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ORIGINAL ARTICLE

The role of future-oriented technology analysis in e-Government: a systematic review

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Abstract
During the last three decades, many governments have incorporated Information and Communication Technologies in their internal and external processes, a phenomenon widely known as electronic government (e-Government). Rationales for e-Government include increasing public services' efficiency, speed, transparency, accountability, etc., and enhancing relations between government and stakeholders (citizens, businesses, third sector organisations). e-Government programmes are large-scale innovation projects; and Future-oriented Technology Analysis, FTA, is often used in the design of public policies in science, technology and innovation. FTA tools allow for systematic appraisal of potential challenges, opportunities, and threats, and thus informing the design of long-term strategies. The aim of this paper is to examine what a systematic literature review tells us about the application of FTA to support e-Government planning, implementation or evaluation. The review confirms that FTA played a role in supporting some e-Government initiatives, especially in their planning stages. However, few relevant exercises of this sort are reported in the English language, though the e-Government literature itself in that language- is voluminous. Previous researchers often attribute weaknesses in e-Government efforts to deficiencies in vision and strategic planning. Hopefully, this review can encourage both FTA and e-Government practitioners to apply FTA to e-Government development. This suggests that there is both opportunity and need to take greater advantage of FTA in this field.

Keywords Future-oriented technology analysis · Foresight · e-Government · Open government · Digital government

Introduction

The application of Information and Communications Technology (ICT) has been radically transforming many social and economic activities, including those of the public sector. Over the last three decades, many governments worldwide have implemented e-Government with the belief that it can improve efficiency, cost effectiveness, and transparency between citizens and public agencies and authorities [1–4]. Such e-Government initiatives are usually undertaken at the national policy-making level. They necessarily require many technological and innovation decisions and capabilities to support their planning, design and implementation. Multiple stakeholders must contribute time, effort, and financial cost; coordination is critical [5, 6].

Despite high hopes, and much promotion by consultancies and ICT companies, it is well-established that many ICT public projects are unsuccessful [7, 8]. Heeks & Stanforth [9] reported that the rate of failure of ICT public projects is close to 60%. This is not just a matter of delays, cost overruns, and the like: systems are quite often rejected by their intended users as not fit for purpose. Researchers have attributed these problems to several factors, including failure to take end-user requirements into sufficient account - and to lack of vision and strategy [7, 10].

Future-oriented Technology Analysis (FTA) is an umbrella concept proposed in 2004 by the Technology Futures Analysis Methods Working Group [11] to represent "*any systematic*

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process to produce judgments about emerging technology characteristics, development pathways, and potential impacts of a technology in the future. In this sense, Technology Future Analysis encompasses the broad technology foresight and assessment studies of the public sector and the technology forecasting and intelligence studies in private industry." We shall adopt this terminology here, so as to avoid debate about whether individual studies do or do not represent one or other type of Foresight, Technology Assessment, Strategic Prospective, or other futures-oriented approach. There is also widespread agreement that FTA can be useful in the design of public policies for Science, Technology and Innovation (STI) [12]. In addition to policies for research and development (R&D), technical training, etc., policies often involve STI in public services such as health and environmental management. A focus on government processes themselves is rather less common - indeed, Foresight Programmes that claim to cover the greater part of the economy typically neglect activities like public administration (despite the high levels of employment in such spheres).

Since e-Government is a matter of public policy concerning technological innovation, and FTA is employed in the design of STI policies, the question arises of how FTA has been used in e-Government programmes.

The present study draws on a bibliographic review that analysed when, how, for what, and with whom e-Government initiatives have used FTA. This paper is structured as follows: the second and third sections outline the context of e-Government and FTA, respectively. The fourth section outlines the research method and the fifth section presents and discusses the research results. Finally, the sixth section provides some conclusions and offers suggestions for further studies.

e-Government

The concept of e-Government was first proposed in 1997 by the US government [13], though the use of new ICT in government and public administration had been attracting attention for over a decade before that. e-Government refers to the application of ICT to the public sector, with such aims as improving administrative efficiency, and providing citizens and businesses with more convenient access to government information and services [1–3]. Among the objectives often cited are also: to enhancing the quality of public services; and transforming government by making it accessible, effective, accountable, transparent - and, recently, more engaged and participative with citizens [6, 14–16].

e-Government has been promoted as essential for modernising government operations, as offering opportunities for public services to be more convenient, personalized, accessible and flexibility; and to be provided more rapidly, with lower transaction costs (leading to more efficiency) [16, 17]. Benefits should thus accrue to both citizens and government. For citizens, being able to file requested documents online or download forms from the Internet can increase convenience and save time. For governments, in addition to the benefits mentioned above, there is the hope of boosting citizen confidence in public authorities [16, 18, 19].

e-Government has evolved from very basic use of the Internet to announce policies, meetings, and the like, to more transactional and integrated approaches where government creates and improves services in partnership with citizens and businesses [20, 21]. These collaborations include co-creation process of solutions to problems, and in the design of public policies. In such approaches, e-Government has been considered a facilitator of public value [22, 23].

Where it comes to actual practice, many nations - at a wide range of levels of economic development - have designed e-government strategies, as reported by the Department of Economic and Social Affairs of United Nations [4]. But Holgeid's literature review [24] revealed that public ICT projects often fail - especially in the case of developing countries. Various factors are described whose presence or absence determines success or failure of projects [25]. Some factors that encourage the successful implementation of e-Government projects are understanding of the requirements for such implementation, and user involvement in the process, clarity of vision and strategy, well-defined goals, [7, 9, 10, 26–28] together with government support, and strong consumer expectations [8, 29, 30]. As pointed out by Gichoya [25] the absence of such conditions can mean failure or, at best, only partial success. We might suggest that e-Government initiatives are sometimes undertaken on a "me-too" basis, where programmes are instituted more because others are seen to be doing them and/or they are a badge of modernity, rather than because their potential worth has been systematically appraised.

Future-oriented technology analysis

We have seen that Future-oriented Technology Analysis (FTA) is effectively an umbrella term, especially invoked in the context of STI policymaking for long-term appraisal in order to facilitate decision-making and coordinated action [11, 12]. Ciadi et al. [31: 64] are among those who see FTA as providing analytical tools that can identify and examine possible future scenarios and facilitate efforts to shape of social and economic conditions. FTA is hailed as informing novel approaches useful for designing government STI strategies, and policies [32, 33]. One of the best-known functions is the provision of support for setting Research & Development priorities, taking into account the potential of future technologies [34].

The FTA literature contains several proposals for classifying methods [11, 35–38]. The present study draws on Porter et al. [11], who classify FTA methods in terms of nine "families". The families are described alphabetically:

i) Creative family - based on the inventiveness, ingenuity and inspiration of people engaged in the process [36, 37]. Brainstorming, Science fiction analysis among other methods belong to this family;
ii) Decision family - provision of structure and guidance for systematically thinking through decisions and clarifying the problem that is confronted [39]. Analytic Hierarchy Process (AHP), Analytic Network Process (ANP), balanced score card, Decision Making Trial and Evaluation Laboratory (Dematel), multicriteria analysis, strategic maps, strategic planning among other methods belong to this family;
iii) Descriptive and matrices family - analytical tools used to categorise (internal and/or external) influences affecting prospects for an issue or organisation [36, 40];
iv) Expert opinion family - methods that depend on the skills and knowledge of individuals well-informed about a particular area or topic; usually employing participatory techniques to involve different stakeholders [40, 41]. This family includes citizen and expert panels, Delphi, interviews, surveys, workshops, etc.;
v) Monitoring and intelligence family - systematic identification of opportunities and threats in, for example, technological, political, social, cultural, legislative environments, and support for formulation and execution of the organization's strategy [42–45]. Benchmarking, bibliometrics, environmental scanning are among the methods in this family;
vi) Modelling and simulation family - sophisticated statistical methods and modelling techniques for identifying future trajectories [36]. Gaming and agent-based models are part of this family;
vii) Scenarios family - ways of articulating future states and courses of development, usually organising these by systematic means such as texts, charts, etc. [36]. Includes scenario workshops.
viii) Statistical family - basic statistical analyses, including correlations and the like [46].
ix) Trend analysis family - extrapolating quantitative historical data, and exploring changes in such trends induced by future events and countertrends [43, 46].

