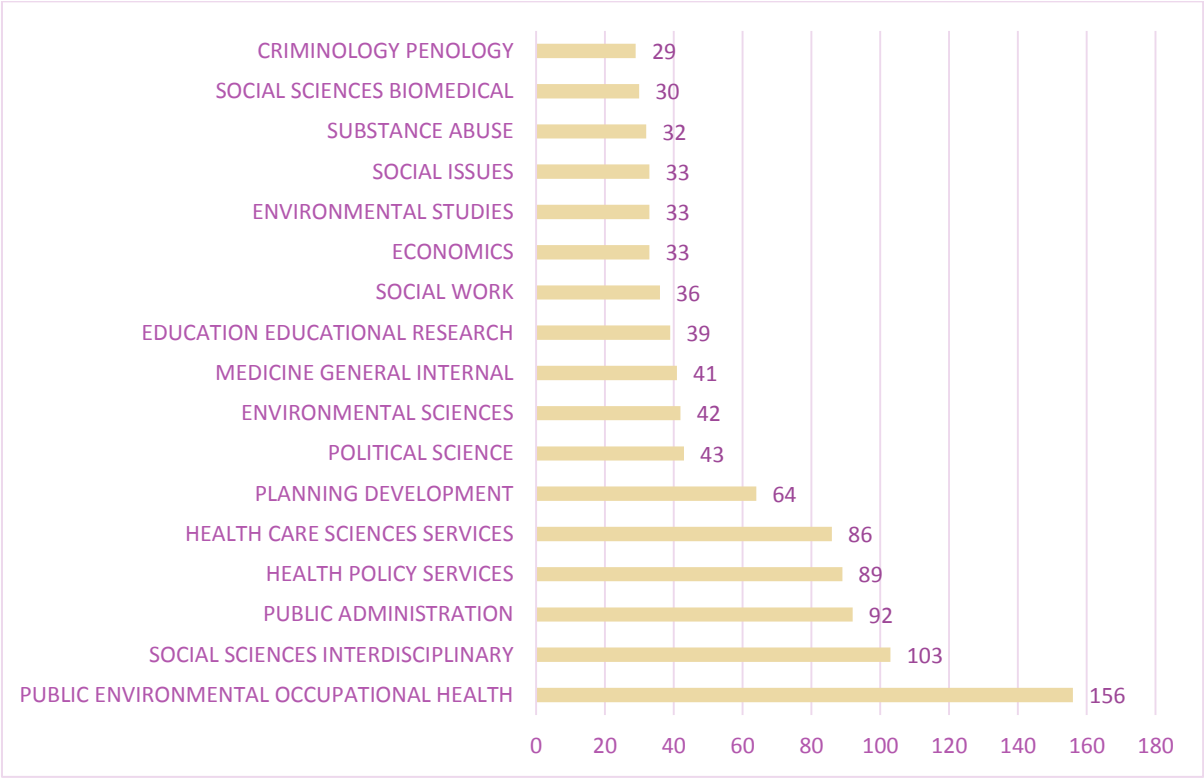


Figure 44: Evidence-based Policy – amount of tagged records per WOS category

4.5.11.3 Evidence-based Policy linked Needs and Trends

Evidence-based policy addresses the need to link impact, quality performance and financial information (N-I-1) and the incorporation of scientific knowledge and expertise (N-I-2).

4.5.12 T-C-12: Lean Approach

4.5.12.1 Lean Approach Trend Description

Core idea of the lean approach is to maximise customer value and to focus on its key processes in order to continuously increase it through an optimum value creation process that has zero waste.

Lean thinking changes the focus of management from optimising separate technologies, assets, and vertical departments to optimise the flow of products and services through entire value streams that flow horizontally across technologies, assets, and departments. [89]

Lean Approach operates in conjunction with policy making, emphasises the incorporation of agility and iterations. Such an approach, which borrows its methodology from software development strategies, has the potential to respond to the fast-moving and multi-stranded nature of the challenges. [90]

4.5.12.2 Lean Approach Trend Tendency and Applications

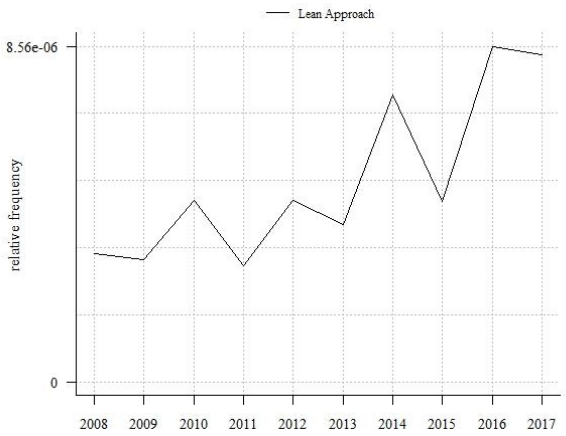


Figure 45: Lean Approach

Figure 45 illustrates that Lean Approach had a peak in 2016. However, the total amount stays low (113 related records, see Figure 2). The two categories “public administration” and “political science” are not affected by the conceptual trend Lean Approach.

Engineering and Management disciplines are most affected categories (Figure 46).

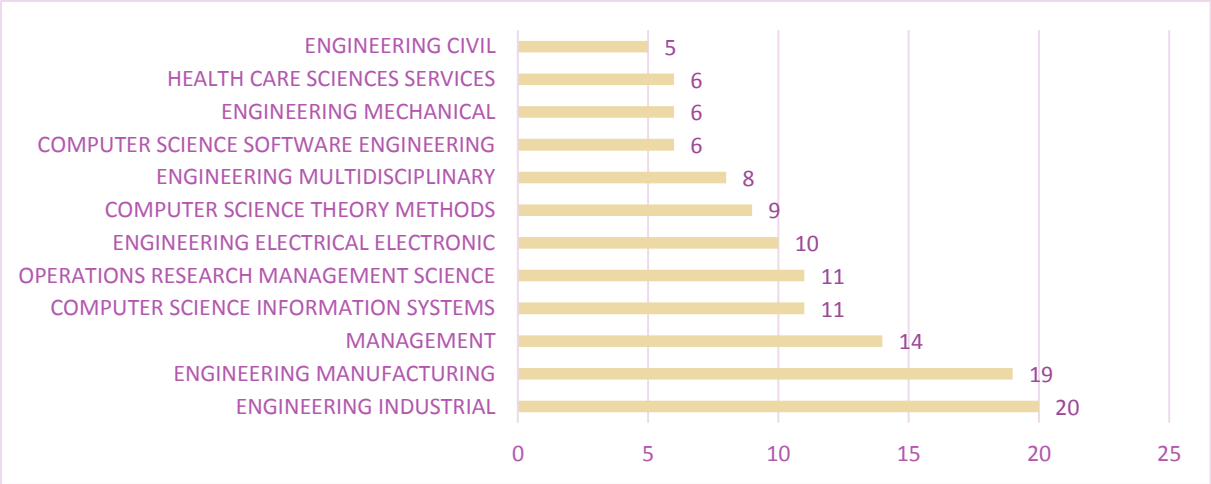


Figure 46: Lean Approach – amount of tagged records per WOS category

4.5.12.3 Lean Approach linked Needs and Trends

The Lean Approach affects the need to optimise processes and resources (N-O-6), since it encompasses conceptual approaches to redesign the policy making and service productions processes in a leaner way.

4.6 Societal Trends

4.6.1 T-S-1: Smart Work

4.6.1.1 Smart Work Trend Description

New technologies have great influence on work and work processes, as we know them today. For example, new technologies offer the possibility of mobile work, can optimise the work process and make it more economical. [91]

Smartness means in this context, that work is connected to innovations, sustainability, and competitiveness. Smart Work is based on the recognition that the working environment must be redesigned due to an increasing digitisation. This reorganisation of the work is associated to the use of technologies, for example, mobile devices, which allow employees to work anytime and anywhere and makes the work more flexible and innovative. Advantages of this smartness are, for example, time saving, improved work-life balance, increased productivity, and in consequence better performance. The public service is not excluded from this developments – it is also facing a profound change and must find new ways to create an attractive work environment.

As Eom et al. stated, smart work is a fundamental part of smart government and contributes to the government's efficiency. [92]

4.6.1.2 Smart Work Trend Tendency and Applications

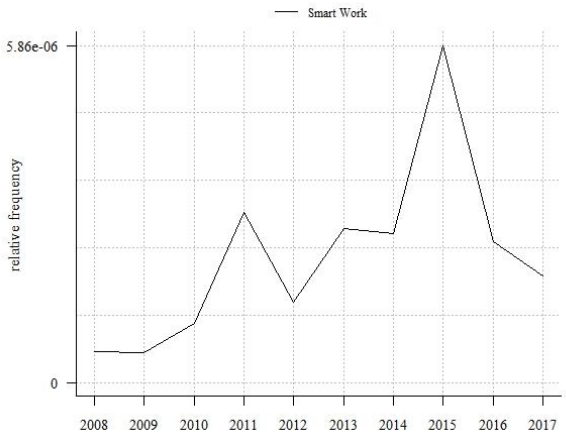


Figure 47: Smart Work

Figure 47 shows that the trend Smart Work had a peak in 2015. Nevertheless, the total amount stays low (49 related records, see Figure 2). The categories "public administration" and "political science" are not affected by the conceptual trend Smart Work.

Engineering and Management disciplines are the most affected categories (Figure 48).

