Jani Kauppinen

CHARACTERISTICS OF PUBLIC SECTOR IT-PROJECTS

UNIVERSITY OF JYVÄSKYLÄ
FACULTY OF INFORMATION TECHNOLOGY
2018

ABSTRACT

Kauppinen, Jani
Characteristics of public sector IT-projects
Jyväskylä: University of Jyväskylä, 2018, 39 p.
Information Systems, Bachelor's Thesis
Supervisor: Seppänen, Ville

Organizations are often divided as being either public or private. Economy is also divided into public and private sectors. Whether significant differences in operations exist between the sectors is not certain: there are views both for and against these differences in literature. If such differences do exist, then they could, for instance, hamper method adoption between the sectors. Some methodologies, like Agile ones, have proven their functionality in a private context, but remain unresearched in a public context. Still, their utilization in a public context has begun due to their alluring success in the private sector. This study aims to define the characteristics of public sector information technology projects, so that these characteristics could be taken in account in method tailoring. The study is conducted as a literature review. 15 characteristics are found in the literature, of which 11 characteristics mentioned more than once are more closely analyzed. Connections between the individual characteristics are formed, and a whole-picture presentation is created. Finally, groups of mutually connecting characteristics are identified. Through these groups, or superset-characteristics, the individual characteristics role in the complex web of connections is further understood, and a higher-level understanding of multivariate influential phenomenon in a public context are formed. The results, limitations of the study and future research ideas are then discussed.

Keywords: public sector, information technology, project, characteristics

TIIVISTELMÄ

Kauppinen, Jani
Characteristics of public sector IT-projects
Jyväskylä: Jyväskylän yliopisto, 2018, 39 s.
Tietojärjestelmätiede, Kandidaatintutkielma
Ohjaaja: Seppänen, Ville

Organisaatiot jaetaan usein julkisiksi ja yksityisiksi. Talous jaetaan myös julkiseksi ja yksityiseksi sektoriksi. Ei ole yksimielisyyttä siitä, onko sektorien välillä merkittäviä eroja niissä toimimisen kannalta. Jos tällaisia eroja on olemassa, ne voivat vaikuttaa haitallisesti esimerkiksi menetelmien siirrossa sektorien välillä. Jotkin menetelmät, kuten ketterät menetelmät, ovat osoittaneet toimivuutensa yksityisellä puolella, mutta niitä ei ole tutkittu julkisessa kontekstissa. Tästä huolimatta niiden käyttö on aloitettu julkisella puolella niiden onnistuvuuden tuoman houkuttelevuuden ansiosta. Tämän tutkimuksen tavoitteena on selvittää julkisen sektorin informaatioteknologisten projektien piirteitä, jotta niiden huomiointi onnistuu menetelmien räätälöinnissä. Tutkimus toteutetaan kirjallisuuskatsauksena. 15 piirrettä löydetään, joista 11 vähintään kahdesti mainittua analysoidaan tarkemmin. Piirteiden väliset yhteydet selvitetään, ja niistä luodaan kokonaiskuva. Piirteiden joukot, joissa kaikki piirteet liittyvät toisiinsa, selvitetään. Näiden joukkojen kautta yksittäisten piirteiden merkitys monimutkaisessa verkostossa selkenee, ja julkisella sektorilla vaikuttavia korkeamman tason monitekijäisiä ilmiöitä saadaan selville. Tutkimuksen tuloksia, rajoitteita ja jatkotutkimusaiheita analysoidaan.

Asiasanat: julkinen sektori, informaatioteknologia, projekti, piirteet

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1 INTRODUCTION

Organizations are often divided as being either public or private. There are many ways this dichotomy can be considered and explained, but it is important to notice that the separation can be made: some organizations are more public and some are more private, even if the methods used in the differentiation would vary (Aryee, 1992, 73).

According to the Oxford Living Dictionaries (n.d.), public sector is "the part of an economy that is controlled by the state", and private sector is "the part of the national economy that is not under direct state control." This can be considered to be the general view, and is supported by Aryee (1992, 73) as well.

Public sector is a prominent user of information technology. Many governmental services today are being digitized - for instance, citizens can do business with governmental agencies through the internet. Investments on information technology also improve governmental efficiency: increasing the state CIO budget with a dollar decreases state expenditure overall by $3.49 (Pang, Tafti & Krishnan, 2015, 1020).

New information technology is often developed in projects. According to Caudle, Gorr and Newcomer (1991, 183-184), concrete management problems, or the things which solving is perceived as mandatory for projects success, are mostly the same in public sector as in private sector, but that there are some differences. Ward and Mitchell (2004, 284) replicated this in their study's results as well. Therefore, the critical success factors of both public and private projects can be considered as being similar.

The spark for this research was the success of Agile methods in the private sector. "Agile" is an umbrella term for development methods which emphasize principles published in the Agile Manifesto (see Beck et al., 2001). They have noticeably larger success rates than projects utilizing traditional methods (Standish Group, 2015 through Hastie & Wojewoda, 2015; Serrador & Pinto, 2015, 1047). Their utilization is also beginning in a public context: for instance, their usage was included in the Finnish governments information system procurement guidelines in 2015 (JUHTA, 2015).

However, there has been no research about Agile methods in a public context according to public sectors unique operating principles (Fernandes, Alencar, Schmitz, Silva, Stefaneas, 2016). There are two viewpoints in the literature on whether the innate characteristics of the sectors differ and have significance in operations: there are those who argue that the differences are negligible and do not affect operations in any way, and there are those who claim that the differences are noticeable and affect operations greatly (Aryee, 1992, 74; Ward & Mitchell, 2004, 300). The divide has no clear winner: neither viewpoint is provably, objectively right. Preliminary results of Gasik (2016) imply that public and private projects are perceived to be different, perhaps completely so, with no shared "common ground" between them, but they do not answer whether these differences have a significant effect.

The importance of aligning methods of operation according to projects environment is highlighted by Shenhar and Dvir (2007), as summarized by Patanakul, Kwak, Zwikael and Liu (2016, 435). They propose a project management model, where "project management approaches should be utilized contingently to the project characteristics." If differences between the sectors exist and are significant, then neglecting them could do harm in method adoption, as a method found to be functional in one sector would not work the same way in a different environment. Therefore, under the precautionary principle, in this research the differences are thought as existing and affecting method transfer greatly.

To adapt methods for a given environment, it is necessary to first define its characteristics and understand their significance. Therefore, to adapt methods from a private context to a public context, the characteristics of public sector IT-projects need to be defined. As such, this study aims to answer the following research questions:

- What characteristics do public sector IT-projects have?
- How do these characteristics affect operations in a public context?

2 RESEARCH METHOD

In this section the methods used as the basis of the research are discussed. The research questions will be solved via the means of a systematic literature review. With a large, systematic mapping of characteristics in literature concerning public sector IT-projects the most commonly manifesting ones can be identified. As this study is interested in characteristics, which are most definitely subjectively inferred and defined, the literature concerned in them can be thought of being mostly formed via hermeneutic, inferring methods. As such no inference of our own is going to be attempted, as inferring already inferred content seems to be a rather questionable practice, possibly leading to an effect similar to the "broken phone."