Porter et al. noted [11] that the families may overlap, with some methods potentially located in different families.

Many FTA exercises, and all Foresight programmes, involve their practitioners combining several methods, usually spanning more than one of these families [12, 47]. Given the need for governments to identify social requirements, and to take into account the viewpoints of different actors, participatory FTA methods will be important - alongside forecasting techniques from other families - to allow policymakers to engage with perspectives of key stakeholders. These can inform mid- and the long-term visions [48–50]. (For the public sector, a stakeholder is usually defined as an individual, group or institution perceived to be affected by, or interested in, decision-making on a certain issue cf. Creighton [51]) FTA exercises produce a wide variety of outputs (cf. Miles & Keenan [36]). These include sectorial analyses, critical technology lists, priorities and policy recommendations, scenarios, Delphi results databases; and less tangible 'process' benefits such as network-building and mutual learning and shared perspectives.

Bearing in mind features of e-Government projects mentioned earlier - including their use of technological innovation and their high rate of failure (related to lack of user involvement and of well-defined strategies), our research question arose: how has FTA been applied in e-Government?

Methodology

This work carried out a Systematic Literature Review, adapting the method proposed by Kitchenham [52].

There are two components to this method: the search strategy and the framework for analysing the publications found.

The search strategy

The search strategy rested on the use of a set of keywords in the English language related both to e-Government and FTA [53] to examine the Scopus database [54]. e-Government keywords such as "*electronic government*", "*open government*", *e-government*, e-gov, "*electronic administration*", *e-administration*, and FTA keywords such as *foresight*, "*technology futures analysis*", TFA, "*Future-Oriented Technology Analysis*", *FTA,* "*future studies*", "*strategic planning*", "*competitive intelligence*", "*scenario planning*", *Delphi, roadmap.*

This search was conducted in February 2017, and examined publications from 1995 until this year. After removing duplicates, 272 publications were identified.

After reviewing the title, abstract, and keywords of each document, in order to check its alignment with our research question, and reading the full-text, 83 publications remained. This was further reduced to 45 publications to be analysed in depth, after reading the full texts, excluding pieces that did not refer to actual practical application of FTA and the one piece where the abstract was not in English (it was in Chinese, and full text was not located).

These are strikingly few publications, compared to the numbers located that dealt with FTA or e-Government alone. (The e-Government keywords produced a set of 11,882 documents.)

Analysis of papers

The 45 studies were classified according to:

- Type of report: the scope of the publication was classified as: "Framework for developing an e-Government strategy" or "Description of case study" or "Both Framework and Case study".
- Region, country and its level of income (using the World Bank classification as updated December 2016 [55]).
- Level of Government concerned.
- Phases of e-Government strategy where FTA concept was applied. (These were defined in terms the three standard project phases: planning, implementation/development, evaluation/closure.
- Families of FTA methods, using the Porter et al. categories [11].
- Outputs of FTA process, using the guidelines proposed by Miles & Keenan [36].
- Focus areas or themes discussed in the FTA process outputs previously identified, using the themes suggested by [56, 57]
- Types of stakeholders involved.

Furthermore, a bibliometric analysis of text in the Abstracts was conducted, using the Natural Language Processing Technique of VantagePoint Software [58].

Findings

General overview

Geographically, the vast majority of the publications were from Asia (18) and Europe (18), followed by publications from Africa (2), Latin America (2), and North America (1).

Two more publications had worldwide scope, and another two featured cases from two regions (see Table 1).

Table 1 also shows that the vast majority of the publications were from High-income countries followed by publications from Upper-middle income countries.

This finding is controversial considering that there was a special promotion plan from United Nations to implement e-Government.

This section continues with an overview of the use of families of FTA methods. We then move to the outputs and results of these FTA-based e-Government initiatives, and finally discuss the relationship between FTA methods and the type of stakeholders.

Families of FTA methods

Of the 9 families of methods of FTA (from Porter et al. [11]) were reported as being used: creative family, decision family, descriptive and matrices family, expert opinion family, monitoring and intelligence family, modelling and simulation family, and, scenarios family. Many studies combine more than one of the families of FTA methods.

Figure 1 shows that the family of expert opinion methods is the most preferred (in 27 studies, 3/5 of the total). The descriptive and matrices, and the monitoring and intelligence families, were not far behind (24 and 23 publications respectively - each in more than half of the studies). A further three were used in 1/5 to 2/5 of the studies - 18 used methods from the decision family; 15 used the scenarios family; 14 the creative family. Only 6 publications used the modelling and simulation family.

Figure 2 relates use of the families of methods (number of publications) to the country income level. The expert opinion family is the most preferred by both high and lower-middle income countries, followed by the descriptive and matrices and their monitoring and intelligence families. The upper-middle income countries preferred the descriptive and matrices family, followed by the monitoring and intelligence family.

Figure 3 provides more detail on the use of specific techniques within the creative, decision, descriptive and matrices,

Table 1 Publications per region

Region	High income	Upper-middle income	Lower-middle income	Low-income	Global	Total
Africa			[59]	[60]		2
Asia	[61]	[62–73]	[74–77]	[78]		18
Europe	[79–95]	[96]				18
Latin America		[97]			[98]	2
North America	[99]					1
Asia & North America	[100]					1
Europe & North America	[101]					1
Worldwide					[30, 102]	2
Total	21	14	5	2	3	45

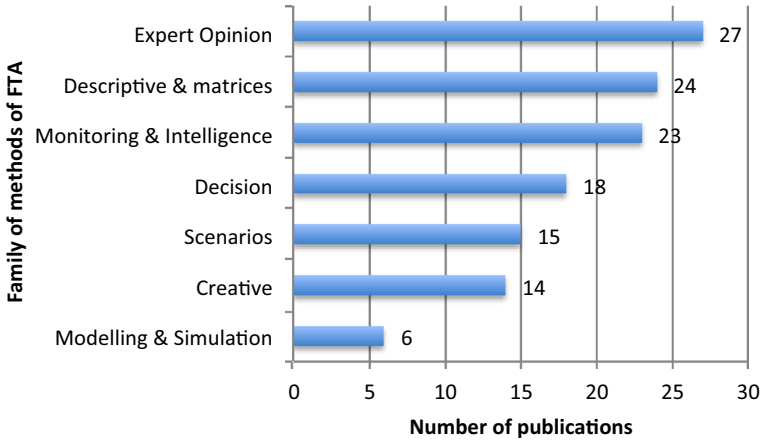


Fig. 1 Publications per family of methods of FTA

expert opinion, monitoring and intelligence, modelling and simulation, and scenarios families, in relation to country income level.

In the case of the creative family, the three methods reported were: brainstorming, near future context, and scenario writing, with brainstorming most frequently used (11 times), across all categories of income level. Other creativity methods were used much less (fewer than 6 times). This finding is not surprising, since brainstorming is relatively easy to apply to a range of FTA tasks, and is thus one of methods most frequently combined with others - as Saritas & Burmaoglu reported [103]. In these 11 cases, brainstorming was used at the beginning of the FTA process to generate inputs and increase the number of alternatives from which choices can be made.

Regarding the decision family of FTA methods, Fig. 3 identifies 9 methods, listed in order from highest to lowest frequency of use: Strategic planning, multicriteria analysis, Analytic Hierarchy Process – (AHP)/Fuzzy AHP, Balanced Scorecard, relevance tree, strategic maps, Analytic Network Process (ANP), Decision Making Trial and Evaluation Laboratory most often known as Dematel, and value chain analysis. In this family, strategic planning[1] was the most used method (8 times) and the remaining 8 methods were applied less than five times each. In both cases, high-income countries and upper-middle income countries preferred strategic planning. Multicriteria analysis was used in second place by upper-middle income countries. In lower-middle income countries and low-income countries, no decision method was preferred. Examination of the publications confirms that this family was used to prioritize issues such as strategies, actual and desired impacts, and the relevance of specific components of e-Government initiatives, in line with Salo et al.'s analysis [104].