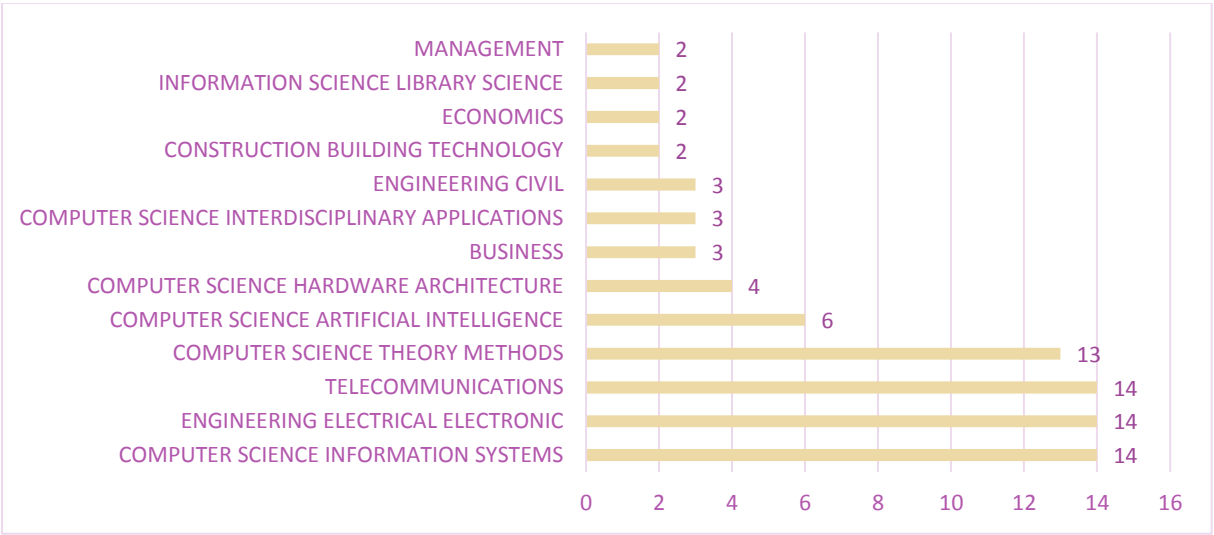


Figure 48: Smart work – amount of tagged records per WOS category

4.6.1.3 Smart Work linked Needs and Trends

Smart Work can have positive effects on nearly all organisational needs (especially: Improved incentive structures (N-O-4), process and resource optimisation (N-O-6), but also standardisation of processes (N-O-7), cross-linked information exchange (N-S-9), improve the process of recruiting (N-O-2)).

4.6.2 T-S-2: Technological Unemployment

4.6.2.1 Technological Unemployment Trend Description

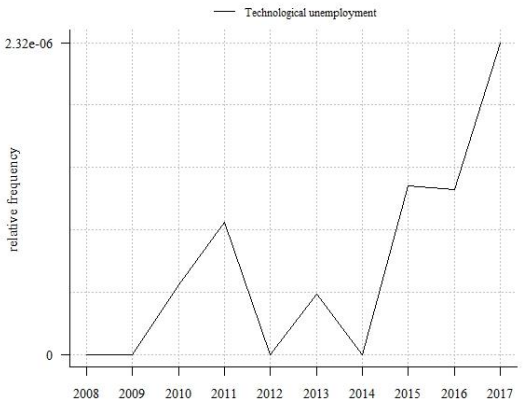
Technological Unemployment is about the societal impacts of technologies. Danaher defines technological unemployment "as the replacement of human workers […] by technological alternatives (machines, computer programs, robots and so forth)". Furthermore, he assumes that artificial intelligence and robots will take over the work of humans in future. This is one reason why

technological developments often come with people´s fear of the consequences. Everything is automated to such an extent that human work is no longer needed. [93]

Loi argues that ICT technologies and the substitution of human work with computer-driven automation are associated with a risk of human disenhancement. The current technological developments substitute particularly middle-class jobs and leads to greater competition for jobs. [94]

Therefore, it is not surprising that there is often scepticism about new technologies, also under civil servants.

4.6.2.2 Technological Unemployment Trend Tendency



The trend line verifies a heavy increasing since 2014. Nevertheless, the absolute frequencies in the WOS database are low (see Figure 2).

Figure 49: Technological unemployment Trend

4.6.2.3 Technological Unemployment linked Needs and Trends

Technological unemployment helps to meet staffing/recruiting problems and challenges connected to demographic changes. It should be considered within the need of a secure organisational (N-O-1) and legal framework (N-L-2), since technological anxiety does not help to strengthen civil servant motivation for innovative changes.

4.6.3 T-S-3: Hate Speech

4.6.3.1 Hate Speech Trend Description

Hate speech is commonly defined as any communication that attacks a person or a group because of its origin, colour, ethnicity, gender, sexual orientation, nationality, religion, or other characteristic. Due to the massive rise of user-generated web content, in particular on social media networks, the amount of hate speech is also steadily increasing. [95][96]

New communication technologies and social media platforms offer many opportunities and can facilitate public communication. However, they can also have negative influence: the anonymity of the Internet suggests a security that allows insults and defamation of others in an apparently save haven.

Some politicians also use hate speech. It is assumed that this can and will influence electoral support. [97]

As Cammarts notes, the "Internet gives rise to anti-public spaces, voicing hatred and essentialist discourses". To counteract this development, many countries have already adopted laws against hate speech. However, a conflict of objectives can be detected here because also the freedom of speech must be protected, as it is an important pillar for democracy. [98]

It must therefore be weighed carefully and examined in each case, whether or not something can be called hate speech.

4.6.3.2 Hate Speech Trend Tendency and Applications

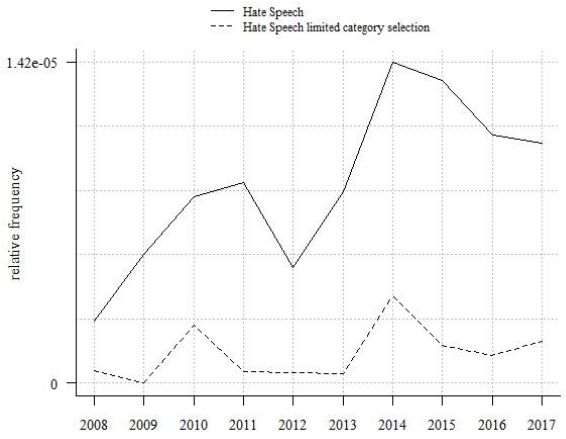


Figure 50: Hate Speech (1)

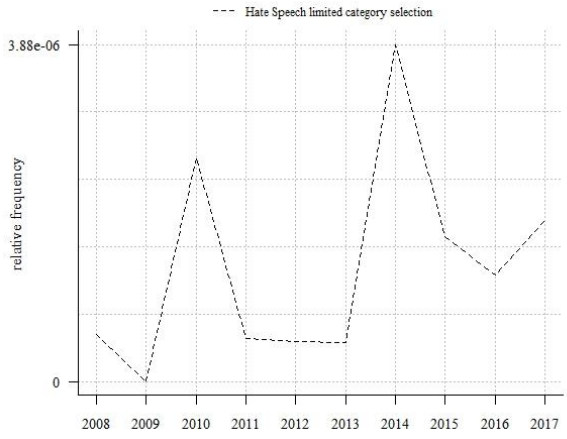


Figure 51: Hate Speech (2)

Both curves show an acme in 2014 and an afterwards decreasing. The curves are going up again since 2016. The distributions of tagged categories in Figure 52 show highest impact on law, communication and political science applications fields. This indicates relevance for policy domains such as Public Affairs or Justice and Legal System.

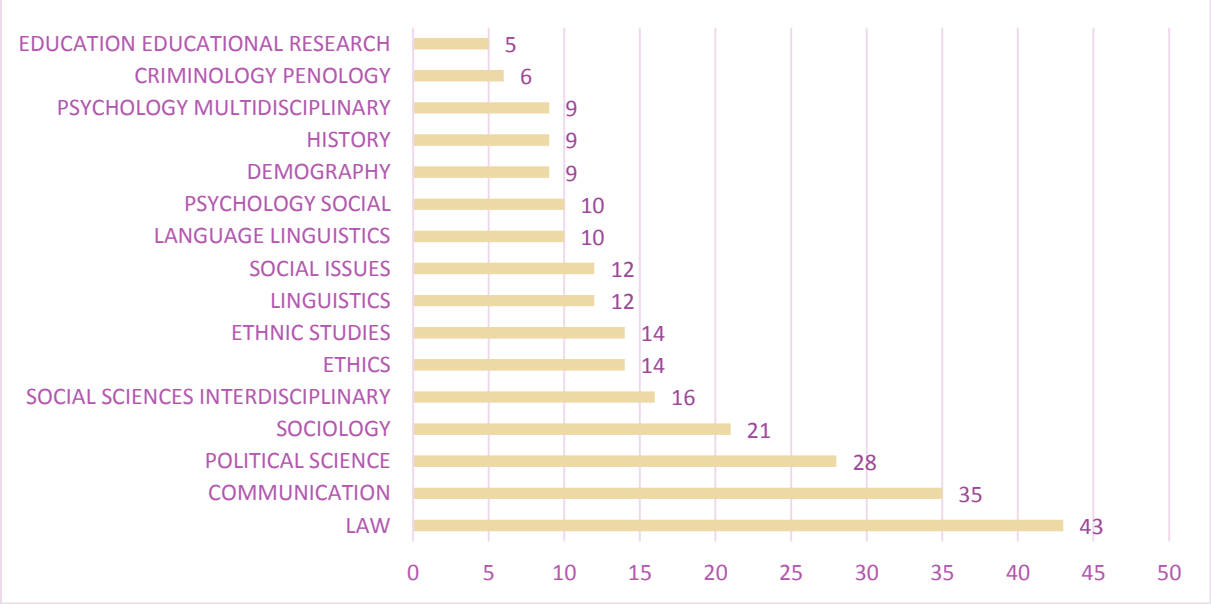


Figure 52: Hate Speech – amount of tagged records per WOS category

4.6.3.3 Hate Speech linked Needs and Trends

The trend should be recognised within the involvement of public and citizens into the policy making process (N-S-2). It is strongly related to the Social Media trend (T-T-1).

4.6.4 T-S-4: Smart Surveillance Systems

4.6.4.1 Smart Surveillance Systems Trend Description

The term "smart" in this trend indicates, that it is not only about collecting and storing data, but about automation of data analyses. Kim et al. describe this as follows: "Smart surveillance system is mainly composed of automatic video/audio analysis. Therefore, an emerging surveillance system must consider multimedia information for monitoring activities and extracting meaningful information from the environment."[99]

In this context, Zuboff introduced the concept of surveillance capitalism. Surveillance capitalism can be described as a new subspecies of capitalism that considers data as a source of revenue. In this type of capitalism, profit is obtained from the supervision and modification of human behaviour. For this purpose, real-time data are used (for example from insurance companies) to influence people. [100]

4.6.4.2 Smart Surveillance Systems Trend Tendency and Applications

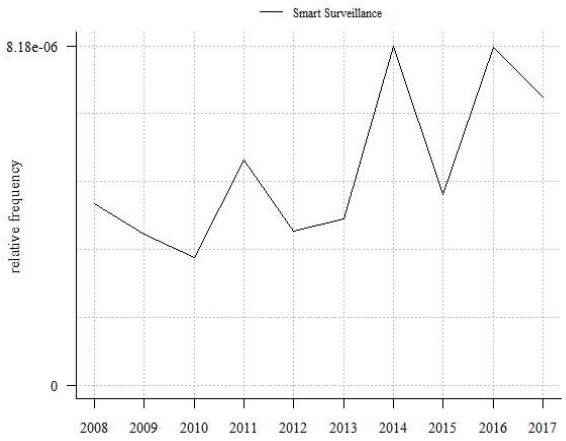


Figure 53: Smart Surveillance

The trend curve develops waveringly and remains on a high level from 2016 to 2017 with just a small fall. The limited category selection is not affected by the trend, but the categories electronic engineering and artificial intelligence (see Figure 54).