2.1 Search criteria

Search criteria of source material will be following:

- The source must be a peer-reviewed academic article.
- The article must have been published in a publication which has a rating of 1 or higher in the Federation of Finnish Learned Societies Publications Forum (JUFO), or if the publication has not been assessed, then the article must have received a numerous amount of citations: at least 25 per year since its publication.
- The article must have a sound scientific basis, which is considered to be fulfilled if there are at least 15 scientific sources listed in the articles bibliography.
- The article must have been published in 2007 or afterwards. Articles picked from other articles bibliographies were exempt from this.
- The article must be written in English or Finnish
- The full text of the article must be available from the University of Jyvaskyla's network

- The article must be relevant to the topic of the research. This is assessed through the articles title, abstract and/or keywords.

Other relevant sources, like laws and statistics, can be used in the introductory section of the research and in the discussions of the results, but are not to be included in the literary analysis. Articles which fully fulfill the given search criteria but are published before 2007 can be included if they are used in one of the primary articles.

Reason for the rather short breadth of timespan of the publications included lies in the limited time and resources granted for this study, which by necessity requires a limited scope. The easiest way to achieve this, whilst ensuring a high quality and relevancy of the potential source material, is considered to be the limitation of the articles to only those published relatively recently. Based on preliminary searches it was decided to set this limit to 2007, as this provided enough potential results, whilst keeping the number of articles manageable by the researcher.

However, the limit of publication year is lifted on the case of inclusion of a source from primary articles source material. The reason for this is the assumption that after the selection of the primary articles, the number of articles included from their sources should be small. Therefore, no limit on the time limit in these cases is deemed necessary. Also, as other articles with less strict restrictions than this one could possibly use brilliant sources published in the past, it is considered important to keep the inclusion of those possible.

As public IT-projects can be considered a subset of general public projects, then through deductive reasoning the characteristics of these projects also apply to IT-projects. Therefore, sources concerning general public projects are included in the research as well.

2.2 Databases

As the researcher lacked previous knowledge about suitable channels for finding quality sources, a small-scale research was conducted first to point out these channels. As such knowledge is fundamentally important for future research, and the choice of channels affects the material that can be potentially used in the research, it was deemed necessary to elicit these results.

From JUFO all relevant publications concerned with information systems research with the highest ranking of 3 were procured and the platforms they were indexed and available in were then listed. Eight databases were identified as containing top quality publications: ACM Digital Library, AIS eLibrary, IEEE Xplore, INFORMS PubsOnLine, ScienceDirect, Springer Link, Taylor & Francis Online and Wiley Online Library. These databases along with the publications used as a basis for their selection are listed in table 1. From these eight databases all except Springer Link were decided to be used in the main research, the

reason for the exclusion being the Link services severely limited search options, with no capability in narrowing down preliminary six-digit search results.

TABLE 1 The databases used in the research

Database	Publications	Included
ACM Digital Library	(Numerous)	Yes
AIS eLibrary	Journal of the Association for Information Systems, Management Information Systems Quarterly	Yes
IEEE Xplore	(Numerous)	Yes
INFORMS PubsOnLine	Information Systems Research	Yes
ScienceDirect	Information and Computing, Information and Software Technology, Journal of Computer and System Sciences, Journal of Strategic Information Systems, Journal of Systems and Software	Yes
Springer Link	European Journal of Information Systems, Journal of Information Technology	No
Taylor & Francis Online	Journal of Management Information Systems	Yes
Wiley Online Library	Information Systems Journal, Journal of the Association for Information Science and Technology	Yes

2.3 Search queries

The search queries for finding literature concerning the characters of public sector IT-projects, broken down into semantic subsections, are displayed in table 2. For each semantic category the focus of the search term group is also displayed. All rows are connected by an AND-operator.

TABLE 2 The search query for literature concerning public sectors projects characteristics

Topic	Focus	Search query
Public sector	Title	Public OR "Public administration" OR "public administrations" OR "Public sector" OR "public sectors" OR Government OR governments OR "Electronic government" OR "e-government" OR "Public project" OR "Public projects"
Information technology	Abstract / full text	"Information technology" OR "information system" OR "Information systems"
Projects	Abstract / full text	Project OR Projects OR "Project work"
Characteristics	Abstract / full text	Principle OR Principles OR Properties OR Difference OR Differences OR Dissimilarity OR Dissimilarities OR Characteristic OR Characteristics OR Defining OR Factor

As IEEE Xplore had a limit of 15 search terms the search query had to be modified. The query used for literature concerning public sector is displayed in table 3.

TABLE 3 The search query for literature concerning public sector projects characteristics on IEEE Xplore

Topic	Focus	Search query
Public sector	Title	Public OR "public administrations" OR "Public sector" OR Government OR "e-government" OR "Public projects"
Information technology	Abstract / full text	"Information technology" OR "Information systems"
Projects	Abstract / full text	Projects
Characteristics	Abstract / full text	Principles OR Properties OR Differences OR Dissimilarities OR Characteristics

In case the amount of articles resulting from a single database exceeded the researches capabilities in assessing them, which was the case when the amount was getting close to or exceeded 100, then the focus of the search was decided to be narrowed in a suitable way according to the researchers best judgement. All such cases were naturally documented to ensure the repeatability of the research and openness of the research method.

2.4 Progress of the search process

First phase of the search was performing the searches in the selected scientific databases using the queries listed above, filtering the results by year and if available by availability and by status of the articles peer-reviewedness. On the second phase results which did not satisfy the search criteria stated above were excluded from the review. On the third phase the abstracts of the remaining articles were read, and ones deemed irrelevant for the study were yet again excluded from the review. The articles which remained after this phase were read thoroughly, and if they contained usable information concerning this study the characteristics mentioned in them were listed in the final results. Otherwise the article was yet again excluded from the review. After this final elimination, more potential sources were included from the remaining articles bibliographies. They were then subjected to the same process of elimination, with the only difference being the assessment of their publication year, which, as stated above, could now have been before 2007.

2.5 Analysis of the results

The following factors were extracted from the articles assessed, when applicable: the type of the study (case, theoretical model, etc.), the amount of statistical

units assessed and countries involved in the study. Characteristics of public projects were categorized dynamically as they manifested in the literature.

3   SEARCH AND RESULTS

In this chapter, the actualized search and it results are presented. First, the search and assessment process of articles is elaborated. Then the characteristics found from the criteria-filling articles are displayed.

3.1   Actualized search

The search was conducted very uniformly across the different scientific data-bases, as only one of them required narrowing the focus of one category of search terms due to a very large number of articles produced by the initial search. The actualized searches in each of the databases, along with initial results, are displayed in table 4.

TABLE 4 Actualized searches and numbers of search results by database.

	ACM DL	AISeL	IEEE Xplore	PubsOnLine	ScienceDirect	Taylor & Francis Online	Wiley Online Library
Public	Title	Title	Title	Title	Title	Title	Title
IT	Abstr.	Abstr.	Abstr.	Full text	Abstr.	Full text	Abstr.
Project	Abstr.	Abstr.	Abstr.	Full text	Abstr.	**Title***	Abstr.
Char.	Abstr.	Abstr.	Abstr.	Full text	Abstr.	Full text	Abstr.
Filters	-	Peer-reviewed	-	-	Journal search	Fully accessable content	-
Year	2007	2007	2007	2007	2007	2007	2007
Results	23	4	5	11	8	40	10
*=The filtered search result from Taylor & Francis counted 1,238 articles, so a second search term was exceptionally focused on article titles in order to keep the amount of found articles manageable.							