[1] Strategic planning is an umbrella concept for a disciplined effort that is used to set priorities, resources, for establishing agreement around outcomes, results, and assess and adjust the organization's direction in response to a changing environment with a focus on the future. Strategic planning involves different methods.

As depicted in Fig. 3, the descriptive and matrices family comprises 6 methods listed in order from highest to lowest frequency: Strengths, Weaknesses, Opportunities and Threats (SWOT), roadmapping, content analysis, Importance & Governance (IGO), interdependences, and strategic life cycle analysis.

The descriptive and matrices family may be achieving a high level of use because it generates forms and ways to facilitate interpretation of information, as argued by Porter [46]. In this family, SWOT was the most preferred, being used 17 times, while the remaining methods were used less than 6 times. Both high-income countries and upper-middle income countries preferred SWOT.

Roadmapping was used by those 2 e-Government initiatives studies that were applied across the world. This suggests that the outputs of these roadmaps are general guidelines, providing common steps and targets that could be implemented by different governments. This family may be achieving a high level of use because it generates forms and ways to facilitate interpretation of information, as argued by Porter [46]. In this family, SWOT was the most preferred, being used 17 times, while the remaining methods were used less than 6 times. Both high-income countries and upper-middle income countries preferred SWOT.

The expert opinion family is formed of 7 methods, listed in order from highest to lowest frequency: workshops, interviews, expert panels, surveys, Delphi/fuzzy Delphi, focus group, and citizen panels. Workshops, being used 14 times, were the most prevalent, but three methods. Other methods were employed often, too: interviews (11 times); expert panels and surveys (10 times each). The remaining methods were used fewer than 6 times each.

High-income countries preferred expert panels, followed by workshops and surveys. Upper-middle income countries chose workshops as the first option, with interviews and expert panels in second place. Preferences were less marked for lower-middle income and low-income countries. Workshops, surveys and interviews were used by

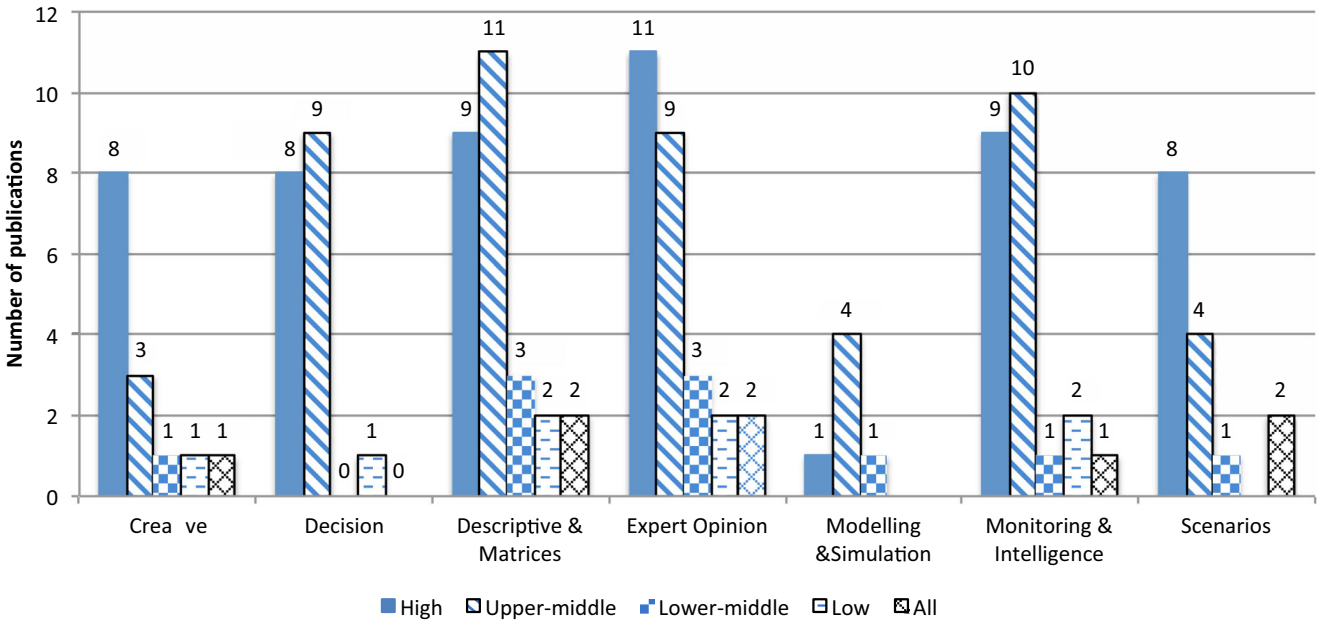


Fig. 2 Publications per family of methods of FTA per country income level

countries at all income levels, implying that involvement of different points of view was common to many FTA efforts in connection with e-Government. This is also consistent with the results of Saritas & Burmaoglu in [103], who found these methods to be among those most frequently combined with other FTA methods.

The monitoring and intelligence family comprises 5 methods listed in order from highest to lowest frequency:

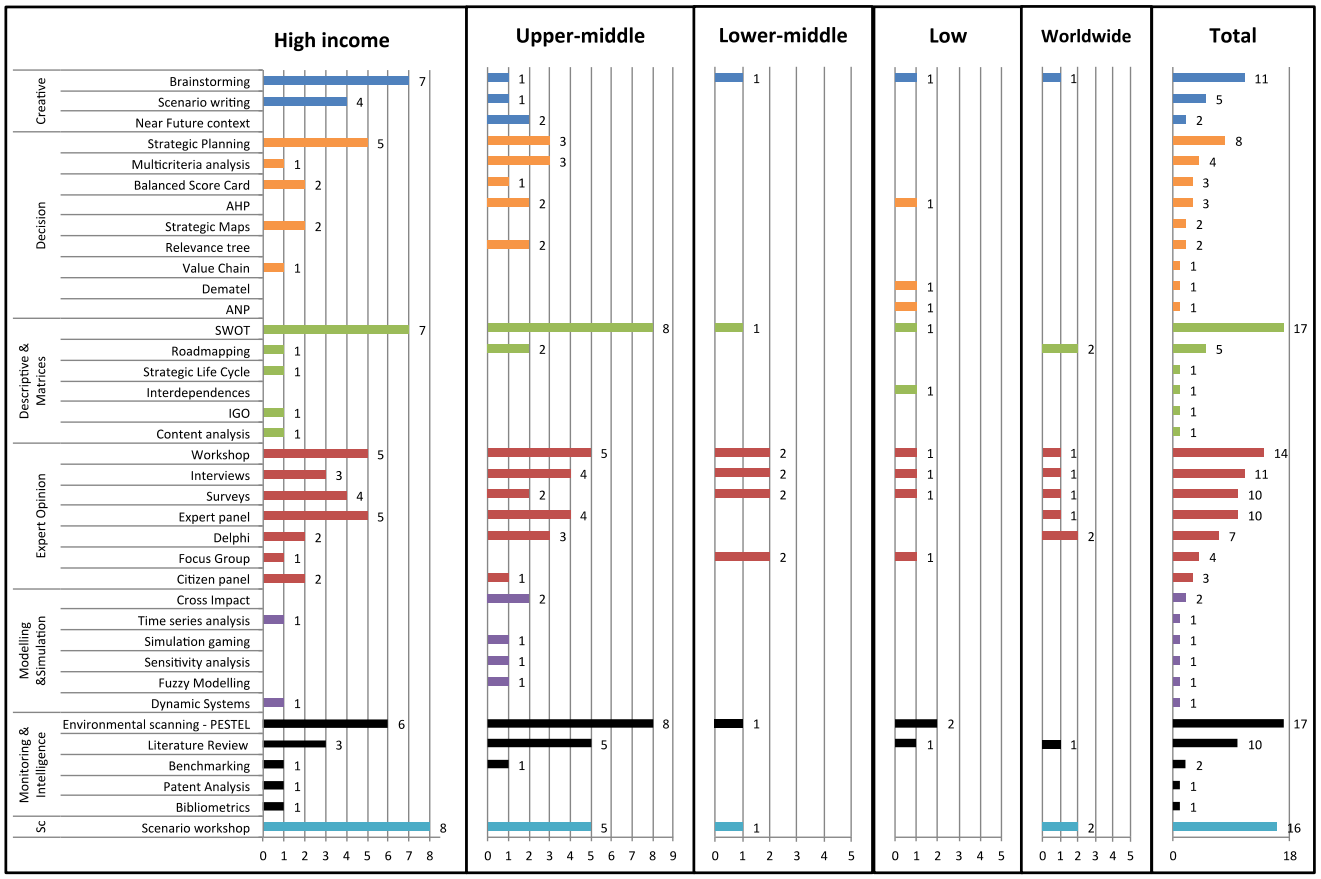


Fig. 3 Families of methods of FTA related to country income level

environmental scanning (Political, Economic, Social, Technological, Legal, and Environmental factors, PESTEL[2]), literature review, benchmarking, bibliometrics, and patent analysis. PESTEL was most used (17 times), followed by literature reviews (10 times). The remaining methods were used fewer than 3 times each. In 3 of the 4 groups of countries (high-income, upper-middle income and low-income countries), PESTEL method was a preferred method, overall it is (tied) third most used; Popper [105], also found this to be a commonly used method.

The modelling and simulation family involves 7 methods including cross-impact, dynamic systems, fuzzy modelling, sensitivity analysis, simulation gaming, and time series analysis. These methods were used rarely - cross impact, the most used, only made 2 appearances. The other 6 methods were each used only once. This limited use can be related to Reis et al.'s [106] observation that these are expensive methods that require specialists, and whose implementation is more complex than most.

The "family" of scenarios methods in reality only consists of one method here. Scenario workshops (which Popper [105] also found to be very commonly used method) were used 15 times, making them the (tied) third most used method overall.. These workshops were employed by countries across all income levels, other than low-income countries.

In sum, the literature review uncovered some 37 FTA methods being applied to e-Government initiatives. Some of these methods, such as SWOT, PESTEL, brainstorming, workshops, surveys and interviews were very widely used across countries. These methods tend to be cheaper than others (Reis et al. [106]), though they may require more time for generating results; they also engage a range of stakeholders and potentially involve many participants.

The average number of FTA methods was 4 methods per initiative (Fig. 4) (a result similar to that obtained by Popper [105] examining Foresight exercises more generally). There is some indication that the number of methods used has increased across time, from 2003 to the present (cf. Fig. 5), which is in line with the findings of Saritas & Burmaoglu [103]. Figure 5 also shows that the most prolific years in terms of use of FTA were 2007 (21), 2009 (31) and 2014 with 17, 17 and 16 methods per year, respectively. Although the set of documents in this research is small, these peaks are in line with the time sequence analysis done by Alcaide-Muñoz et al. [107] related to a gradual increase in the number of studies on e-Government published in international journals.

Analysis of the publications demonstrates that some of the FTA methods used here themselves deployed ICT: to increase the number of experts and stakeholders that could be involved, to speed up the FTA, and/or to facilitate analyses of large amounts of data [108].

The combination of methods is believed to establish more effective and more robust results from FTA processes [47, 103, 109].

Figure 6 depicts patterns in the combination of FTA methods: the colour of nodes in the network diagram represents the number of papers reporting a method's use, while the extent to which two methods were used in the same paper comprises the links. Visualization of the resulting relationships among FTA methods shows the strongest links. (Methods used more than 10 times are identified with white nodes, and those used between 5 and 10 times with black nodes.)

Figure 6 suggests that there were six groups featuring frequently combined FTA methods:

- Literature review, brainstorming, expert panels, scenario workshops, scenario writing, and surveys cluster together. Some of these methods, such as brainstorming, literature review, and surveys, are usually implemented at the beginning of the FTA process in order to collect and generate inputs to discuss later [36, 41]. This group also contains participatory methods, i.e. scenario workshop, workshops, citizen and expert panels, which are usually implemented for generating long-term visions using the previous inputs [36, 41]. Thus, this group is formed of methods that could be used across the whole FTA process.
- Patent analysis, bibliometrics, time series analysis, and dynamic systems contributed to another group (a result similar to that of Saritas & Burmaoglu [103]). These are methods typically used early on in the FTA process, to identify trends and produce inputs for consideration in building long-term visions [36, 41, 110] As mentioned before these methods are also rather demanding of technical skills - and good data [106].
- AHP, sensitivity analysis, and multicriteria analysis comprised one group; and ANP, Dematel and interdependences formed another group. Thus, there are two clusters of approaches used to prioritize different options. They are usually used at the end of the FTA process for providing information such as priority lists to inform particular policies and their implementation [36].
- Another cluster, featuring balanced score card, value chain, strategic maps, and strategic life cycle analyses, involves methods used to examine linkages between components (e.g. for determining the sequence or interdependency of actions), and also to monitor the added-value of an initiative.
- Finally, strategic planning, IGO, SWOT, and PESTEL tend to co-occur: these are (or contribute to) approaches for assessing the broad context within which objectives are the be achieved, helping to inform planning and decision-making [111].

[2] PESTEL is one of several acronyms signifying frameworks for classifying issues, the most familiar being STEEPV (Social, Technological, Economic, Environmental, Political and Values categories) and also TEEPSE, STEPJE, STEEEPLED, LEPEST, and others.

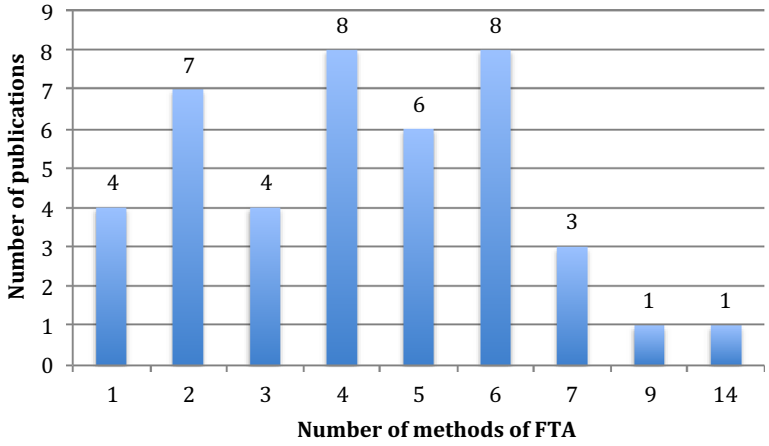


Fig. 4 Number of methods of FTA used in e-Government initiatives

These four last groups are used during the later stages of the FTA process.

In our opinion these six groups also show different approaches. The Anglo-Saxon approach is closer to the first and second group than to the other groups, which are closer to the French approach.

FTA in phases of e-Government initiatives

Figure 7 shows the use of the families of FTA methods across (1) planning, (2) implementation or development, and (3) evaluation and closure phases of e-Government initiatives. Figure 7 also shows that FTA has had most role in the planning phase of e-Government initiatives. This suggests that initiatives using FTA are seeking to avoid the lack of adequate strategy that has been reported as leading to e-Government failures in other studies [7, 9, 10, 26–28]).

In the planning phase both the expert opinion and monitoring and intelligence families were the most used, followed by the descriptive and matrices family. Scenario workshops and PESTEL were the most preferred methods in the planning phase of an e-Government initiative, followed in third place by SWOT.