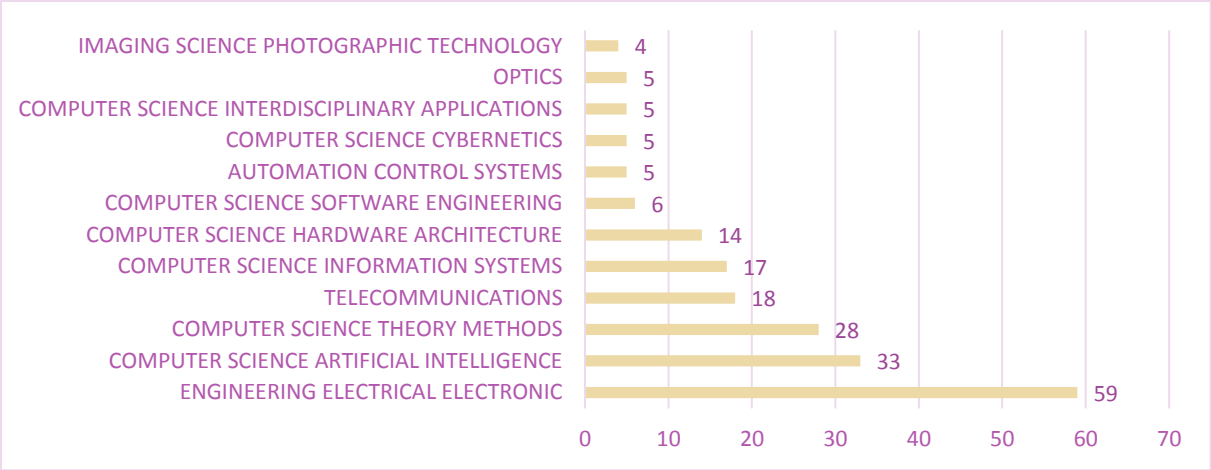


Figure 54: Smart Surveillance – amount of tagged records per WOS category

4.6.4.3 Smart Surveillance Systems linked Needs and Trends

The trend affects the need to ensure availability of real time data (N-I-3) and the continuous evaluation of policies (N-S-5).

However, the trend carries the risk that the work done by people, which is very time-consuming and cost-intensive, is no longer needed in some areas, for example in the threat detection. Therefore, this trend also has a close connection to technological unemployment (T-S-2). Furthermore, it is closely related to the trends artificial intelligence (T-T-3), big data (T-T-2) and smart cities (T-S-1).

4.6.5 T-S-5: Algorithmic Regulation

4.6.5.1 Algorithmic Regulation Trend Description

This trend deals with the use of algorithms in policy and decision making. First, there is the trend of algorithmic regulation. Algorithmic regulation means that regulatory decision making is delegated to algorithms. The algorithms give the instructions of what should be done to achieve a desired outcome. [101]

The trend of using algorithms in governance and an increasing reliance of public decision making on algorithms is sometimes also called algocracy. [102]

In this context two other more ideological and sceptical terms has been raised. Dataism is a kind of ideology or philosophy in which trusts in big data and algorithms is central and which relies on the assumption, that the world´s complexity can be handled through data. Yuval Harari introduced this ideology in his book “Homo Deus” to a wider audience. Dataism is very similar to the obove mentioned trend of algorithmic accountability/ algogracy. [103] [104]

Solutionism is a term coined by Evgeny Morozov. Solutionism means the belief that there are simple technical solutions to everything. It is about the conviction that technologies, algorithms and robots can solve highly complex social problems by making processes more efficient. Morozov is critical of such an ideology of problem solving, in which algorithms and not elected governments make the decision. [105] [106]

Algorithmic Regulation is further accompanied by algorithmic accountability. Algorithmic Accountability concerns control mechanisms of the algorithms used for decision making. It has emerged as a concept in the public and private sector that includes obligations through which algorithmic decision making needs to be reported, explained and justified, to mitigate any negative social impacts, biases or potential harms. The goal is to hold the algorithmic regulation accountable and ensure transparency in algorithm-based decision making processes. [107]

4.6.5.2 Algorithmic Regulation related Needs and Trends

Algorithmic Regulation needs to be recognized within the need of a secure legal framework, since the legal framework needs to define how Algorithmic Regulation has to be applied by the policy making process. For this reason, it has also a close relation to the E-Governance trend (T-C-7).

4.6.6 T-S-6: Socio-Technical Systems

4.6.6.1 Socio-Technical Systems Trend Description

The pervasive use of information and communication technologies results in an increasing interdependency between social and technical systems. Socio-Technical Systems are an approach to complex organisational work design that recognises the Human-Machine-Interaction. Due to this interdependence, it is not possible to consider social systems and the technical systems independently of each other. This connection allows both subsystems to benefit from each other. [108][109]

4.6.6.2 Socio-Technical Systems Trend Tendency and Applications

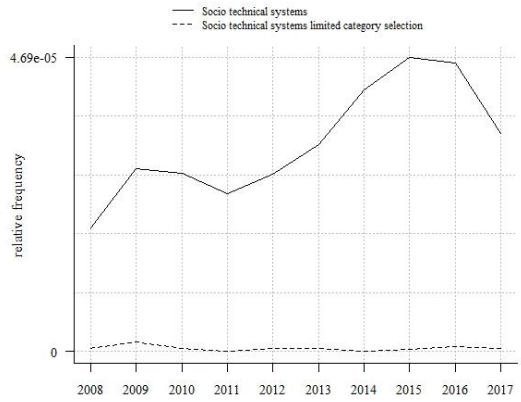


Figure 55: Socio-Technical Systems (1)

The trend curve development reveals an increase from 2011 to 2015. Since 2015, however, there are fewer publications on this topic. The limited category selection trend curve remains near zero, which indicates a low impact on the public sector related categories. The distribution on WOS categories shows a primary relevance for computer science related disciplines.

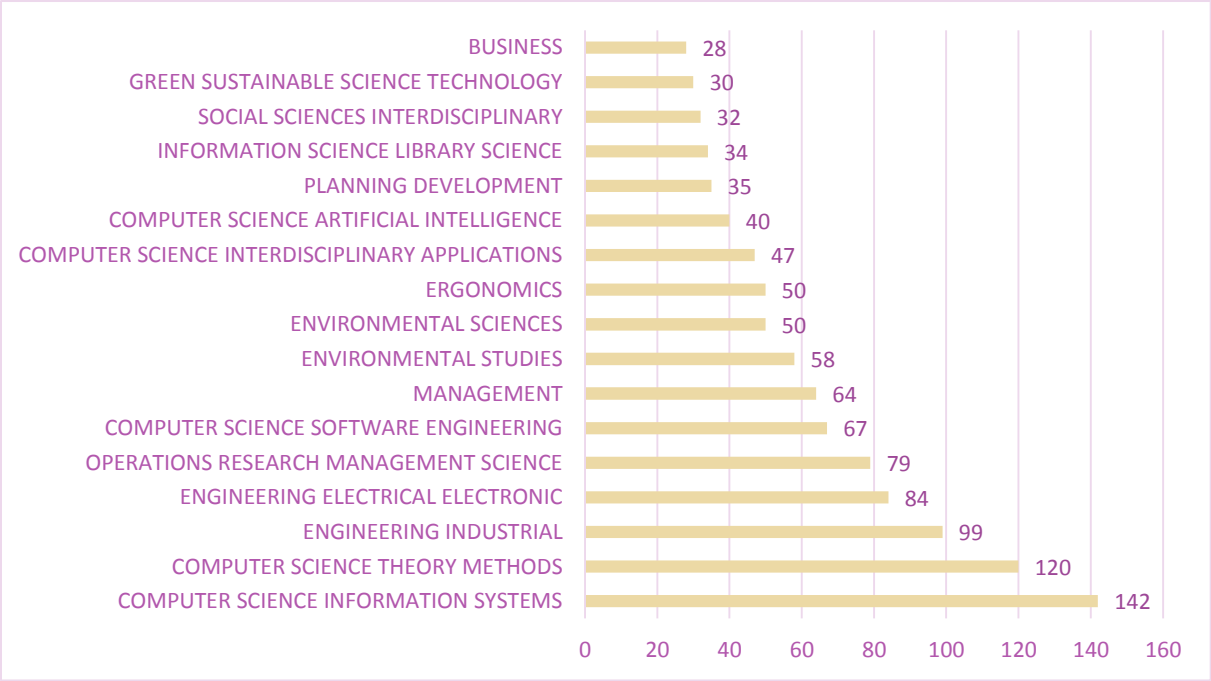


Figure 56: Socio-Technical Systems – amount of tagged records per WOS category

4.6.6.3 Socio-Technical Systems related Needs and Trends

Socio-Technical Systems are relevant in the context of organisation related needs such as the process and resource optimisation (N-O-6), the improvement of the recruiting process (N-O-2), and the cooperative working (N-O-5), since the consideration of interaction between social and technical systems needs to be considered to meet these needs in an optimal way.

4.6.7 T-S-7: Nudging

4.6.7.1 Nudging Trend Description

Nudge or Nudging in governmental context can be seen as a concept of libertarian paternalism, which is about improving decision making. Nudging comes from the behavioural economics and the basic assumption is that people are not able to make the right decisions. Therefore, the behaviour of individuals should be influenced in a predictable way. Experts decide what the best possible decision is and try to steer the people into this direction. The people still have the option to choose an alternative, which makes this concept different to classical paternalism. [110]

Instead of intervening massively in people´s freedom of choice through prohibitions and taxes, nudging is an instrument to strengthen the impact of political activities and campaigns e.g. in terms of consumer protection, fight against corruption or financial market regulations. [111]

This document is issued within the frame and for the purpose of the *Big Policy Canvas* project. This project has received funding from the European Union's Horizon2020 Framework Programme under Grant Agreement No. 769623. The opinions expressed and arguments employed herein do not necessarily reflect the official views of the European Commission.