101 articles were found. From these articles one was eliminated based on language criteria, 28 were eliminated based on quality criteria and 63 were eliminated based on deemed irrelevancy after abstract review, leaving 9 articles for further study. From these nine articles four were eliminated after full-text review as not containing any useful information concerning this study. From the remaining five articles six additional articles, which all fulfilled the search criteria, were included in the review through the primary articles bibliographies. From these six articles three were eliminated after full text review as not containing any useful information concerning this study.

All in all, the search resulted in a total of 8 usable articles, which, considering the rather limited breadth of the search with 101 potential articles returned, can be considered a satisfactory amount. The elimination process, along with the number of articles added or removed in each step, is elaborated in table 5.

TABLE 5 The progress of the search for literature concerning public sector projects characteristics.

Step	Articles included or excluded
Search	101
Language criteria	-1
Quality criteria	-28
Abstract review	-63
Full text review I	-4
Reference inclusion	+6
Full text review II	-3
RESULTS	8

3.2 Search results

The eight articles, along with their type, the amount of statistical units they possibly observed, their country of observation and their field of study are displayed in table 6. Four of the sources concerned projects in general, while the other four focused, at least partly, to information technology and information systems development.

TABLE 6 The articles found concerning public sector project characteristics

Article	Type	n	Country	Field
Patanakul, Kwak, Zwikael & Liu (2016)	Case study	39	Australia, UK, US	Infrastructure, Defence and space, IS development
Pang (2017)	Case study	135	US	IT projects
Wagner & Antonucci (2009)	Case study	1	US	ERP implementation

TABLE 6 (continues)

Gomes, Yasin & Small (2012)	Questionnaire - Theoretical	102	Portugal	General
Wells & Bullen (2008)	Case study	1	New Zealand	Health informatics
Aryee (1992)	Questionnaire	262	Singapore	General
Caudle, Gorr, Newcomer (1991)	Questionnaire	354	US	General
Ward & Mitchell (2004)	Questionnaire	250	US	General

15 characteristics manifested in the literature reviewed. The manifestation of these characteristics by article is displayed in table TABLE 7 The search results for public sector project characteristics.

TABLE 7 The search results for public sector project characteristics

	Non-financial target benefits	Long product service life	Multiple stakeholders	Complexity	Political environment	Formal process	Risk aversion	Large teams	Complex financing	Country-specific differences in requirements	Customer difficult to define	High scrutiny / accountability	Less job satisfaction	Low market exposure	Technology transfer	SUM
Patanakul et al. (2016)	X	X	X	X	X	X										6
Pang (2017)		X			X	X	X									4
Wagner & Antonucci (2009)			X	X	X	X	X	X	X	X	X					9
Gomes, Yasin & Small (2012)			X		X				X			X				4

(continues)

TABLE 7 (continues)

Wells & Bullen (2008)	X		X	X	X											4
Aryee (1992)			X			X						X	X			4
Caudle et al. (1991)	X		X	X	X	X	X					X	X	X	X	10
Ward & Mitchell (2004)	X		X		X	X						X	X	X		7
SUM	4	2	7	4	7	6	3	1	2	1	1	4	3	2	1	48

Overall most of the characteristics found were from articles which originated from the United States, or other Anglophonic countries: they together counted 36 out of the 48 characteristics found, 75% of them overall. The distribution of characteristics by country of origin can be seen in figure FIGURE 1.
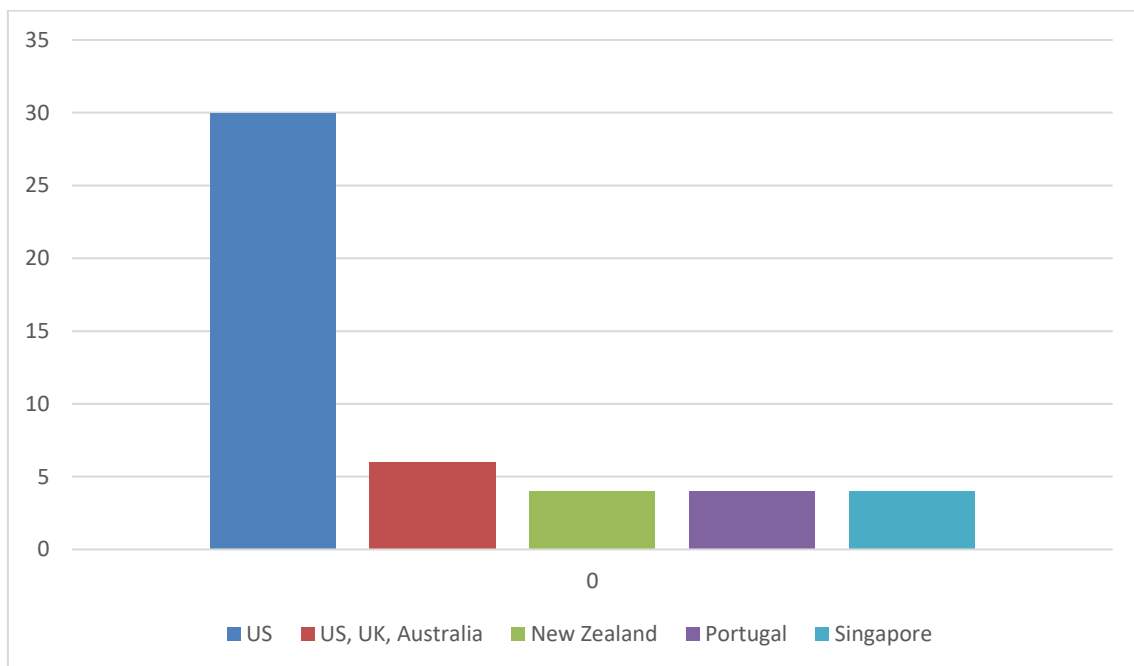