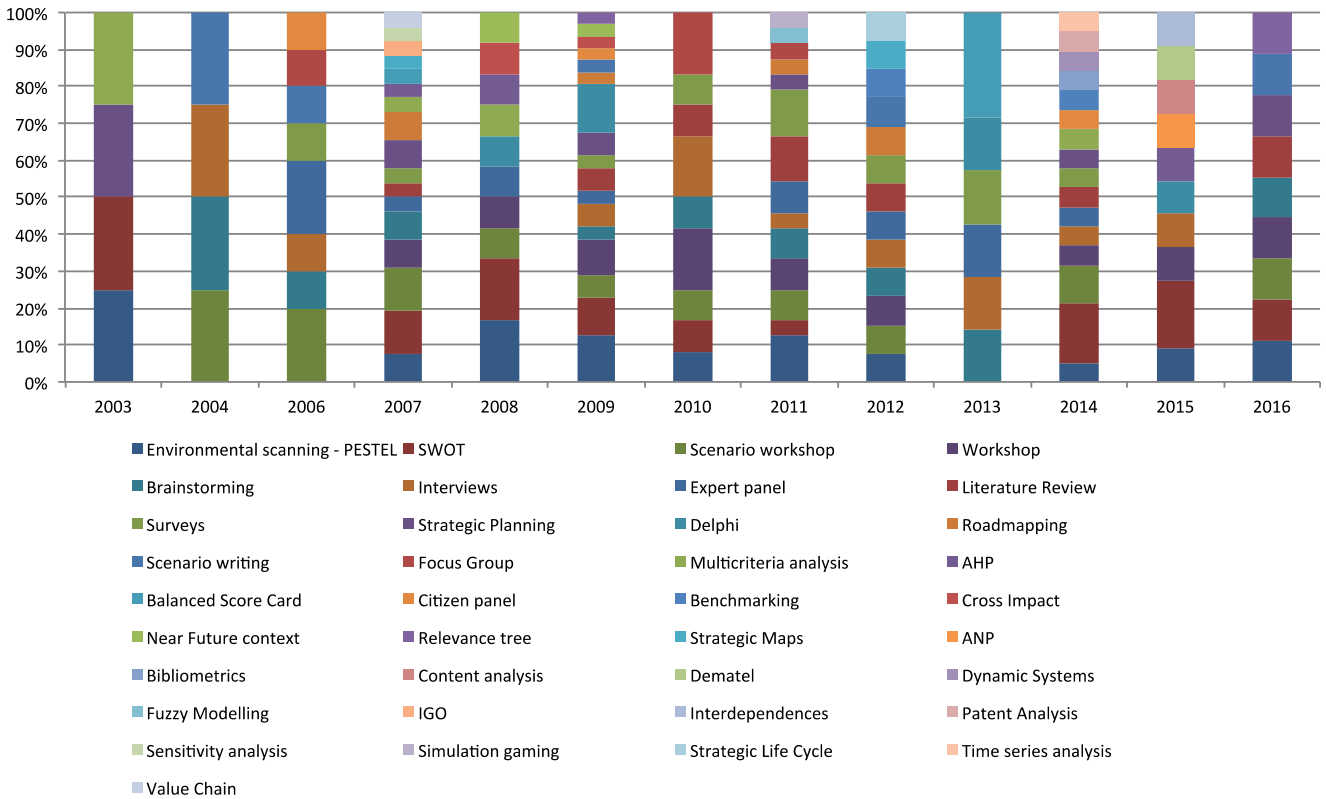


Fig. 5 Distribution of FTA methods per year

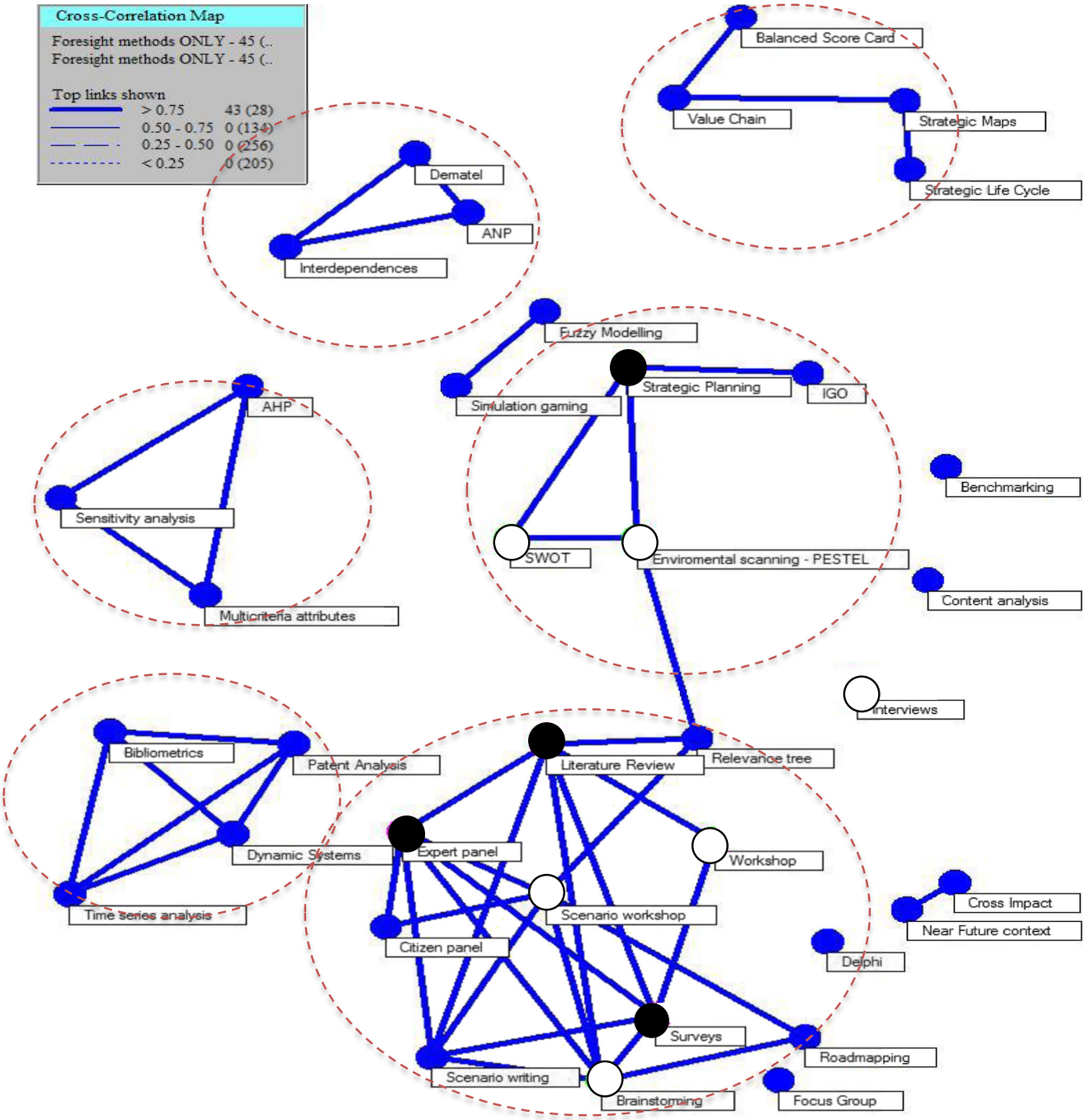


Fig. 6 Relationships between foresight methods

In the evaluation phase, the expert opinion family was again the most used, followed closely by descriptive and matrices and decision methods families. SWOT was the most used method in the evaluation phase, followed by PESTEL.

The wide use of expert opinion in planning and evaluation phases suggests that FTA is being used to collect and deliberate different points of view, as pointed out by Eerola & Miles [12], and Loveridge [49]. These viewpoints are useful both in designing e-Government strategies and in providing feedback on them - and are less relevant to the implementation process.

Outputs and issues of results of the FTA process in e-Government initiatives

Figure 8 shows that the typical formal outputs of the FTA process for helping policy-making were also found in this study: policy recommendations, strategies, scenarios, roadmaps, priority lists, action plans, and research agendas.