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Over the last years, more and more Behavioural Insights Teams have been formed to find ways to improve governmental policymaking and public service, for example, in the United Kingdom and the United States of America. [112]

4.6.7.2 Nudging Trend Tendency and Applications

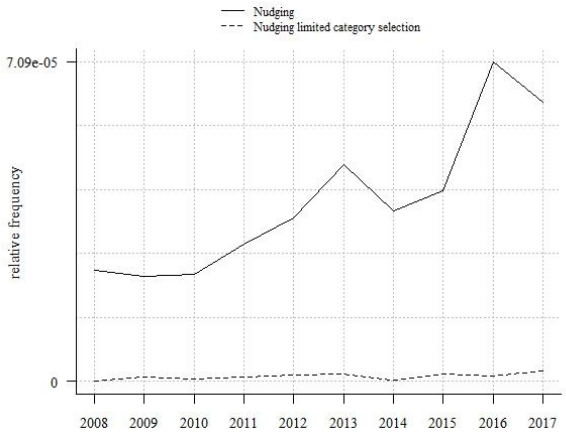


Figure 57: Nudging (1)

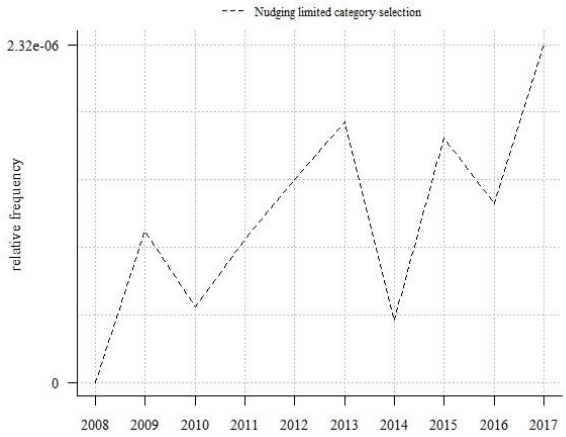


Figure 58: Nudging (2)

The trend curve development reveals an increase since 2008 and a soft drop in 2017. The trend curve in the limited category selection remains near zero (Figure 57). The closer view in the trend development in the limited category selection shows a volatile course, but a strong rise in 2017, which indicates growing importance for the public sector. The distribution on WOS categories in Figure 59 reveals that the term nudging is applied in two different ways. In the WOS categories meteorology atmospheric science and geo science, nudging is appropriated as surface nudging as the basis for climate models. For this reason, only certain categories are relevant in our contexts, e.g. ethics, economics, sociology or law. The amount of tagged records in the relevant categories is significantly lower.

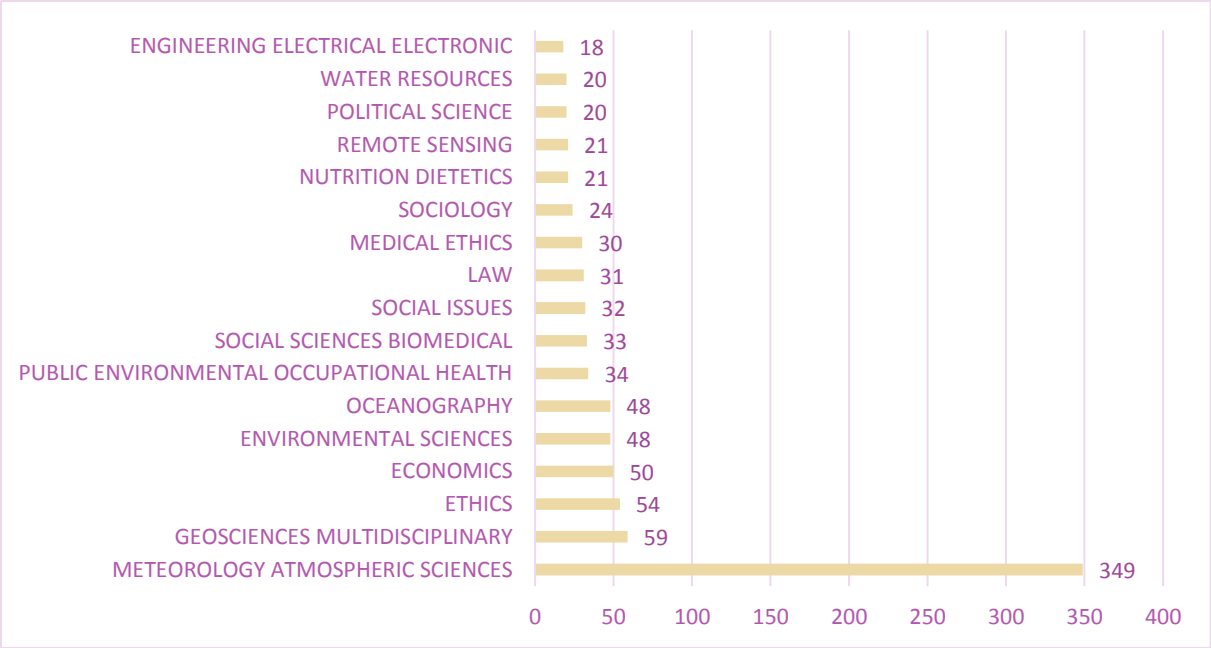


Figure 59: Nudging – amount of tagged records per WOS category

4.6.7.3 Nudging related Needs and Trends

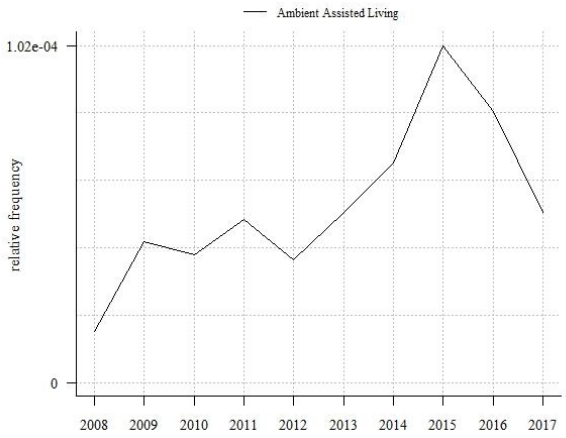
Nudging can potentially contribute the involvement of the public and citizens (N-S-2) and strengthen citizen's trust in public administrations (N-S-4). It is also usable in the organisation in connection with personnel management.

4.6.8 T-S-8: Ambient Assisted Living

4.6.8.1 Ambient Assisted Living Trend Description

Ambient Assisted Living (AAL) can be seen as the smartification of everyday life. It consists of concepts, methods, electronic systems, products and services, which transparently assist people. Most of these systems are designed to help elderly and disabled persons mastering everyday life until old age and to support a self-determined living. Concrete examples for AAL systems are the monitoring of the state of health and automatic emergency calls. This holds the potential of increased quality of life and significant economic savings. In future, demographic change is likely to increase the demand for such systems. However, the risks of such systems cannot be ignored. The technical penetration of everyday life can also have negative impacts and is not considered positive by all people. Lack of acceptance, which is associated with the fear of paternalism, loss of control and isolation, is one of the biggest challenges for the integration of Ambient Assisted Living. [113]

4.6.8.2 Ambient Assistant Living Trend Tendency and Applications



The trend curve is developing volatile and has its peak in 2015. Since then, the trend is heavily decreasing. The WOS categories „Political Science" and "public administration" are not affected by the trend. Instead, Computer Science and Health Care related categories are mostly tagged (Figure 61), which indicates an impact on the Health policy domain.

Figure 60: Ambient Assisted Living

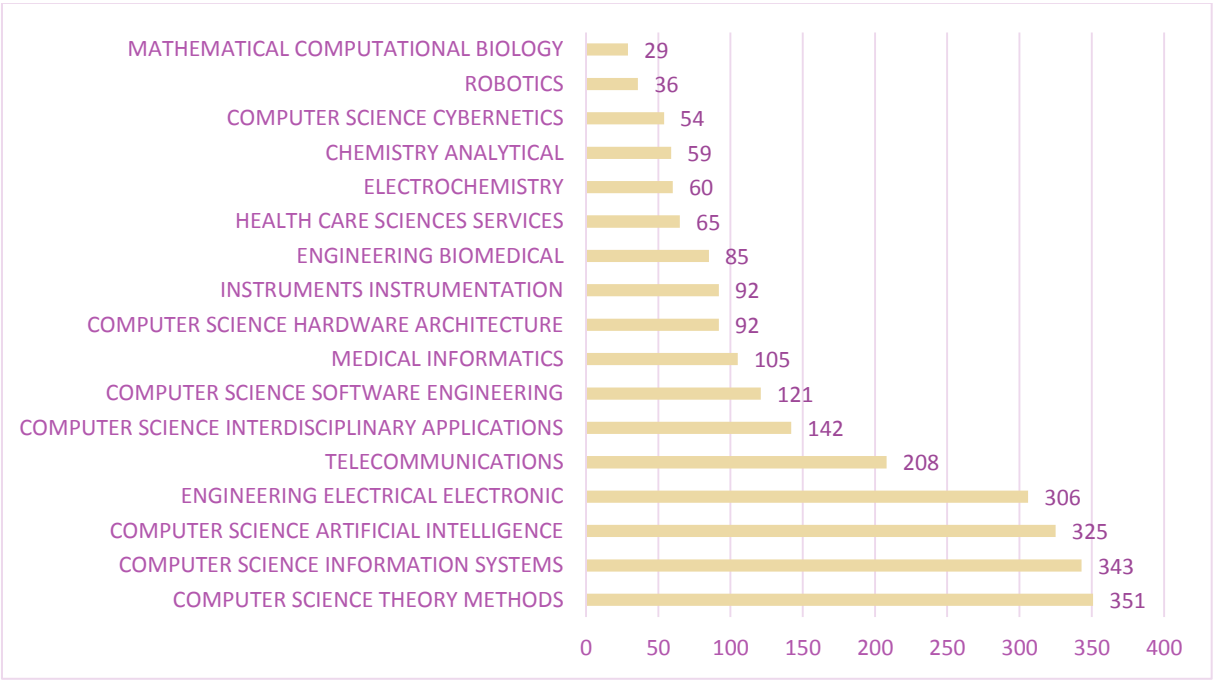


Figure 61: Ambient assisted living – amount of tagged records per WOS category

4.6.8.3 Ambient Assisted Living linked Needs and Trends

Ambient Assisted Living is an application field that is closely related to the trend Internet of Things (T-T-8) and Cloud Computing (T-T-7), since medical measuring devices need to be connected with higher level monitoring systems through cloud computing services.

4.7 Conclusion of section "Trends in European Public Administrations"

For the trend identification, we combined qualitative and quantitative research approaches. We conducted a literature analysis, as well as interviews, in order to identify and validate trends in the European public sector.

In a next step, we identified trends through frequencies of two-word and three-word combinations in the Web of Science database and in Twitter tweets.

The Web of Science and the Twitter query revealed that the term Health and the term Social Media are very high rated. However, most of the gained terms are multifarious terms with only one or two mentions.

To sum up, we have gained eight technological, twelve conceptual and eight societal trends with manifold interdependencies. The multidisciplinary perspective makes it possible to reflect on trends, which in other contexts are only separately treated.