FIGURE 1 The distribution of characteristics by country

The articles can be split in half based on the number of the characteristics they contributed: half of the articles contributed four characteristics, and the other half contributed more. Individual articles number of characteristics, and there-fore their contribution to the results overall, can be seen from figure FIGURE 2.
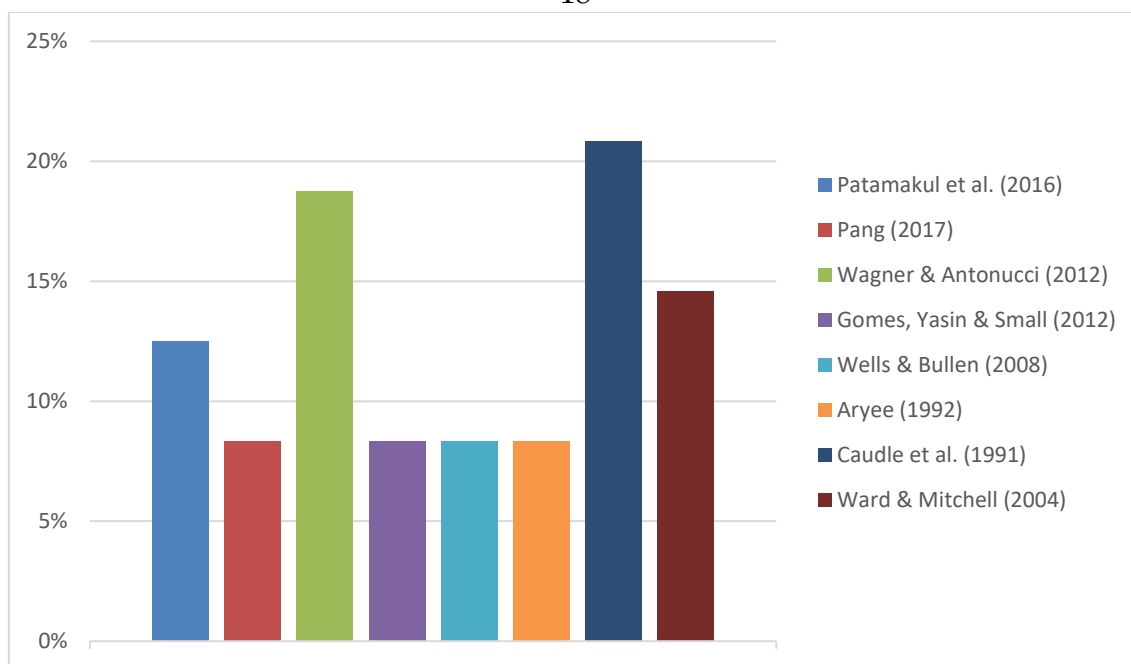
FIGURE 2 The distribution of characteristics by article

The characteristics, sorted by their frequency of manifestation in the literature, are displayed in table 8. In the next section the characteristics which were mentioned two or more times will be further analyzed.

TABLE 8 Public sector project characteristics sorted by their frequency of manifestation

Characteristic	n	%
Political environment	7	87.50%
Multiple stakeholders	7	87.50%
Formal process	6	75.00%
Non-financial target benefits	4	50.00%
Complexity	4	50.00%
High scrutiny / accountability	4	50.00%
Risk aversion	3	37.50%
Less job satisfaction	3	37.50%
Long product service life	2	25.00%
Low market exposure	2	25.00%
Complex financing	2	25.00%
Technology transfer	1	12.50%
Large teams	1	12.50%
Country-specific differences in requirements	1	12.50%
Customer difficult to define	1	12.50%

4 CHARACTERISTICS OF PUBLIC SECTOR PROJECTS

4.1 Political environment

Pang (2017, 40) studied the effects of politics on information technology investments of US government agencies and concluded that "national politics [have] a significant impact on [bureaus] IT investment profiles." Other sources also conclude that public sector is impacted and influenced by politics (Caudle et al., 1991, 171; Rainey, Backoff, Levine, 1976 through Caudle et al., 1991, 172 and Ward & Mitchell, 2004, 286; Williams & O'Leary, 2008 through Gomes, Yasin & Small, 2012, 317).

The political system was relevant in the project studied by Wells and Bullen (2008, 703), as the system was build to repair the disparity in health between the country's ethnicities, and the political environment was pressing for results. They also noted an earlier case where a public educational IT-project "was discontinued because widespread negative public and teacher perception of the system allegedly threatened success at upcoming elections" (see Myers (1994) for more).

Interestingly, Wells and Bullen (2008, 703) note that "reports of political factors influencing IT systems are uncommon," even though other literature seems to point to it having a marked effect in public projects. Maybe, because this type of effect might be hard to discern, it affects public projects in the shadows unnoticed, emerging only as failure to obtain top management support in later analysis.

Top management in the public sector are political operators. Their work is politicized and measured with political means (Caudle et al., 1991, 181). They are periodically re-elected to their positions by other political operators, making their positions temporary and frequently changing (Aggarwal & Mirani, 1999 through Ward & Mitchell, 2004, 292; Caudle et al., 1991, 181; Rainey et al., 1976 through Ward & Mitchell, 2004, 286; Wagner & Antonucci, 2009, 278).

Due to this frequently changing composition it is more difficult to obtain long-term top-management commitment (Wagner & Antonucci, 2009, 278). This is made even more difficult by the fact that they are driven by short-term views of their own political agenda, rather than the beneficial management of a project (Patanakul et al., 2016, 459; Caudle et al., 1991, 181; Bozeman & Bretschneider, 1986 through Ward & Mitchell, 2004, 292).

Overall the periodically changing management interferes with the agencies long-term plans (Rainey et al., 1976 through Ward & Mitchell, 2004, 287). There are multiple ways this can happen. The politicized top management has power over projects funding and continuation (Pang, 2017, 35; Dilts & Pence, 2006 through Gomes et al., 2012, 317). The funding and execution of public projects are subject to scrutiny of external political stakeholders as well (Gomes et al., 2012, 315). Patanakul et al. (2016, 459) also consider funding and continuations as important threats in public projects, but unlike other sources don't see them as political. However, considering the evident political role public top management has, then decisions about funding and continuation can be considered being politically charged as well.

Failures can be used as leverage against the opposing party, if the bureaus and the ruling party's ideologies don't coincide (Pang, 2017, 37). Therefore, the success of a project might not always be the best possible outcome for the people who are elected to be in charge of them. This is made especially noteworthy due to public top managements periodically changing composition and power over project continuation, as discussed above.

Also, "reinventing the wheel" might happen when the newly elected powers start to define criteria suitable for their own needs, as described by Caudle et al. (1991, 173) in the case of basic data element definitions (meaning, for instance, "as welfare recipient classes change, components are added or subtracted to tax bases.")

Given such ample evidence it is hard to come up with arguments why political environment might not be characteristic of public sector projects. The one article that lacked this characteristic was Aryee (1992), and in their case the lack of this characteristic could be explained by their notion of public organizations being "societally owned." This could be considered as covering the political aspect, as society through a political process decides who gets to be in charge, decide about funding, et cetera.

4.2 Multiple stakeholders

Public projects include numerous stakeholders, both internal and external to the organization, from both public and private sectors, and with possibly conflicting interests, expectations and goals (Aryee, 1994, 74; Caudle et al., 1991, 184; Torres & Pina, 2004 through Gomes et al., 2012, 315; Zwikael, Pathak, Singh & Ahmed, 2014 through Patanakul et al., 2016, 458). Examples could be political interest groups (like parties or activist movements), other public organizations,

private organizations, financing facilities or overarching actors like the EU or UN. These stakeholders can also affect the project in numerous ways: for instance, politically, socially or financially (Patanakul et al., 2016, 458).

The project studied by Wells and Bullen (2008, 702) contained personnel from many different fields: project management personnel, solution vendors, medical practitioners, IT developers and members of the government. Especially the private medical practitioners can be considered being in direct competition with each other.

There is also more interdependence between organizational units of public sector organizations (Bretschneider, 1990 through Ward & Mitchell, 2004, 286). These organizational units might also have their own competing goals (Thomas & Jajodia, 2004 through Wagner & Antonucci, 2009, 277).

Due to the number of stakeholders and their multitude of differing and mutually conflicting needs, it might be very hard to find solutions that are satisfactory for all parties involved. This is made even more difficult by the fact that the goals of government projects might be intangible, in which case their utility for parties that question their benefit might be very hard to prove, even though it might concern other ones greatly. Intangible benefits are discussed further in section 4.4.