Some of the priority lists were part of broader strategies, research agendas, and roadmaps. The vast majority of the strategies established goals and ways of measuring progress

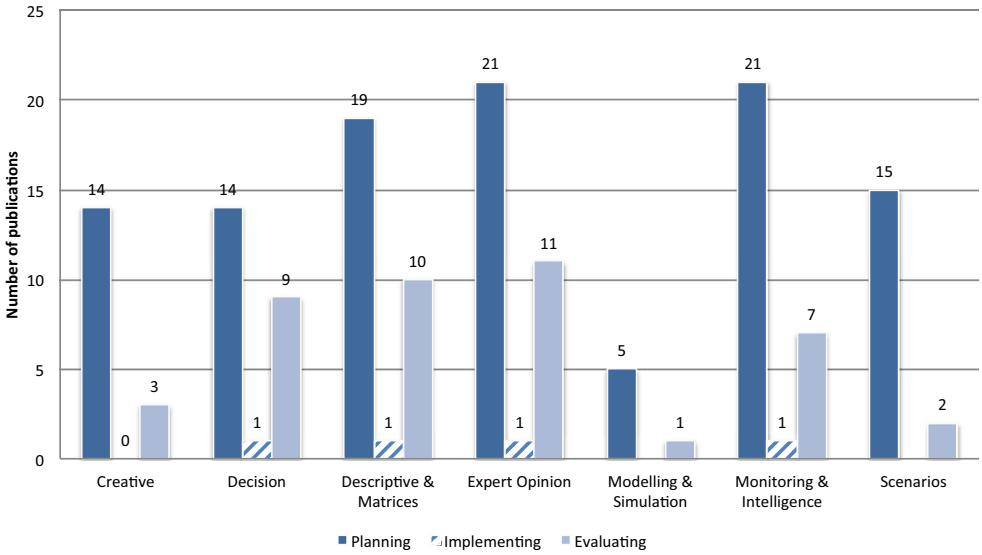


Fig. 7 Families of methods of FTA across Phases of e-Government initiatives

towards them. Some of the strategies also outlined SWOT analysis or lists of barriers or challenges, which could affect e-Government initiatives.

Four subjects featured most frequently in these outputs - issues of ICT, training, participation, and context.

Figure 9 also shows that 2007 and 2012 were the most prolific years in terms of the number of e-Government initiatives discussing these four topics. Although the set of documents in review is pretty small, these peaks are in line with the time sequence analysis done by Alcaide-Muñoz et al. [107] related to a gradual increase in the number of studies on e-Government published in international journals. ICT and training issues were the most discussed topics: this is in line with the trends in e-Government development identified in previous studies [56, 112, 113]. However, it is striking that participation issues were the least discussed, with only around 20% of e-Government initiatives discussing this issue each year.

Figure 10 shows a network diagram of relations between the most frequent 40 keywords used in the publications' abstracts, identified by VantagePoint software using its Natural Process Language technique [58].

The nodes in the network diagram (Fig. 10) represent the number of papers using these keywords, while the extent to which two keywords co-occurred in the same papers comprises the links. This visualization of the keywords network displays the links featuring distance correlation more than 0.5 among terms.

Figure 10 suggests that there are four groups of keywords. One is related to government and policy: for instance, governance, public policy, public sector, etc. Another group relates to ICT, e-Government and services: i.e. ICT, e-Government, e-Government services, services. A third relates to outcomes, and stakeholders: it includes impact, applications, citizen, success factors, and adoption. The final group involves long-term strategy keywords, such as strategy, futures study, and strategic plan. The first two groups are similar to those found in two recent studies: Yusuf et al.'s systematic literature review of e-Government research (based on the most established conferences on e-Government (ECEG) and (ICEG) and on the usual journals in e-Government [57], and Alcaide-Muñoz et al's bibliometric analysis of the thematic evolution of the e-Government field [107].)

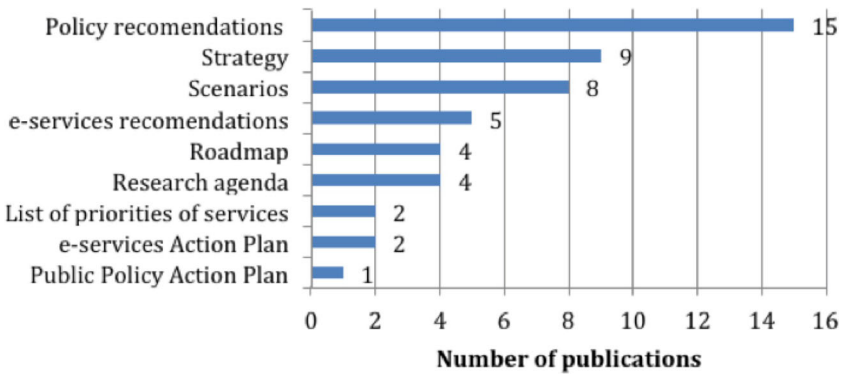
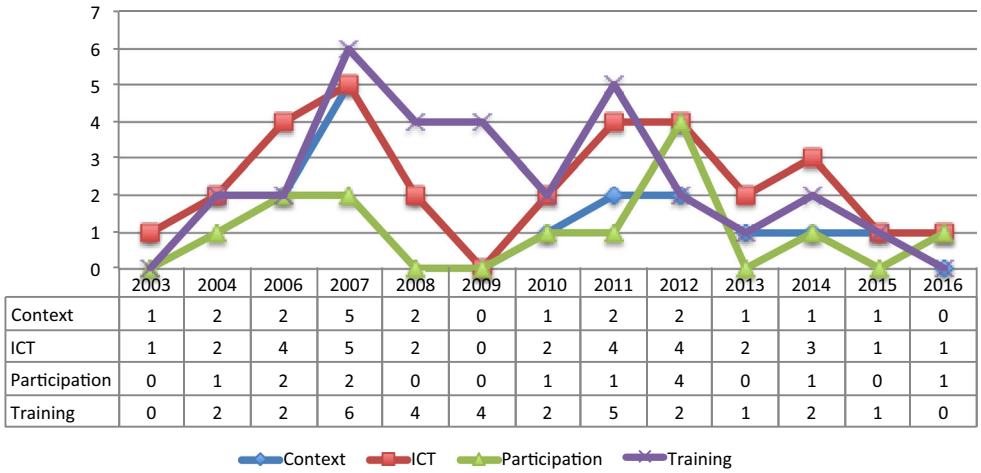


Fig. 8 Type of outputs in e-Government initiatives



	2003	2004	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Context	1	2	2	5	2	0	1	2	2	1	1	1	0
ICT	1	2	4	5	2	0	2	4	4	2	3	1	1
Participation	0	1	2	2	0	0	1	1	4	0	1	0	1
Training	0	2	2	6	4	4	2	5	2	1	2	1	0

Fig. 9 Main topics discussed in FTA-based e-Government initiatives per year

The emergence of these distinct sets of topics suggests that there are studies in this sample of publications related to e-Government and FTA that have substantially different foci of attention.

The biggest cluster of keywords concerns issues such as stakeholders, citizens, adoption and impacts. The most often-mentioned keyword is e-Governance itself, at the core of a cluster of keywords on similar themes, including ICT (thus suggesting that the focus is on transformation of government activities in general). This is linked to other major keywords at the core of the biggest cluster (as just described), and to a cluster with more mention of public service, public sector and organisation issues; innovation also fits in this cluster, which may signify that these are publications with more focus on the process of transformation in specific areas of activity.

Analysing these previous keyword groups per level of income and per year, as shown in Fig. 11, the keyword group related to ICT in government is the one which is most often mentioned in all of the types of level of income per country. The group related to Outcomes, Stakeholders and Participation is in second place, in the case of high, lower-middle and low-income level countries.

This group comes third in the case of the upper-middle income level countries, for whom second place was taken by the group related to long term and strategy issues. Figure 12 shows that the number of publications, which described these four keyword-groups, increased across time especially between 1998 and 2009.

Figure 12 also shows that the Outcomes, Stakeholders and Participation group was in second place in use in abstracts each year. This finding is in contradiction with the previous finding where as mentioned only around 20% of e-Government initiatives discussing this issue each year.

However, Fig. 12 also shows that between 2006 and 2012, this group was very active in terms of the number of e-Government initiatives. This finding is in line with the sub-period pointed out by Alcaide-Muñoz et al. [107] when the focus of e-Government studies was related to how ICT can support more efficient communication and the participation of informed citizens and other stakeholders in public decision-making matters.