Although the conceptual trend Performance Measurement is rated on position two in the limited category selection, the trend curve develops decreasing. Nevertheless, the other two highest rated trends Social Media and Big Data indicate, that Performance Measurement seems to be freshly thought due to the Big Data and Data Analytics related new technological opportunities.

5 Conclusion

The present deliverable, entitled "Needs and Trends in Public Administrations", is the first report recording the work within the work package three. Apart from the methodical approach, which has been applied to identify and describe the needs and trends, it contains the initial collection of public administrations' needs and trends.

The list of needs covers a broad variety of fundamental needs that are requested by European public administrations to design the policy making process more efficient, effective and precise, including strategical, organisational, technical, informational and legal needs.

The collection of trends has its focus on multidisciplinary technological, conceptual and societal trends. Both the needs and the trends provide the starting point to derive a holistic view on the complexity of renewing the public sector through open innovation and big data analytics opportunities.

To take up the fact that a relevant amount of tweets in Twitter was related to the term "dehumanizing", it can thus be stated that political regulation is a precondition for the use of data analytics, in order to protect personal data and citizens´ informational self-determination. This goes also along with the identified need to ensure data security and to protect citizens' privacy, as well as with the trend to enforce algorithmic regulation. A deeper understanding of IT potential and IT processes is needed to ensure the highest value in context of IoT and Smart City approaches for citizens, society, and the public sector.

Since there is a relevant number of trends that are significantly lower rated as others in the Web of Science database and the trend tendency just provides one perspective, further efforts will be undertaken to prioritise and to assess the identified trends through the application of the assessment framework. The same assessment will be done with regard to the identified needs. The design and implementation approach of the assessment framework will be developed in a next step in work package three and will be published in the deliverable D3.2. (Design and Implementation of Needs and Trends Assessment Framework). The list of needs and trends will be fostered through the disseminated survey, further interviews, and further focus groups in order to obtain stakeholder input from a broad range of countries, policy domains and governmental levels. The results of these efforts will be considered in the deliverable D3.3. (Needs and Trends Assessment with a multidisciplinary Big Data perspective).

Work package four focuses on methods, tools, technologies, and applications, termed as assets. These assets, together with the input from work package three, will be consolidated in an online dynamic repository, the Big Policy Canvas Knowledge Base. The identified and assessed needs, trends, and assets will result in a three-dimensions mapping, which will constitute the main input for the envisioned gap analysis and strategic roadmap in work package five.

References

[1] European Open Data Portal, https://www.europeandataportal.eu, retrieved January 5, 2018.

[2] Crossover deliverable lead author Osimo, David (ed.), Towards Policy-making 2.0, International Roadmap and case studies on ICT for Governance and Policy Modelling; Deliverable of the Crossover Project, 2015, 30 – 32.

[3] Maslow, A. H. (1954), *Motivation and personality*, Harper, New York.

[4] Sonnets deliverable lead author Gaur, Aakanksha (ed.), D2.1 Societal and Public sector Needs Analysis (1st version). Deliverable of the Sonnets project, 2016, http://www.sonnets-project.eu/sites/default/files/sonnets/public/content-files/pages/SONNETS_D2.1%20Societal%20and%20Public%20Sector%20Needs%20Analysis%20%281st%20version%29_v1.1.pdf, retrieved January 23, 2018.

[5] Oxford Dictionary (2018), *Need*, https://en.oxforddictionaries.com/definition/need, retrieved January 20, 2018.

[6] IEEE Computer Society (n.a.), *IEEE Standard Glossary of Software Engineering Terminology, IEEE Std. 610.12-1990, 2002*, http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=159342, retrieved February 2, 2018.

[7] Rupp, C. (2014), *Requirements Engineering* , Carl Hanser Verlag, Munich.

[8] OECD Glossary of Statistical Terms (2005), *Trend Definition*, https://stats.oecd.org/glossary/detail.asp?ID=2769, retrieved February 15, 2018.

[9] Mayring, P. (2014), *Qualitative content analysis: theoretical foundation, basic procedures and software solution*, http://nbn-resolving.de/urn:nbn:de:0168-ssoar-395173, retrieved January 5, 2018.

[10] Weber, M. (1980), *Wirtschaft und Gesellschaft: Grundriss der verstehenden Soziologie*, Mohr, Tübingen.

[11] Budäus, D., Buchholtz, K. (1997), Konzeptionelle Grundlagen des Controllings in öffentlichen Verwaltungen, *Die Betriebswirtschaft*, 57(3), 322–337.

[12] Thomas, J. C. (2013), Citizen, Customer, Partner: Rethinking the Place of the Public in Public, *Public Administration Review*, 73(6), 786-796.

[13] Grimmelikhuijsen, S., Porumbescu, G., Hong, B., Im, T. (2013), The Effect of Transparency on Trust in Government: A Cross-National Comparative Experiment, *Public Administration Review*, 73(4), 575-586.

[14] Wang, X., Van Wart, M. (2007), When Public Participation in Administration Leads to Trust: An Empirical Assessment of Managers´ Perceptions, *Public Administration Review*, 67(2), 265-278.

[15] Olabe, P. B. (2017), Responding to citizen´s need: Public services and trust, in: OECD, *Trust and Public Policy. How Better Governance Can Help Rebuild Public Trust*, OECD Publishing, Paris, 47-65.

[16] Jann, W., Wegrich, K. (2007), Theories of the Policy Cycle, in: Fischer F./ Miller, G. J./ Sidney, M. S.(ed.), *Handbook of Public Policy Analysis. Theory, Politics and Methods*, Taylor & Francis, Boca Raton, 43-62.

[17] Höchtl, J., Parycek, P., Schöllhammer, R. (2016), Big data in the policy cycle: Policy decision making in the digital era, *Journal of Organizational Computing and Electronic Commerce*, 26(1-2), 147-169.

[18] Bovaird, T. (2016), Researching Europeanisation of Public Administration and Policy: Conceptual Issues in Integration and Differentiation, in: Nemec, J. (ed.), *Europeanisation in Public Administration Reforms*, NISPAcee Press, Bratislava, 13-22.

[19] Laski, K., Podkaminer, L. (2012), The basic paradigms of EU economic policy-making need to be changed, *Cambrigde Journal of Economics*, 36, 253-270.

[20] Website of EMAS (EU Eco-Management and Audit Scheme), http://ec.europa.eu/environment/emas/index_en.htm, retrieved January 24, 2018.

[21] Bundesumweltministerium, Umweltbundesamt (2003), *Umweltschutz lohnt sich für öffentliche Verwaltungen. Strategien und Beispiele für ökonomische Anreize*, https://www.umweltbundesamt.de/sites/default/files/medien/publikation/long/2616.pdf, retrieved January 24, 2018.

[22] Ogonek, N., Gorbacheva, E., Räckers, M., Becker, J., Krimmer, R., Broucker, B., Crompvoets, J. (2016), Towards Efficient EGovernment: Identifying Important Competencies for EGovernment in European Public Administrations, Electronic Government and Electronic Participation, 23, 155-162.

[23] Van der Voet, J. (2014), The effectiveness and specificity of change management in a public organization: Transformational leadership and a bureaucratic organizational structure, *European Management Journal*, 32(3), 373-382.

[24] Dukić, D., Dukić, G., Bertović, N. (2016), Public administration employees' readiness and acceptance of e-government. Findings from a Croatian survey, *Information Development*, 35(5), 525-539.

[25] Bundesministerium des Innern (2014), *Digitale Verwaltung 2020 – Regierungsprogramm*, https://www.bmi.bund.de/SharedDocs/downloads/DE/publikationen/2014/regierungsprogramm-digitale-verwaltung-2020.html, retrieved December 17, 2017.

[26] Klinger, D., Sabet, G. (2006), Toward a New Perspective in Strategic Human Resource Management in the Public Sector, in: Farazmad, A. (ed.), *Strategic Public Administration: Building and Managing Human Capital for the 21st Century*, Volume 1, 43-66.

[27] Bugess, S., Propper, C., Ratto, M., Tominey, E. (2017), Incentives in the Public Sector: Evidence from a Government Agency, *The Economic Journal*, 127(605), F117-F141.

[28] Ketti, D. (2006), Managing Boundaries in American Administration: The Collaboration Imperative, *Public Administration Review*, 66(1), 10-19.

[29] Cordella, A. (2015), E-government and organizational change: Reappraising the role of ICT and bureaucracy in public service delivery, *Government Information Quarterly*, 23(3), 279-286.

[30] Groppo, G., Heck, U. (2009), Strategische Neuausrichtung der öffentlichen Verwaltung. Ein Erfolgsfaktor zur Umsetzung der Verwaltungsmodernisierung, *Verwaltung und Management*, 15(5), 271-277.

[31] OECD (2013), Exploring data-driven innovation as a new source of growth: Mapping the policy issues raised by "big-data", in: OECD: *Supporting Investment in Knowledge Capital, Growth and Innovation*, OECD Publishing, Paris, 319-356.

[32] OECD (2017), *OECD Digital Government Toolkit. 12 Principles*, http://www.oecd.org/governance/digital-government/toolkit/12principles/, retrieved December 21, 2017.

[33] Website of the EU General Data Protection Regulation (GDPR), https://www.eugdpr.org/, retrieved February 7, 2018.

[34] International Organization for Standardization (n.d.), *ISO/IEC 27000 family*, https://www.iso.org/isoiec-27001-information-security.html, retrieved February 7, 2018.

[35] Kaplan, R., Norton, D. (1992), The Balanced Scorecard: Measures that Drive Performance, *Harvard Business Review*, 70(1), 71-79.

[36] Pollanen, R. M. (2016), *Linking Strategic Planning and Performance. Measurement in Canadian Public organizations: Does it improve Performance?* Financial Management Institute of Canada, http://www.fmi.ca/media/828299/Linking%20Strategic%20Planning%20and%20Performance%20Measurement_R%20Pollanen_March%202016.pdf, retrieved February 7, 2018.

[37] Choi B. C., Pang, T., Lin, V., Puska, P., Sherman, G., Goddard, M., Ackland, M.J., Sainsbury, P., Stachenko, S., Morison, H., Clottey, C. (2005), Can scientists and policy makers work together?, *Journal of Epidemiology and Community Health*, 59 (8), 632-637.

[38] Van der Waldt, G., Du Toit, D. (1999), *Managing for excellence in the public sector*, Juta & Co, Landsdowne.

[39] Hanger. S., Pfenninger, S., Dreyfus, M., Patt, A. (2013), Knowledge and information needs of adaptation policy-makers: a European study, Regional Environmental Change, 13(1), 91-101.