4.3 Formal process

Public projects have a highly mandated work environment. There are legal and formal regulations and standards in how operations, like budgeting, are to be performed (Aryee, 1992, 74; Caudle et al., 1991, 171; Patanakul et al., 461; Rainey et al., 1976 through Caudle et al., 1991, 172 and Ward & Mitchell, 2004, 286; Wagner & Antonucci, 2009, 278). According to Ward & Mitchell (2004, 286) "customers and clients are selected by legislative and political processes rather than the market." This can be seen in the case of United States, where utilization of the Program Office is required when contracting projects to industry (Wagner & Antonucci, 2009, 277-278). Because of the high amount of regulation, managers have less power over decisionmaking (Rainey et al., 1976 through Ward & Mitchell, 2004, 286). This makes them have less control over their work, and their role as managers as more akin to a referee keeping sure the rules are followed.

4.4 Non-financial target benefits

Non-financial target benefits in public sector are summed up by Patanakul et al. (2016, 455) followingly:

> "Whereas private sector projects are driven by profit maximization and return on investment, government projects are not-for-profit and funded to make efficient use of tax resources, and increase social and democratic values, such as equality, openness, and transparency. As a result, government projects often target non-financial benefits. They are undertaken in the service of the public (for the public good), rather than being driven by revenue or profit."

The notion of public projects being run for the sake of "public goods" is supported by other literature as well (Caudle et al., 1991, 171; Rainey et al., 1976 through Caudle et al., 1991, 172 and Ward & Mitchell, 2004, 287; Savas, 1982 through Caudle et al., 1991, 172). Lack of financial goals and focus on public good was evident in the project studied by Wells and Bullen (2008, 701), where the purpose of the system developed was the fight against Hepatitis B. Bretschneider (1990) through Ward and Mitchell (2004, 286) also notes that in the lack of monetary incentives other, non-financial benefits are used to measure the state of a public organizations technological state. Rainey et al. (1976) through Ward and Mitchell (2004, 287) also noted that public organizations use different kinds of measurement criteria in achieving their competing goals.

The "public goods" produced by the public sector are "for problems that should be solved (like crime and poverty), even though these problems may have no known feasible solutions" (Caudle et al., 1991, 171). These goals are also conflicting and intangible (Caudle et al., 1991, 171; Downs & Larkey, 1989 through Caudle et al., 1991, 172; Rainey et al., 1976 through Caudle et al., 1991, 172). One example could be the freedom of speech and the safety of a state: if freedom of speech is not suppressed, then radical elements can establish themselves publicly, potentially causing unrest. Restricting freedom of speech might be considered as a violation of human rights, but it eliminates the risk of radical groups gaining public support. Indeed, one could argue that the censorship in Russia and China are established as much for the sake of public good as the guarantied freedom of expression in the west. They are just two sides of the same coin, or different faces of a multi-faced dice, trying to answer a problem with no one right solution.

While the long-term goals of public organizations would be intangible, progressing the public good, these organizations still have their day-to-day management functions which needs are most likely very concrete, financially measurable and similar to those of any other organization. Therefore, maybe not all projects in the public sector need to be considered as immediately serving the public good, even though they might be doing so indirectly by enhancing the operations of the public organization.

4.5 Complexity

"Complexity" is a complex word which might mean different things to different people. According to the Oxford Living Dictionaries (n.d.), complexity is "the

state or quality of being intricate or complicated." It could also be defined as a "mess" that is hard to untangle and comprehend. In this section it is expected that when talking about complexity, this kind of phenomenon is meant.

Public sector projects are structurally complex (Patanakul et al., 2016, 457; Wagner & Antonucci, 2009, 278). Most of the projects studied by Patanakul et al. (2016, 459) were highly complex, as measured by a framework of Shenhar and Dvir (2007). Complexity was also present in the project studied by Wells and Bullen (2008, 703). Public organizations have many organizational units with their unique operating principles (Thomas & Jajodia, 2004 through Wagner & Antonucci, 2009, 277). These units also have higher interdependence between each other (Bretschneider, 1990 through Ward & Mitchell, 2004, 286). High amount of interdependent organizational units makes their integration difficult (Wagner & Antonucci, 2009, 277).

Complexity in public sector is not only caused by structrural factors, but also by the intangible, conflicting nature of its goals (Rainey et al., 1976 through Caudle et al., 1991, 172). This connection, along others, is further analyzed in section **Error! Reference source not found.**.

4.6   High scrutiny / accountability

Government projects are subject to scrutiny from external entities (Aryee, 1992, 74; Bretschneider, 1990 through Ward & Mitchell, 2004, 286; Gomes et al., 2012, 317; Rainey et al., 1976 through Caudle et al., 1991, 172 and Ward & Mitchell, 2004, 287). This is because of their increased pressure for accountability (Aryee, 1992, 74; Rainey et al. 1976 through Caudle et al., 1991, 172 and Ward & Mitchell, 2004, 287).

4.7   Risk aversion

Employees working in public sector are more risk averse than those working in private sector (Caudle et al., 1991, 181, 184; Pang, 2017, 35; Wagner & Antonucci, 2009, 277). Reasons for this are highly tied to other characteristics, which combinations are further analyzed in section **Error! Reference source not found.**.

4.8   Less job satisfaction

Public sector employees are less satisfied in their work than private sector employees (Aryee, 1992, 75; Rainey et al., 1976 through Caudle et al., 1991, 172 and Ward & Mitchell, 2004, 287). According to Caudle et al. (1991, 172), this is be-

cause large bureaucracies, which public organizations often are, lack motivating job characteristics, like task autonomy and feedback.

4.9   Long product service life

Patanakul et al. (2016, 457) found that products of public projects are expected to be operational for years or decades after launch. This raises the need to answer to or accommodate future needs (which is difficult, as no human or machine, at least yet, is capable of foresight). Also, in the United States, only 23.9% of IT-spending is spent on development of new systems, while the rest is spent on upkeep (Pang, 2017, 33). As old systems are such a major factor in budgeting, it further supports the notion of public IT being operational for a long time.

4.10 Low market exposure

Low market exposure means that financial and operative decisions are made without much care about the state of the market: whereas private firms invest to satisfy or grab sections from the market and measure their success by profit they gain from it, public organizations are not driven by financial, but intangible goals and serve the public good instead of market sectors (see section 4.4). Instead of the principles of the market, customers of public organizations are selected by legislative and political means (Ward & Mitchell, 2004, 286). For instance, a public school might have a legal obligation to teach every applicant it receives, whereas a private school only teaches those that can afford the tuition.

   Funding of public projects is achieved through budgeting and appropriation, instead of profit gained from the markets (Caudle et al., 1991, 184; Rainey et al., 1976 through Caudle et al., 1991, 172 and Ward & Mitchell, 2004, 286). Because of the low market exposure, public organizations have less incentives for improving their operations productivity and financial effectiveness (Rainey et al., 1976 through Caudle et al., 1991, 172 and Ward & Mitchell, 2004, 286).

4.11 Complex financing

According to Wagner and Antonucci (2009, 278), the budgeting of governmental agencies is very complex. Funds for public organizations come from various sources (Sjoquist & Le Bel, 2002 through Wagner & Antonucci, 2009, 278), and these sources have unique restrictions on the usage of funds supplied by them (Torres & Pina, 2004 through Gomes et al., 2012, 317).