Stakeholder engagement in FTA-based e-Government initiatives

What stakeholders were involved in these FTA processes for shaping e-Government initiatives? As Fig. 13 shows, government stakeholders were the most often consulted; followed by those from academy and industry. Citizens and non-governmental organizations were relatively rarely consulted. So, while some advantage was taken of the scope for FTA exercises to involve a wide variety of stakeholders [36], this variety remains constrained.

The expert opinion family was most often used for involving stakeholders; the descriptive and matrices, and the monitoring and intelligence families were not far behind (Fig. 13).

The share of citizens and NGOs in activities is highest when scenario methods are being employed. This may mean that these are tools that can be used fairly readily to broaden the extent of participation in FTA.

There is scope for establishing how to use such methods to engage these wider groups of stakeholders. The e-Government initiatives have not taken advantage of the all of the features of participatory FTA methods. The lack of user involvement – regardless of whether a user is a civil servant, a citizen or another stakeholder - may signify lack of awareness of the importance of taking user requirements into account.

Conclusions

The discussion above has only given a flavour of the sorts of result that the sort of systematic literature review presented here can provide. Likewise, space constraints mean that we

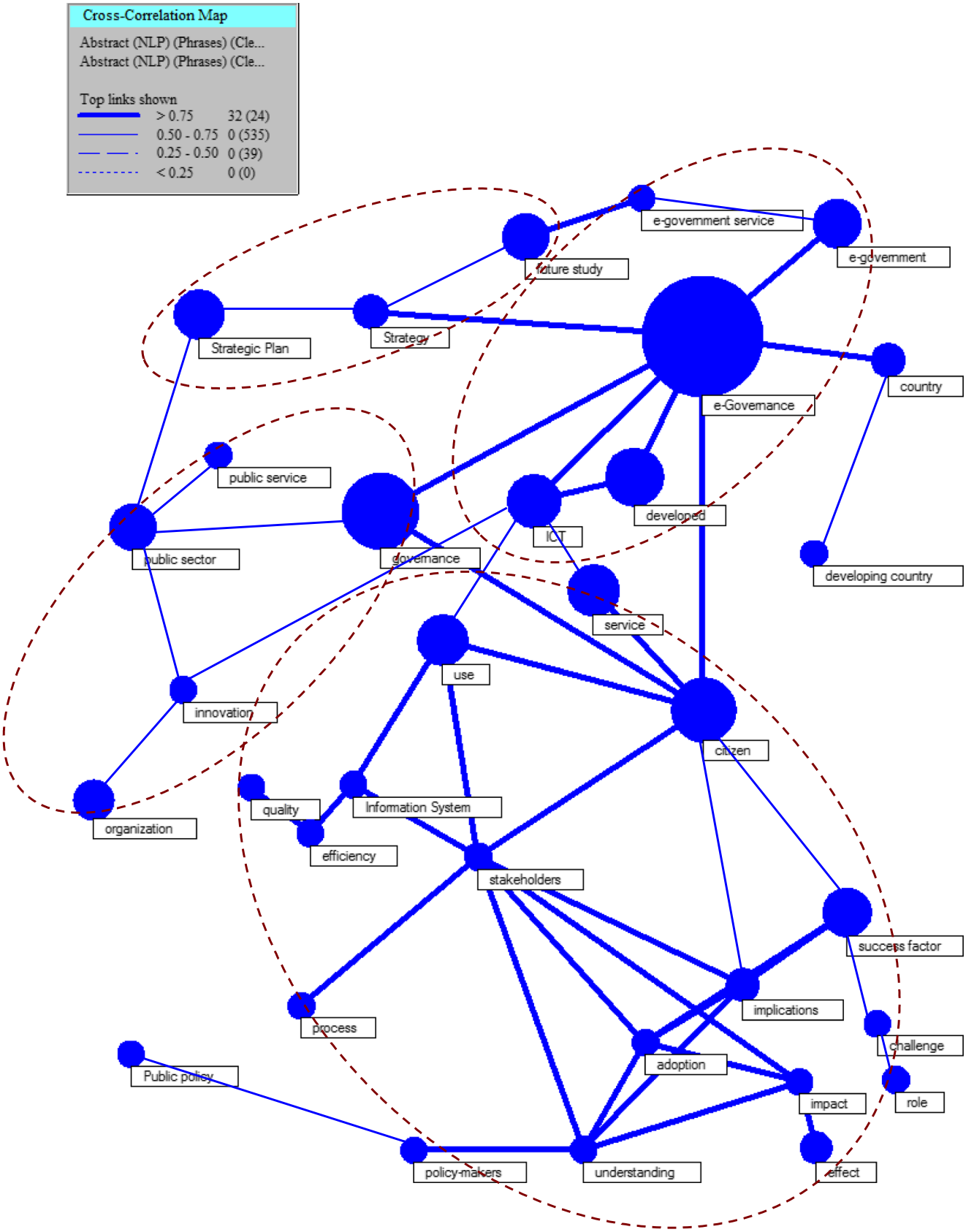


Fig. 10 Keywords network based on use of terms in Abstracts

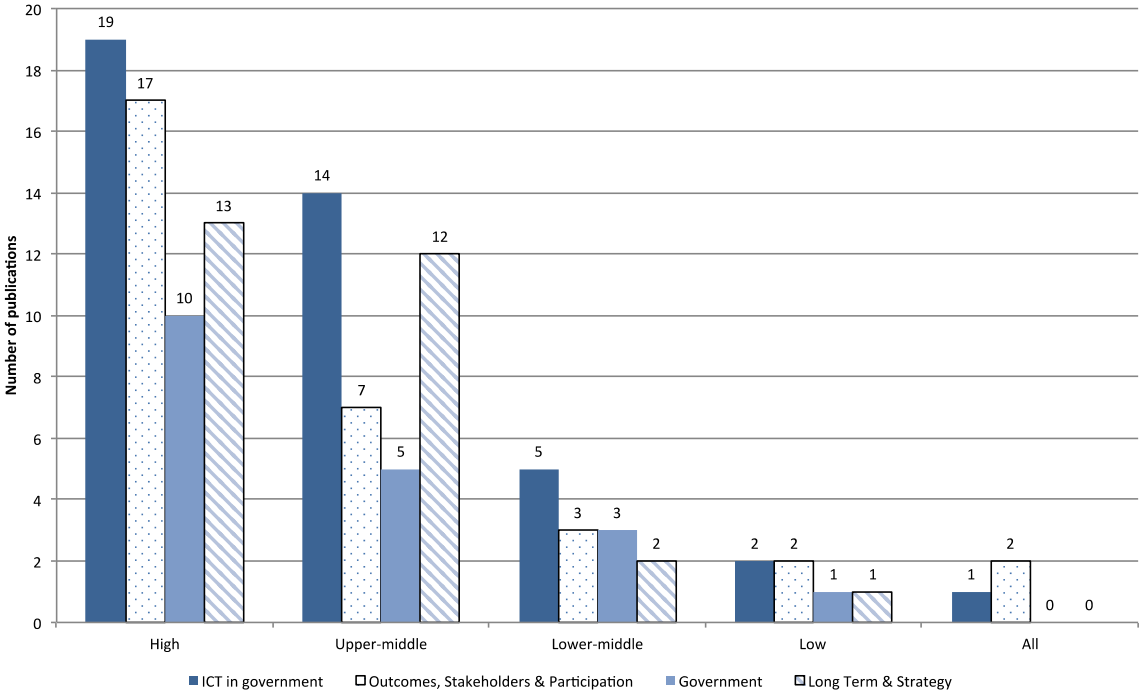
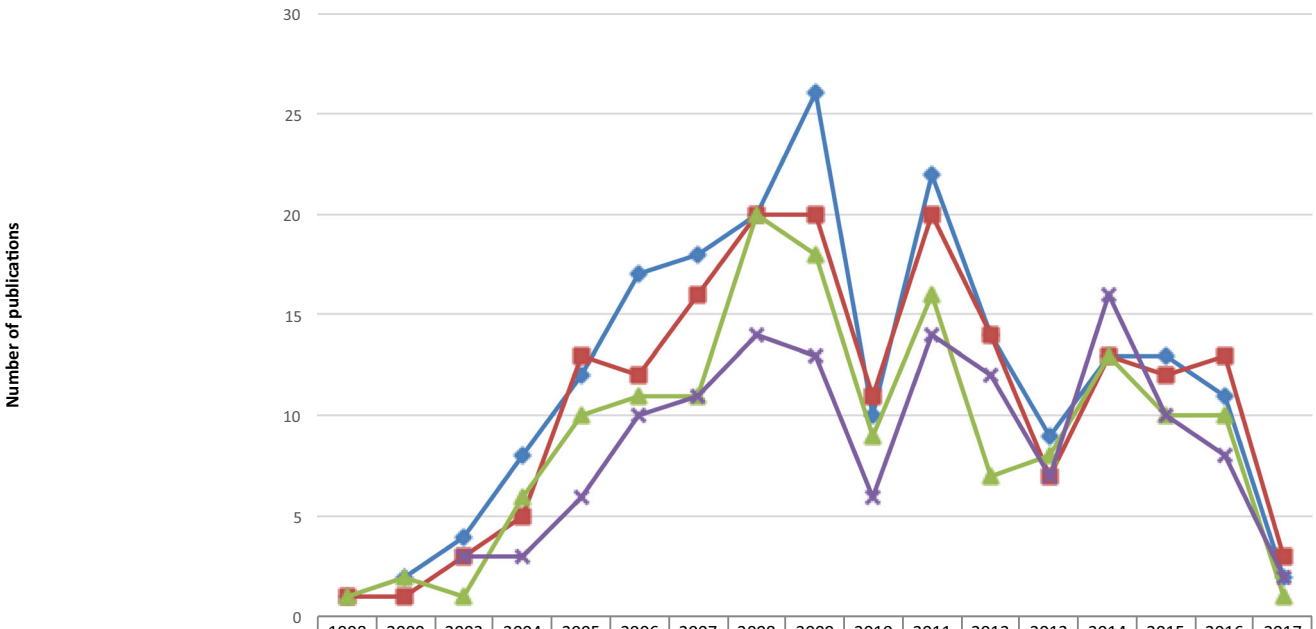