[40] OECD (n.d.), *Knowledge management in the public and private sectors: similarities and differences in the challenges created by the knowledge-intensive economy*, www.oecd.org/edu/innovation-education/2667077.pdf, retrieved December 20, 2017.

[41] Wigg, K. M. (2002), Knowledge management in public administration, *Journal of Knowledge Management*, 6(3), 224-239.

[42] Arndt, C., Hermanutz, S., Kauffmann, S., Schultz, R. (2016), Building Regulatory Policy Systems in OECD Countries, *OECD Regulatory Policy Working papers*, 5, OECD Publishing, Paris.

[43] National Regulatory Control Council Germany (2017), *Bureaucracy Reduction. Better Regulation. Digital Transformation. Leverage Successes - Adress Shortcomings*, https://www.normenkontrollrat.bund.de/Webs/NKR/Content/EN/Publikationen/2017_annual_report.pdf?__blob=publicationFile&v=2, retrieved February 13, 2018.

[44] Bogumil, J., Jann, W. (2009), *Verwaltung und Verwaltungswissenschaft in Deutschland: Einführung in die Verwaltungswissenschaft*, VS Verlag für Sozialwissenschaften, Wiesbaden.

[45] Clarivate Analytics, Web of Science Core Collection,https://clarivate.com/products/web-of-science/web-science-form/web-science-core-collection/, retrieved February 6, 2018.

[46] Androutsopoulou, A., Charalabidis, Y., Loukis, E. (2015), Using Social Media Monitoring for Public PolicyMaking - An Evaluation. MCIS 2015 *Proceedings*, 8, http://aisel.aisnet.org/cgi/viewcontent.cgi?article=1029&context=mcis2015, retrieved February 19, 2018.

[47] Linders, D. (2012), From e-government to we-government: Defining a typology for citizen coproduction in the age of social media, *Government Information Quarterly*, 29 (4), 446-454.

[48] OECD (2013), Exploring data-driven innovation as a new source of growth: Mapping the policy issues raised by "big-data", in: OECD: *Supporting Investment in Knowledge Capital, Growth and Innovation*, OECD Publishing, Paris, 319-356.

[49] Laney, D. (2001), *3D Data Management: Controlling Data Volume, Velocity, and Variety*, https://blogs.gartner.com/doug-laney/files/2012/01/ad949-3D-Data-Management-Controlling-Data-Volume-Velocity-and-Variety.pdf, retrieved February 20, 2018.

[50] Oxford Dictionary (2018), Big Data, https://en.oxforddictionaries.com/definition/big_data, retrieved February 20, 2018.

[51] Mayer-Schönberger, V., Cukier, K. (2013), *Big Data: A Revolution That Will Transform How We Live, Work, and Think*, Houghton Mifflin Harcourt, New York.

[52] Milano, M. , O´Sullivan, B., Gavanelli, M. (2014), Sustainable Policy Making: A Strategic Challenge for Artificial Intelligence, *AI Magazine*, 35(3), 22-35.

[53] Bossmann, J. (2016), *Top 9 ethical issues in artificial intelligence*, https://www.weforum.org/agenda/2016/10/top-10-ethical-issues-in-artificial-intelligence/, retrieved March 1, 2018.

[54] Martinho-Truswell, E. (2018), *How AI could help the public sector*, https://hbr.org/2018/01/how-ai-could-help-the-public-sector, retrieved February 12, 2018.

[55] Encyclopaedia Britannica (2018), Machine Learning, https://www.britannica.com/technology/machine-learning , retrieved February 13, 2018.

[56] Mitchell, T. (1997), *Machine Learning*, McGraw-Hill Education, Boston.

[57] Sallam, R. L., Howson, C., Idoine, C. J., Oestreich, T. W., Richardson, J. L., Tapadinhas, J. (2017), *Magic Quadrant for Business Intelligence and Analytics Platforms*, https://cdn2.hubspot.net/hubfs/2172371/Q1%202017%20Gartner.pdf?t=149626062, retrieved February 12, 2018.

[58] Beal, V. (n.d.), *Predictive analytics*, https://www.webopedia.com/TERM/P/predictive_analytics.html, retrieved March 7, 2018.

[59] Gartner IT Glossary (n.d.), *Predictive Analytics*, https://www.gartner.com/it-glossary/predictive-analytics-2/, retrieved March 7, 2018.

[60] Gartner (n.d.): Next-generation data and analytics paradigms, https://www.gartner.com/document/3773164, retrieved March 7, 2018.

[61] Goyal, S. (2013), Software as a Service, Platform as a Service, Infrastructure as a Service –A Review, *International journal of Computer Science & Network Solutions*, 1(3), 53-67.

[62] Gartner IT Glossary (n.d.), *Software as a Service (SaaS)*, https://www.gartner.com/it-glossary/software-as-a-service-saas/, retrieved Mach 7, 2018.

[63] Strick, L., Piswanger C. (2017), European innovation procurement "Pre-Commercial-Procurement" and Cloud computing by reference to the research project "Cloud for Europe", *2017 Fourth International Conference on eDemocracy & eGovernment (ICEDEG)*, 161-166.

[64] Minerva, R., Biro, A., Rotondi, D. (2015), *Towards a definition of the Internet of Things (IoT)*, https://iot.ieee.org/images/files/pdf/IEEE_IoT_Towards_Definition_Internet_of_Things_Revision1_27MAY15.pdf, retrieved March 6, 2018.

[65] International Electrotechnical Commission (2017), *Edge intelligence*, http://www.iec.ch/whitepaper/pdf/IEC_WP_Edge_Intelligence.pdf, retrieved February 26, 2018.

[66] Heidrich, M., Luo, J. (2016), *Industrial Internet of Things: Referenzarchitektur für die Kommunikation*, https://www.esk.fraunhofer.de/content/dam/esk/dokumente/Whitepaper_IoT_dt_April16.pdf, retrieved February 27, 2018.

[67] TU Berlin (n.d.), *Smart City Definition*, http://www.smartcity.tu-berlin.de/smart-city-definition-an-der-tu-berlin-smart-city-platform/, retrieved March 20, 2018.

[68] DIN SPEC 91357:2017-12, Reference Architecture Model Open Urban Platform (OUP)

[69] Von Lucke, J., Grosse, K. (2017), Open Approaches for smart government: Impulses from Germany, *International Journal of Digital and Data Law*, 3, 1-18.

[70] Open Definition (n.d.), *Open Definition 2.1*, http://opendefinition.org/od/2.1/en/, retrieved February 28, 2018.

[71] European Data Portal (2018), *Open Data in a nutshell*, https://www.europeandataportal.eu/en/providing-data/goldbook/open-data-nutshell, retrieved February 28, 2018.

[72] European Data Portal (2016), *Understanding the European Data Portal*, https://www.europeandataportal.eu/sites/default/files/edp_factsheet_portal_architecture_online.pdf , retrieved February 27, 2018.

[73] Boyle, R. (2005), *Civil Services Performance Indicators*, Institute of Public Administration, Dublin.

[74] Schedler, K., Proeller, I. (2011), *New Public Management*, UTB, Bern.

[75] Van Dooren, W., Bouckaert, G., Halligan, J. (2010), *Performance Management in the Public Sector*, Routledge, Oxon.

[76] Schmeling, J. (2017), *Wirkungorientiertes Fachcontrolling*, Kommunal- und Schul-Verlag, Wiesbaden.

[77] Coglianese, C. (2012), Measuring Regulatory Performance, https://www.oecd.org/gov/regulatory-policy/1_coglianese%20web.pdf, retrieved January 24, 2018.

[78] Informations Commisioner´s Office (n.d.), *Privacy by design*, https://ico.org.uk/for-organisations/guide-to-data-protection/privacy-by-design/, retrieved January 25, 2018.

[79] Cavoukian, A. (2006), *Privacy by Design. The 7 Foundational Principles*, https://www.ipc.on.ca/wp-content/uploads/Resources/pbd-implement-7found-principles.pdf, retrieved January 25, 2018.

[80] OWASP (2016), Security by Design Principles, https://www.owasp.org/index.php/Security_by_Design_Principles, retrieved January 25, 2018.

[81] Thomas, G. (2013), *Defining Data Governance*, http://www.datagovernance.com/defining-data-governance/, retrieved February 1, 2018.

[82] Von Lucke, J., Reinermann, H. (2002), *Speyerer Definition von Electronic Governance*, http://www.joernvonlucke.de/ruvii/Sp-EGvce.pdf, retrieved February 2, 2018.

[83] OECD (2017), *Core Skills for Public Sector Innovations*, https://www.oecd.org/media/oecdorg/satellitesites/opsi/contents/files/OECD_OPSI-core_skills_for_public_sector_innovation-201704.pdf, retrieved January 25, 2018.

[84] Oxford Dictionary (2018), *Glocalization*, https://en.oxforddictionaries.com/definition/glocalization, retrieved February 12, 2018.

[85] Kirkpatrick, R. (2013), *A new type of philanthropy: donating data*, https://hbr.org/2013/03/a-new-type-of-philanthropy-don, retrieved February 12, 2018.

[86] Taddeo, M. (2017), Data Philanthropy and Individual Rights, *Minds and Machines*, 27(1), 1-5.

[87] Banks, G. (2009), *Challenges of evidence-based policy-making*, http://www.apsc.gov.au/publications-and-media/archive/publications-archive/evidence-based-policy, retrieved February 6, 2018.

[88] Höchtl, J., Parycek, P., Schöllhammer, R. (2016), Big data in the policy cycle: Policy decision making in the digital era, *Journal of Organizational Computing and Electronic Commerce*, 26(1-2), 147-169.

[89] Lean Enterprise Institute (2018), *What is lean?* https://www.lean.org/WhatsLean/, retrieved February 226, 2018.

[90] Verhulst, S. (2017), *Introducing the Digital Policy Model Canvas*, http://thegovlab.org/introducing-the-digital-policy-model-canvas/, retrieved February 6, 2018.

[91] Sorensen, C.-F., Wang, A.I., Conradi, R. (2005), Support of Smart Work Processes in Context Rich Environements, in: Krogstie, J./ Kautz, K./ Allen, D. (ed.), Mobile Information Systems II. IFIP – The International Federation of Information Processing, 191, Springer, Boston, 15-30.

[92] Eom, S.-J., Choi, N., Sung, W. (2016), The use of smart work in government: Empirical analysis of Korean experiences, *Government Information Quarterly*, 33(3), 562-571.

[93] Danaher, J. (2017), Will Life Be Worth Living in a World Without Work? Technological Unemployment and the Meaning of Life, *Science and Engineering Ethics*, 23(1), 41-64.