5 SYNTHESIS OF THE LITERATURE REVIEW

Each individual characteristic might be interesting in itself, but it is also important to form a complete view on how they connect to each other as a whole. First, connections of the characteristics made in the literature, or by subjective reasoning of the author based on the analysis in section **Error! Reference source not found.**, were identified. Then, a large-scale view was formed, and groups of mutually dependent characteristics were identified. These groups should provide grounds for understanding the intricate relationships the numerous characteristics analyzed in this study have and their impact in a public sector context overall.

5.1 Connections of the characteristics

Connections were made sequentially, along each individual characteristics analysis: as a characteristic being analyzed seemed to tie to a not yet analyzed one, the two were connected in the later characteristic. This way, characteristics were tied only to those ones already discussed, and new connections to already analyzed characteristics emerge under later ones. It was thought that an iteratively forming, comprehensive picture of the connections of the characteristics could be made this way.

Multiple stakeholders ties very closely to the political environment discussed in section 4.1, as public project managers need to deal with political influence of multiple stakeholders (Caudle et al., 1991, 181; Rainey et al., 1976 through Caudle et al., 1991, 172; Patanakul et al., 2016, 458). As top management of public organizations are elected by these very stakeholders, they have an interest to cater to their needs (Meyer, 2000 through Gomes et al., 2012, 317). Because of this it could be argued that the conflicting needs of stakeholders and the political agendas of decision makers together define what projects are funded and what are terminated.

Formal process could tie with the political environment, at least in the case of the United States. According to Pang (2017, 36), public top managers in the United States need legitimated congress approval to be able to function effectively, as the congress would not support "an agency which, in its opinion, lacks formal leadership." Gaining the approval of the congress however is a highly politically charged process, and the politcal environment affects the agencys capapilities to operate even when legitimation of the top executive is received (Pang, 2017, 36, 40).

Ward & Mitchell (2004, 286) state that "customers and clients are selected by legislative and political processes rather than the market." Therefore, it seems that formal and political forces are simultaneously affecting operations in public projects.

Political goals of the political top management of public sector organizations, as discussed in section 4.1, might very well by nature be intangible. This is evident when considering that there are numerous different political groups trying to answer the same problems in their own way, like closing the borders or providing further humanitarian aid to answer an immigration problem, none of which is universally accepted as being the one and only right one. As such, the political powers currently reigning decide in what way these problems are solved, which then guides public sector projects in what they should accomplish. Therefore, non-financial target benefits ties to both political environment and multiple stakeholders. An example was the project studied by Wells and Bullen (2008, 701), where the political system was pressing for the elimination of a health gap between the countries ethnicities.

Complexity seems to tie in with multiple stakeholders and intangible goals: a lot of constituents need to be involved and they have very different needs, which definition and implementation might be very difficult. As such the project might grow very large and involve numerous conflicting goals, which somehow still should be implemented. Organizational complexity and large number of users was noted by Wagner and Antonucci (2009, 278) and Patanakul et al. (2016, 457). Rainey et al. (1976) through Caudle et al. (1991, 172) noted the complexity caused by the intangible goals.

High scrutiny and increased pressure for accountability ties very closely to other characteristics, namely multiple stakeholders and intangible goals. The multiple stakeholders, which have their own competing, intangible goals, try to make certain that their viewpoints get through, that their hopes and goals are implemented, and that public officials are acting fairly, and therefore keep a close eye on the project. Some of the stakeholders also have political interests (Gomes et al., 2012, 315), or control the projects funding (Aryee, 1992, 74). It could be argued that without the large breadth and their societal, public nature, there would not be as much scrutiny on public projects, as they would affect the lives of, and therefore interest, only a few. Also, as success is not measured by financial measures (see section 4.10), appropriations are used instead. This naturally means higher scrutiny.

Risk aversion is caused by the political environment, where the top management is concerned with its political duties and fears the consequences of failures for their political careers (Caudle et al., 1991, 181, 184). High scrutiny of public projects also adds to risk aversity (Wagner & Antonucci, 2009, 277). Pang (2017, 35) noted that risk adversity is the reason why so many legacy systems are upkept, as public officials fear retribution from the congress in case the project would not be successful.

Lack of job satisfaction is caused by the lack of motivating job characteristics (Caudle et al., 1991, 172). Buchanan (1974) through Aryee (1992, 75) noted that intangible goals in public sector organizations affect these characteristics negatively. Intangible goals being the third most common characteristic, and therefore probably a major effector, it is very probable that this characteristic exists. Aryee's (1992, 75) notion of large bureaucracies lacking the motivating characteristics could also imply connection to formal process and complexity, as large bureaucracies could by their size be considered complex and are formally controlled by definition.

Pang (2017, 35) found that the reason for public organization having legacy systems was a combination of political environment (the power of the senate) and public employees risk aversion. As the senate supports projects of agencies politically inclined with the views of the current majority, and requires the formal acceptance of the agencies head, the agencies are reluctant or incapable of doing new system development if these conditions are not met.

As public sector projects funding is based on budgeting and appropriations, it could be argued that there is naturally more oversight, and therefore higher scrutiny. Aryee (1992, 74), in their notion of public organizations being "societally owned", noted that they are also dependent of the society for funding. This, according to them, leads to greater scrutiny from external entities.

Ward and Mitchell (2004, 286), as already mentioned above, tied the selection of customers into political and legislative means, instead of the marketplace. This connects low market exposure to the characteristics "political environment" and "formal process."

The lack of financial, market-driven factors affecting operations in public sector was evident in the notion of Bretschneider (1990, through Ward & Mitchell, 2004, 286), where instead of market-based ones other, intangible means were used to measure the state of the organizations information technology.

According to Wagner and Antonucci (2009, 278), the budgeting of governmental agencies is very complex. This complexity could increase the complexity of projects, as discussed in section 4.5.