Fig. 11 Keywords groups based on use of terms in Abstracts per level of income

here give only a brief summary of findings and overview of implications of the study.

Before setting these out we must acknowledge that a major limitation of our analysis if the restriction of our search strategy to works in the English language. As a referee has helpfully pointed out, governmental Foresight activities will generally be primarily oriented to national audiences, and thus reported in local languages. What gets reported in English will



	1998	2000	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
ICT in Government	1	2	4	8	12	17	18	20	26	10	22	14	9	13	13	11	2
Outcomes, Stakeholders & Participation	1	1	3	5	13	12	16	20	20	11	20	14	7	13	12	13	3
Government	1	2	1	6	10	11	11	20	18	9	16	7	8	13	10	10	1
Long Term & Strategy			3	3	6	10	11	14	13	6	14	12	7	16	10	8	2

Fig. 12 Keywords groups (based on use of terms in Abstracts) per year of publication

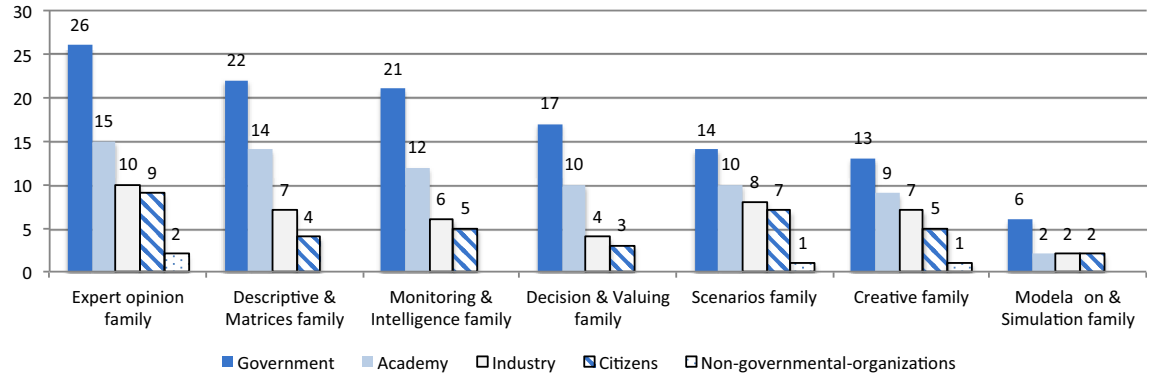


Fig. 13 Families of FTA methods per stakeholders

be fairly selective, and some work on e-Government may have been missed. Future research should seek to reach beyond the English language, and perhaps be informed by a survey of relevant governmental actors. We can only speculate as to whether our results would be much affected by such efforts.

This literature review found very few studies reporting on the use of FTA by e-Government initiatives in Scopus and in the English language. This finding is unexpected given that FTA studies have been often applied to ICT issues, and sometimes to Public Administration and more general political affairs [105]. Further research could set about identifying the reasons for this situation, and how it could be remedied. Are policymakers assuming that their own ways of working are somehow different from (or above) those of the many other fields where FTA is employed to help guide decisions about the use of technology?.

When it is applied, FTA has been shown to be mainly used in the planning phase of e-Government initiatives. This is encouraging, in that the literature points to inadequacies in strategy as a cause of e-Government failures [7, 9, 10, 26–28]. But whether the application of FTA really made a difference in these cases remains another question for further research. To the extent that it has, we might learn from the methods used, and make the case for more general application of these approaches. When it has not, there is the matter of whether this reflects inherent limitations of current FTA approaches, or forces it simply result from poorly implementation of FTA?

Whatever is the case, e-Government practitioners need to focus more on the design of long-term visions for their initiatives. FTA is a tool that can support this activity, and it should be of value to examine earlier efforts to apply this approach.

Practitioners will want to know the quality and utility of the outputs generated in these FTA-based e-Government initiatives. To further research this will probably require evidence going beyond the sorts of document studied here. There is scope for research covering documentary sources beyond those captured in Scopus. This might include reports from national foresight programs and e-Government projects (most of them likely to be written in national languages for decision-making purposes), and masters' dissertations and doctoral theses (which may also be written in a variety of languages). Some of these sources are transitory or grey literature, and some are inadequately archived. Non-English language materials will require translation (or some other common language being used). Such a wider range of documents might simply confirm our main results, above, but might point to other, perhaps different, applications of FTA for supporting e-Government initiatives. Interviews and surveys may be required, however, to fully understand the use and usefulness of FTA in this field, especially for policy-makers who belongs to different levels of government. In this study, the convenience and limitations of FTA in e-Government also emerges as a further research topic, for which it could be useful to design interviews and surveys for FTA experts.

A wide variety of FTA methods were brought to bear in those e-Government initiatives studied here. Of the 37 methods documented, there was a tendency to prefer the family of expert opinion methods. This may reflect this family's participatory aspects, and the comparatively low costs of many of its methods. Conversely, the modelling family was least preferred - possibly its high costs outweighed its power in the analysis of large volumes of data.

Typically, several FTA methods were used in combination. (The average number of FTA methods per study was remarkably similar to that found in studies of FTA in general [103, 105]). The relationships found between FTA methods in this study raise questions for further analysis, in which could help address a question commonly confronted by FTA practitioners - what combinations of methods will be most suitable in specific circumstances?

Finally, the review found a low level of involvement of citizens and non-governmental organizations in FTA applied to e-Government. This result echoes criticisms of e-Government initiatives more generally. FTA practitioners should examine the causes of this low level of engagement, and explore ways in which more stakeholders can be constructively involved. Policymakers should also be encouraged to

take action in order to increase engagement. The aim is not just to confer greater legitimacy on the FTA: it can lead to a better understanding of citizens' demands (once understood, they can then be better addressed), and help realise the objective of a citizen-centred government.

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