[94] Loi, M. (2015), Technological unemployment and human disenhancement, *Ethics and Information Technology*, 17(3), 201-210.

[95] Schmidt, A., Wiegand, M. (2017), A Survey on Hate Speech Detection using Natural Language Processing, http://www.aclweb.org/anthology/W17-1101, retrieved March 7, 2018.

[96] Ben-David, A., Metamoros-Fernandez, A. (2016), Hate speech and covert discrimination on social media: Monitoring the Facebook pages of extreme-right political parties in Spain, *International Journal of Communication*, 10, 1167-1193.

[97] van Spanje, J., de Vreese, C. (2015), The good, the bad and the voter: The impact of hate speech prosecution of a politician on electoral support for his party, *Party Politics*, 21(1), 115-130.

[98] Cammarts, B. (2009), Radical pluralism and free speech in online public spaces. The case of North Belgian extreme right discourses, *International journal of cultural studies*, 12(6), 555-575.

[99] Kim, B., Psannis, K., Bhaskar, H. (2017), Special section on emerging multimedia technology for smart surveillance system with IoT environment, *The Journal of Supercomputing*, 73(3), 923-925

[100] Zuboff, S. (2015), Big Other: Surveillance Capitalism and the Prospects of an Information Civilization, *Journal of Information Technology*, 30, 75-89.

[101] Brice, J. (2017), Algorithmic regulation on trial? Professional judgement and the authorisation of algorithmic decision making, in: Andrews, L./ Benbouzid, B./ Brice, J./ Bygrace, L.A./ Demortian, D./ Griffiths, A./ Lodge, M./ Mennicken, A./ Yeung, K. (ed.), *Algorithmic Regulation*, The London School of Economics and Political Sciene, London, 25-30.

[102] Danaher, J. (2016), The Threat of Algocracy: Reality, Resistance and Accommodation, *Philosophy & Technology*, 29(3), 245-258.

[103] Harari, Y. N. (2016), *Homo Deus: A Brief History of Tomorrow*, Havill Secker, London.

[104] Harari, Y. (2016), *Yuval Noah Harari on big data, Google and the end of free will*, Financial Times, https://www.ft.com/content/50bb4830-6a4c-11e6-ae5b-a7cc5dd5a28c, retrieved March 1, 2018.

[105] Tucker, I. (2013), *Interview. Evgeny Morozov: `We are abandoning all the checks and balances'*, The Guardian, https://www.theguardian.com/technology/2013/mar/09/evgeny-morozov-technology-solutionism-interview, retrieved March 1, 2018.

[106] Morozov, E. (2013), *The Perils of Perfection*, The New York Times, http://www.nytimes.com/2013/03/03/opinion/sunday/the-perils-of-perfection.html, retrieved March 1, 2018.

[107] World Wide Web Foundation (2017), Algorithmic Accountability. Appliying the concept to different country contexts, http://webfoundation.org/docs/2017/07/Algorithms_Report_WF.pdf, retrieved March 9, 2018.

[108] Baxter, G., Sommerville, I. (2011), Socio-Technical Systems: From design methods to systems engineering, *Interacting with computers*, 23(1), 4 - 17.

[109] Leeds University Business School: Socio-Technical Systems Theory, https://business.leeds.ac.uk/research-and-innovation/research-centres/stc/socio-technical-systems-theory/, retrieved March 20, 2018.

[110] Thaler, R. H., Sunstein, C. R. (2009), *Nudge. Improving Decisions About Health, Wealth and Happiness*, Yale University Press, New Haven.

[111] Kompetenzzentrum Öffentliche IT (2018), *Stupsen*, http://www.oeffentliche-it.de/-/stupsen, retrieved March 15, 2018.

[112] Website of the The Behavioural Insights Team UK, http://www.behaviouralinsights.co.uk/, retrieved March 15, 2018.

[113] Kompetenzzentrum Öffentliche IT (2018), *Ambient World*, http://www.oeffentliche-it.de/-/ambient-world, retrieved March 15, 2018.

Annex 1

Interview Guidelines – Needs

1. Please briefly describe your professional activity. Please provide information about your field(s) of expertise, your specialist focus and your function.

2. In which policy area is your work primarily located? Please choose from the list below:

    a. Agriculture, Fisheries, Forestry & Foods
    b. Economy & Finance
    c. Education, Youth, Culture and Sport
    d. Employment and Social Welfare
    e. Environment and Energy
    f. Health
    g. Foreign Affairs and Defense
    h. Justice, Legal System & Public Safety
    i. Public Affairs
    j. Science & Technology
    k. Urban Planning & Transport
    l. Institutional Questions/ Internal Services

3. At which administrative level is your work primarily located?
    a. Local/municipality
    b. Regional/Federal State
    c. National
    d. EU
    e. International

4. At which stage of the policy cycle would you position your work? (Multiple choice possible)
    a. Agenda Setting
    b. Policy Design and Analysis
    c. Policy Implementation
    d. Policy Monitoring and Evaluation
    e. other

The interviewer should note down as much information as possible with regard to the respondent, in order to be able to provide adequate profiling information, when reporting the respective activities.

5. In your opinion, which phase of the policy making cycle is the most important, and why?

    a. The agenda setting phase
    b. The policy design and analysis phase
    c. The policy implementation phase

d. The policy monitoring and evaluation phase

Justification:……...

……

The interviewer should circle the policy making phase indicated by the respondent and note down their justification. If needed, the interviewer should explain the scope of each phase.

6. What do public administrations need to get more effective, efficient and precise, in your opinion? Please name at least three needs. These needs can be characterized as e.g. strategical, organisational, informational, legal, technical or other and can have a different scope (local, regional, national, EU-wide, international.)

	Need name	**Characterization**	**Scope**
Need No 1			
Need No 2			
Need No 3			
…			

The interviewer should note down all named needs including real life examples, mentioned by the respondent, as well as the character (strategical, organisational, informational,…) of each.

7. How relevant are the following identified needs from your personal career perspective? (1= not relevant; 5 = highly relevant)
8. To which policy cycle stage would you assign the respective need? (agenda setting, policy design and analysis, implementation, monitoring and evaluation)

The interviewer should go through the following list of identified needs and note down the indicated relevance, policy cycle stage and justification for relevance and stage.

	1	**2**	**3**	**4**	**5**	**Policy Cycle Stage**
	Relevance					**PC**
Need No 1 *(as mentioned in the previous question)*						
Justification						
Need No 2 *(as mentioned in the previous question)*						
Justification						

Need No 3 *(as mentioned in the previous question)*						
Justification						
Better quality standards in the formulation and verification of norms						
Justification						
Secure legal framework						
Justification						
Link between impact, quality and performance measurement, results and financial accounting *(integration of financial and non-financial indicators and a holistic reporting system)*						
Justification						
Include findings from other disciplines (e.g. education, social, youth, work)						
Justification						
Include scientific knowledge and expertise (for example from administrative science, political science, sociology and law)						
Ensure availability of information and knowledge						
Comprehensive knowledge management (e.g. centralized information on workgroups and topics)						
Secure organisational framework						
Improve the process of recruiting in order to acquire						

suitable staff in a timely manner						
Improved incentive structures for working in the public sector (for example adequate pay for professionals, mobile work)						
Develop target-oriented personnel development (e.g. training of employees in the public sector)						
Process and resource optimization						
Organisational interface between politics and administration (structures for "translation" between politics and administration)						
Cooperative working between decision makers, departments, hierarchy levels (e.g. information exchange between different departments and administrations)						
Standardization of processes						
Standardization of data management						
Involvement of the public and citizens, as well as the development of citizen-centred policy-making						
Forward-looking strategic						

planning for the use of data and technologies as well as for practical implementation						
Development of domain-specific indicator systems						
Strengthen citizens trust in public administration						
Continuous Evaluation of Policies						
Improve/ strengthen Europeanization						
Take into account local and regional specificities						
Cope with the production of huge volume of data (technical and human resource)						
Deeper understanding of IT potential and IT processes						
Ensuring data security taking into account the protection of the citizens privacy						
Development of a comprehensive technical infrastructure and IT architecture (for example to support mobile work, harmonization of interface access)						

9. Can you name needs that are specific to certain policy domains from your point of view and experience? You can also name new needs that have not been mentioned before as well.

	Need 1	Need 2	Need 3
Agriculture, Fisheries, Forestry & Foods			
Economy & Finance			
Education, Youth, Culture & Sports			
Employment & Social Security			
Environment & Energy			
Health			
International Issues and Defence			
Justice, Legal System & Public Safety			
Public Affairs			
Science & Technology			
Urban Planning & Transport			
Institutional Questions/ Internal Services			

10. Can you name needs, which are relevant to a specific level of government from your point of view? You can name new needs that have not been mentioned here before as well.

	Need 1	Need 2	Need 3
Local/ Municipality			
Regional/ Federal State			
National			
EU			
International			

Annex 2

Interview Guidelines – Trends

1. Please briefly describe your professional activity. Please provide information about your field(s) of expertise (e.g. policy domain, administrative level) and your specialist focus.
   Policy Domains:
   a. Agriculture, Fisheries, Forestry & Foods
   b. Economy & Finance
   c. Education, Youth, Culture and Sport
   d. Employment and Social Welfare
   e. Environment and Energy
   f. Health
   g. Foreign Affairs and Defense
   h. Justice, Legal System & Public Safety
   i. Public Affairs
   j. Science & Technology
   k. Urban Planning & Transport
   l. Institutional Questions/ Internal Services

   Administrative levels:
   a. Local/municipality
   b. Regional/Federal State
   c. National
   d. EU
   e. International

   The interviewer should note down as much information as possible with regard to the respondent, in order to be able to provide adequate profiling information, when reporting the respective activities.

2. Please name and assess at least three emerging trends.

   Please consider specific **policy domains**, the **policy cycle stage** and the **administrative level** in your trend assessment.

3. Can you name trends that are specific to certain policy domains from your point of view and experience? You can name new trends that have not been mentioned before as well.

	Trend 1	**Trend 2**	**Trend 3**
Agriculture, Fisheries, Forestry & Foods			
Economy & Finance			

Education, Youth, Culture & Sports			
Employment & Social Security			
Environment & Energy			
Health			
International Issues and Defence			
Justice, Legal System & Public Safety			
Public Affairs			
Science & Technology			
Urban Planning & Transport			
Institutional Questions/ Internal Services			

4. Can you name trends, which are relevant to a specific level of government from your point of view?

	Trend 1	Trend 2	Trend 3
Local/ Municipality			
Regional/ Federal State			
National			
EU			
International			

Annex 3

Importance of Policy Cycle Stages

Which is the most important Policy Cycle Stage in your perspective?