A model of all the connections between the characteristics discussed above can be seen in figure FIGURE 3. Unified line represents a connection made in the literature, and a dotted line represents a connection made by the author, based on subjective reasoning. Characteristics are also sorted into inner rings based on their frequency of manifestation in the literature reviewed. This is also represented by the different sizes of the boxes.
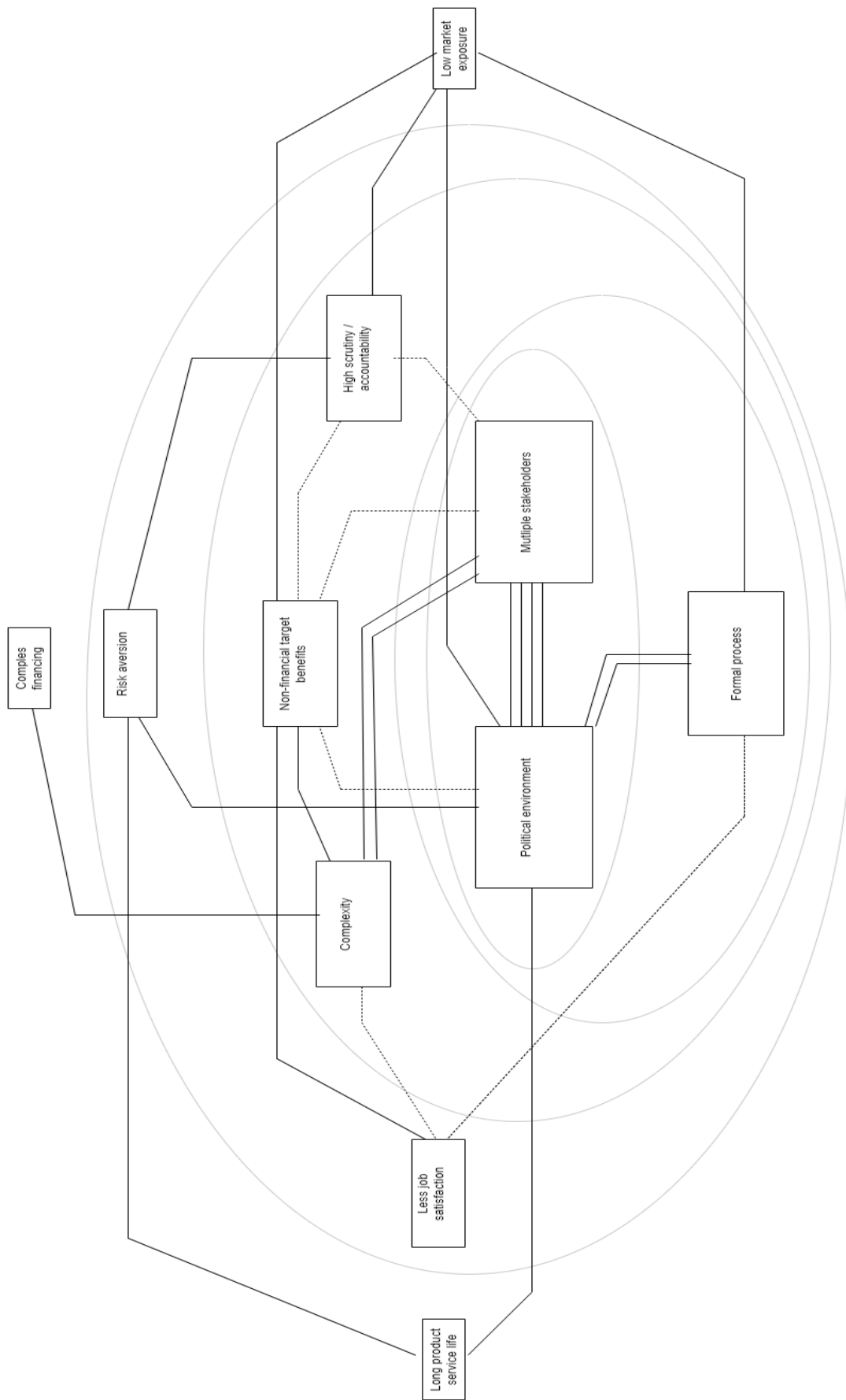
FIGURE 3 Model of the connections of the characteristics of public sector projects

5.2 Mutually connected characteristics

From figure FIGURE 3 it can be seen that some of the characteristics form groups, where each characteristic is connected to every other. Identifying these groups could bring the separate, individual characteristics together, forming kind of "super-characteristics" (super as in superset), which existence can only be understood through the connection and mutual contribution of the characteristics they contain. This way the complex connections which the individual characters form can be reduced into simple elements, and through their analysis the significances of the individual characteristics as parts of the whole can also be formed.

There are eight groups of mutually connected characteristics. These groups are displayed in table TABLE 9.

TABLE 9 Groups of mutually connected characteristics

Group	1. characteristic	2. characteristic	3. characteristic
1	Non-financial target benefits	Political environment	Multiple stakeholders
2	Non-financial target benefits	Political environment	Low market exposure
3	Non-financial target benefits	Multiple stakeholders	Complexity
4	Non-financial target benefits	Multiple stakeholders	High scrutiny / accountability
5	Non-financial target benefits	Low market exposure	High scrutiny / accountability
6	Non-financial target benefits	Complexity	Less job satisfaction
7	Political environment	Risk aversion	Long product service life
8	Political environment	Low market exposure	Formal process

It is clear that in these groups some characteristics connect to others more prominently. "Non-financial target benefits" with six connections has the highest amount of connections to other characteristics, while "complex financing", as not being a part of any mutually connecting groups, has no connections at all. The number of connections each characteristic has in these groups is displayed in table TABLE 10.

TABLE 10 The number of connections of individual characteristics in mutually connected groups of characteristics

Characteristic	Number of connections
Non-financial target benefits	6
Political environment	4
Multiple stakeholders	3
Low market exposure	3
Complexity	2
High scrutiny / accountability	2
Formal process	1

(continues)

TABLE 10 (continues)

Less job satisfaction	1
Risk aversion	1
Long product service life	1
Complex financing	0

5.3   Analysis of the groups of characteristics

First, in each section the individual characteristics contained in the group are named. Then, unless already done in a previous group, a short summary of the individual characteristics is given to strengthen understanding before they are combined in a single context. A short summary about the group follows the combination.

5.3.1 Group 1 - Goals

Group 1 contained the characteristics"non-financial target benefits", "political environment" and "multiple stakeholders." "Non-financial target benefits" meant two things: that public sector projects are driven for the sake of "public good" instead of financial gain, and that the goals stemming from this are conflicting and intangible (section 4.4). "Political environment" meant that public agencies, and hence their projects as well, are subject to political influences. Public top management is periodically re-elected, and therefore changing, which causes a multitude of quirks. (Section 4.1.) "Multiple stakeholders" meant that there are many parties, both internal and external to the project, that are included or interested in public projects. These parties can have their own differing, conflicting needs and goals. (Section 4.2.)

The numerous stakeholders have their own views on what should be accomplished in the society (the intangible nature of target benefits). These target goals may not have any concrete solutions, but should still be tried to be solved (Caudle et al., 1991, 171). As public top managers are elected to their posts, their selection reflects the majoritys view on what is deemed as important and how things should be done. This way, through a democratic process, selection of public officials, and therefore the way public organizations operate, is defined by the views of the majority of the stakeholders (which, considering the public nature of the goods produced by the public sector, could be considered as covering every citizen) on how problems, which have no right or wrong solution, should be handled.

Together these three characteristics seem to largely discuss the "goals" of public sector: what they are, how they are managed and how they are formed. It seems to define the very existence of the public sector as a whole: how a society concretely tries to solve a problem that has no right or wrong solution.

5.3.2 Group 2 - Operations

Group 2 contained the characteristics"non-financial target benefits", "political environment" and "low market exposure." "Low market exposure" meant that markets don't affect financial and operational decisions made in the public sector much: funding is achieved through budgeting instead of profit, and there is less incentive for improving financial efficiency (section 4.10). Customers are also selected by legislative and political means, rather than by market selection (Ward & Mitchell, 2004, 286).

As discussed in previous section, the intangible target benefits, or things which ought to be solved, are solved by the politicized top management reflecting the view of the majority of the stakeholders (or every citizen). As these goals are intangible, their success is not financially measured, but appropriated, and funding is therefore not determined by profit, but by budgeting, as mentioned above. Perhaps, because of the lack of financial drive, it is so that the customers of public sector are rather not selected by financial means, but by political and formal ones, as noted by Ward and Mitchell (2004, 286).

Together these three characteristics seem to touch on how goals are achieved in the public sector, defining the principles of its "operations." This still seems to concern public sector as a whole, as it is necessary to define the "how" when there already is "what" and "why", which for the public sector were defined in the first group "goals."