Perspective (ID of respondents)	Agenda-Setting	Formulation	Implementation	Monitoring and Evaluation
20180207_1	X			
20180114_1		X (the phase between Agenda Setting and Formulation)		X (also very important in a big data perspective)
20180202_1			X (most relevant in a problem centered perspective)	
20180123_1		X (but all stages have their own relevance)		
20180123_2				X
20180123_3	The connection between the different stages			
20180123_4				X
20180123_5	all equal			
20180123_6				X
20180123_7	all equal			
20180123_8				X

The answers of our respondents are of course very subjective assessments and depend often on their own work field. A clear prioritisation was rejected a few times with reference to the closed cycle, which theoretically could not work with one of the phases missing. Nevertheless, a prioritisation of the evaluation phase is particularly evident among public administration employees.

Annex 4

WOS - Trend Identification

Query: ("policy" OR "policies") AND ("big data" OR "open data" OR "data analytics") AND ("public")

Period: 2012 to 2018

Total amount Two-Word-Combinations: 4614 records

Total amount Three-Word-Combinations: 2317 records

Table 5: WOS Two-Word-Combinations (extract)

Term	Freq	stemSource.Ordered.by.Freq
big_data	126	big_data
open_data	86	open_data
public_polici	43	public_policy public_policies
public_sector	36	public_sector public_sectors
public_health	33	public_health
open_govern	25	open_government
data_analyt	22	data_analytics data_analytic data_analytical
polici_maker	22	policy_makers
govern_data	19	government_data governing_data governments_data
data_polici	17	data_policies data_policy
data_set	17	data_sets data_set
data_collect	16	data_collection data_collected data_collections
public_administr	16	public_administration public_administrations public_administrative
public_data	15	public_data publicizing_data
data_analysi	14	data_analysis
data_initi	14	data_initiatives data_initiative
social_media	14	social_media
data_sourc	13	data_sources data_sourcing
open_up	13	opening_up open_up opened_up opens_up
public_servic	13	public_services public_service
social_network	13	social_network social_networks social_networking
data_mine	12	data_mining
data_share	12	data_sharing

health_polici	12	health_policy health_policies
privat_sector	12	private_sector private_sectors
public_opinion	12	public_opinion public_opinions
better_understand	11	better_understand better_understanding
case_studi	11	case_study
commun_technolog	11	communication_technology communication_technologies communications_technologies communications_technology
decis_make	11	decision_making
inform_system	11	information_systems information_system
data_avail	10	data_available data_availability
health_data	10	health_data
inform_about	9	information_about
smart_citi	9	smart_city smart_cities
cloud_comput	8	cloud_computing
data_repositori	8	data_repositories data_repository
decisionmak_process	8	decisionmaking_process decisionmaking_processes
health_care	8	health_care
polici_make	8	policy_making
public_transport	8	public_transport public_transportation
take_advantag	8	take_advantage taking_advantage takes_advantage
technolog_ict	8	technology_ict technologies_ict technologies_icts
unit_state	8	united_states
data_about	7	data_about

Table 6: WOS Three-Word-Combination (extract)

Term	Freq	stemSource.Ordered.by.Freq
open_data_polici	15	open_data_policies open_data_policy
open_govern_data	15	open_government_data
open_data_initi	9	open_data_initiatives open_data_initiative
big_data_analyt	8	big_data_analytics big_data_analytic
commun_technolog_ict	8	communication_technology_ict communication_technologies_ict communication_technologies_icts communications_technology_ict
electron_health_record	7	electronic_health_records electronic_health_record
public_sector_inform	7	public_sector_information
big_data_analysi	6	big_data_analysis

link_open_data	6	linked_open_data linking_open_data
open_data_movement	6	open_data_movement
public_health_research	6	public_health_research public_health_researchers
big_data_applic	5	big_data_applications
data_big_data	5	data_big_data
open_data_portal	5	open_data_portal open_data_portals
applic_program_interfac	4	application_programming_interfaces application_programming_interface
big_data_mine	4	big_data_mining
govern_open_data	4	government_open_data
health_record_ehr	4	health_records_ehrs health_record_ehr health_records_ehr
open_data_big	4	open_data_big
open_data_platform	4	open_data_platforms open_data_platform
open_up_public	4	open_up_public opening_up_public
public_health_polici	4	public_health_policy public_health_policies
public_sector_organ	4	public_sector_organizations
up_public_data	4	up_public_data
advers_event_monitor	3	adverse_event_monitoring
big_data_technolog	3	big_data_technology big_data_technological big_data_technologies
big_data_tool	3	big_data_tools
concern_about_data	3	concern_about_data concerns_about_data
concern_diseas_incid	3	concerning_disease_incidence
data_analyt_framework	3	data_analytics_framework data_analytic_framework
data_storag_data	3	data_storage_data
digit_public_servic	3	digital_public_services
geograph_inform_system	3	geographic_information_systems geographical_information_systems
govern_data_initi	3	government_data_initiatives government_data_initiative
govern_data_ogd	3	government_data_ogd
health_care_system	3	health_care_systems health_care_system
health_inform_system	3	health_information_systems
includ_public_health	3	including_public_health
integr_open_data	3	integrating_open_data integrated_open_data
issu_face_ophthalmolog	3	issues_facing_ophthalmology
key_issu_face	3	key_issues_facing

open_data_provid	3	open_data_provides open_data_provided open_data_providers
open_data_repositori	3	open_data_repositories open_data_repository

Annex 5

Twitter –Trend Identification

Query: (policy OR policies) AND ("open data" OR "big data" OR "data analytics") AND (public)

Period: 2013-01-11 to 2018-01-11.

Total amount of tweets: 2771

Table 7: Twitter Two-Word-Combinations

Term	Freq	stemSource.Ordered.by.Freq
public_polici	1677	public_policy public_policies
big_data	1623	big_data big_datas
open_data	543	open_data
chang_public	527	changed_public change_public changing_public
how_big	527	how_big
data_polici	300	data_policy data_policies
dehuman_impact	213	dehumanizing_impact
data_dehuman	211	datas_dehumanizing data_dehumanizing
big_problem	176	big_problems
some_big	175	some_big
whi_big	175	why_big
polici_…	143	policy_… policies_…
data_analyt	90	data_analytics
public_health	48	public_health
public_input	45	public_input
polici_#bigdata	44	policy_#bigdata policies_#bigdata
social_media	44	social_media
…_via	43	…_via
polici_via	43	policy_via policies_via
shape_public	43	shape_public shaping_public shaped_public
data_public	41	data_public
public_comment	41	public_comment public_comments
public_sector	37	public_sector
shape_open	34	shape_open
better_public	33	better_public

citi_turn	32	cities_turn
polici_challeng	32	policy_challenge policy_challenges
long_tail	31	long_tail
data_social	30	data_social
biggest_public	29	biggest_public
health_polici	27	health_policies health_policy
polici_public	26	policy_public policies_public policy_publications
data_contribut	25	data_contribute data_contributes
data_help	25	data_helps data_help
address_public	24	address_public
mobil_data	24	mobile_data
draft_open	23	draft_open
public_data	23	public_data
support_public	23	supporting_public support_public
via_gigaom	23	via_gigaom
gerrisdigit_how	21	gerrisdigital_how
help_startup	21	help_startups
public_issu	21	public_issues
rt_gerrisdigit	21	rt_gerrisdigital
startup_address	21	startups_address
data_revolut	20	data_revolution data_revolut
data_support	20	data_supporting
polici_research	20	policy_research policy_researchers
public_engag	20	public_engagement
data_scienc	19	data_science
polici_data	19	policy_data
seek_public	19	seeks_public seeking_public
telangana’_‘open	19	telangana’s_‘open
‘open_data’	18	‘open_data’
data’_polici	18	data’_policy

Table 8: Twitter Three-Word-Combinations

Term	Freq	stemSource.Ordered.by.Freq
chang_public_polici	527	changed_public_policy change_public_policy changing_public_policy
how_big_data	525	how_big_data
open_data_polici	287	open_data_policy open_data_policies
big_data_dehuman	211	big_datas_dehumanizing big_data_dehumanizing
data_dehuman_impact	210	datas_dehumanizing_impact data_dehumanizing_impact
whi_big_data	175	why_big_data
some_big_problem	174	some_big_problems
public_polici_…	104	public_policy_… public_policies_…
public_polici_#bigdata	42	public_policy_#bigdata public_policies_#bigdata
shape_public_polici	41	shape_public_policy shaping_public_policy shaping_public_policies shaped_public_policy
public_polici_via	38	public_policy_via public_policies_via
better_public_polici	32	better_public_policies better_public_policy
data_polici_…	31	data_policy_… data_policies_…
shape_open_data	31	shape_open_data
data_social_media	30	data_social_media
public_polici_challeng	30	public_policy_challenge public_policy_challenges
big_data_social	29	big_data_social
data_public_polici	29	data_public_policy data_public_policies
polici_…_via	29	policy_…_via policies_…_via
biggest_public_polici	27	biggest_public_policy
public_health_polici	25	public_health_policies public_health_policy
big_data_public	24	big_data_public
mobil_data_contribut	24	mobile_data_contribute
draft_open_data	23	draft_open_data
address_public_issu	21	address_public_issues
gerrisdigit_how_big	21	gerrisdigital_how_big
help_startup_address	21	help_startups_address
rt_gerrisdigit_how	21	rt_gerrisdigital_how
startup_address_public	21	startups_address_public
data_support_public	20	data_supporting_public
support_public_health	20	supporting_public_health

big_data_revolut	19	big_data_revolution big_data_revolut
big_data_support	19	big_data_supporting
‘open_data’_polici	18	‘open_data’_policy
…_via_gigaom	18	…_via_gigaom
telangana’_‘open_data’	18	telangana’s_‘open_data’

Table 9: Twitter Hashtag Frequency (extract)

Hashtag	Frequency
bigdata	159
data	54
opendata	48
policy	24
analytics	21
privacy	20
public	17
opengov	12
datascience	9
open	9
iot	8
publicpolicy	8
tech	8
big	7
iapp	7
job	7
pepsico	7
purchasenewyorkusa	7
socialmedia	7
ciudades	6
policies	6
technology	6
infographic	5
awesm	4
bigdata4policy	4

business	4
cpsr	4
datamining	4
gov20	4
hounews	4
news	4
qatar	4
transparency	4
uscg	4
boisestate	3
cdnpoli	3
data4policy	3
education	3
ehealth	3
government	3
govt	3
h2020	3
health	3
healthcare	3
india	3
innovation	3
opendatapic	3
research	3
startups	3
suryaray	3
usarmy	3
agriculture	2
alaicamexico2017	2
ashe2014	2