5.3.3 Group 3 - Complexity

Group 3 contained the characteristics "non-financial target benefits", "multiple stakeholders" and "complexity." "Complexity" meant that public sector projects are complex, especially structrurally (section 4.5). Complexity is also caused by the intanginle, conflicting nature of the goals (Rainey et al., 1976 through Caudle et al., 1991, 172).

Summary of this group is almost self-evident when combining the definitions of the individual characteristics. As the multiple stakeholders have their own views on how the problems which ought to be solved should be solved, their goals can be conflicting. Their number causes structural complexity when integrated in the project, for example when a large information system is designed to integrate many agencies, and their conflicting goals, which somehow should be taken in account and implemented, cause complexity yet in another way.

It is clear that these three characteristics join together through "complexity." Whereas the first two groups were more about public context as a whole, this group seems to be more about an individual peculiarity. It should still be taken in account, for instance when planning what type of project management methodology to implement, as managing multivariate complexity might not be an easy task.

5.3.4 Group 4 - Lobbying

Group 4 contained the characteristics"non-financial target benefits", "multiple stakeholders" and "high scrutiny / accountability." "High scrutiny / accountability" meant that governmental projects are subject to high scrutiny and increased pressure for accountability from external entities (section 4.6).

The multiple stakeholders have their own goals, which can be conflicting. In order to make certain that their voices are heard in projects, and that public personnel act fairly, they keep a close, scrutinizing eye on them, and press for accountability. This way they make certain that the goals they have are fulfilled, and goals opposite to their own are not unfairly favored.

This group seems to relate to the multiple stakeholders holding their own in the landscape of conflicting goals, or their "lobbying." So, in public projects, not only are there many stakeholders increasing the complexity of the project, but they also monitor the project and might try to affect it in numerous ways, if they sense their voices are not heard.

5.3.5 Group 5 - Measuring success

Group 5 contained the characteristics"non-financial target benefits", "low market exposure" and "high scrutiny / accountability." All of these characteristics have already been mentioned in sections above.

As the goals in public sector are intangible, their success cannot be financially measured. This separates it from the market, which is guided by profit maximization. To measure success in public context, other means must be used: appropriations. By scrutinizing the state of public projects/organizations under specific criteria, relating to the intangible goals which must be achieved, success in them can me "measured" through appropriation.

These three characteristics relate to how "measuring success" is achieved in a public context, when financial measures, based on profit maximization, cannot be used. It is an important characteristic, as the definition and implementation of intangible benefits might be hard, but necessary for anything to be considerable as achieved.

5.3.6 Group 6 - Employee satisfaction

Group 6 contained the characteristics "non-financial target benefits", "complexity" and "less job satisfaction." "Less job satisfaction" meant that public sector employees are less satisfied with their jobs than private sector employees (section 4.8).

The lack of job satisfaction in public sector is due to public sector lacking motivating work characteristics (Caudle et al., 1991, 172). Intangibily of goals was noted as negatively affecting these characteristics, therefore causing lesser job satisfaction in itself (Buchanan, 1974 through Aryee, 1992, 75). Intangible, conflicting goals were also a contributing factor to the complexity of public

projects (Rainey et al., 1976 through Caudle et al., 1991, 172). Aryee (1992, 75) noted that bureaucratic environments lack the characteristics affecting work motivation. Bureaucratic environments could be considered structurally complex, which is one part of the complexity of public projects.

These characteristics have to do with "employee satisfaction", or rather why public employees have less of it. It seems that the very nature of public sector is causing workers to be less satisfied, which is unfortunate. Measures to repell their effects might want to be taken in projects.

5.3.7 Group 7 - Systems development

Group 7 contained the characteristics "political environment", "risk aversion" and "long product service life." "Risk aversion" meant that public employees are more risk averse than private sector employees (section 4.7). "Long product service life" meant that products of public projects are expected to be functional for a long time, even decades (Patanakul et al., 2016, 457).

Public sectors employees are considered to be generally more risk averse. But, especially in the case of public top management, risk aversity is also caused by the political environment, as public top managers are nominated through a political process (elections) and fear the consequences of failures for their political careers (Caudle et al., 1991, 181, 184). Pang (2017, 35) noted that unless the political views of the agency and the congress are aligned, the congress is not keen on supporting the agency. In a general case, when a hierarchically higher, politically charged unit is not aligned in opinion with a unit residing lower, the lower unit, lacking the support of the higher one, will not do as much new system development, but rather contents to upkeeping old ones, which causes the systems lifespan to rise. Along with the potential lack of support, it could be argued that public employees risk aversion in general also contributes to the lack of renewing work in replacing old systems.

This group of characteristics has to do with "systems development" in a public context - even if it mostly underlines the lack of it. These characteristics might hamper developing new systems and explain why legacy systems are upkept.

5.3.8 Group 8 - Formal rules of operation

Group 8 contained the characteristics "political environment", "low market exposure" and "formal process." "Formal process" meant that public organizations and projects are highly mandated by legal and formal constraints (section 4.3).

As Ward and Mitchell (2004, 286) noted, both political and formal processes are used for customer selection, instead of free market selection. According to Pang (2017, 36) public top managers in the United States need formal approval from the congress in order to function effectively. This mainly connects the formal process to the political environment, where the political

environment dictates the guidelines of operations, which are used instead of the direction of free competition.

As such, this group has to do with how and why the ″formal rules of operations″ in public sector are formed. Formal guidelines are needed to replace the guidance of free competition in the market, and they are formed by political means.

6   SUMMARY

Purpose of this research was to find out the characteristics of public sector projects and to assess their significance. The research was conducted as a literature review, mapping characteristics which manifested and were discussed in literature concerning the topic. New characteristics were introduced even in the final articles, so saturation of the results was not achieved. However, some characteristics were clearly more prominent than others, surfacing in nearly every article, and as such the review succeeded in its task of revealing at least some of the main characteristics of public sector projects, solving the first research question. Knowledge about individual characteristics which were mentioned at least twice in the literature was then summarized, and their individual traits revealed. Then the connections of these characteristics were analyzed to form a clear picture of their relations to each other on the whole. Then, groups of mutually connecting characteristics, or superset-characteristics, were abstracted to define the individual characteristics meanings in a larger picture, and to create larger, meaningful units defining public sector projects. Eight of these groups were identified, and through them both the individual characteristics meanings were strengthened, and portrayals of their significance in mutual contribution in public context were made. This answers the second research question about the characteristics effects on operations in public sector IT-projects.

The research has limitations. The amount of literature reviewed was very low: only eight suitable sources were found. Therefore, it is hard to make any confident arguments about the reliability or generalizability of the characteristics identified. Also, most of the literature originated from the United States, or from other Anglophonic cultures, which means that the resulting manifestation of characteristics could be culturally biased. Also, no externally validated systematic model was employed in the qualitative analysis and synthesis of the results, which could undermine the repeatability and reliability of the results. The connections were also only analyzed through groups with mutual connectivity, but there could be some major correlations among other types of connections as well. For instance, even though "complex financing" connects only to "complexity", and was therefore not part of a mutually connecting group, it

could still affect the characteristic it connects to in a significant way, which could not have been revealed in this study.

However, even with its limitations, the researcher is confident that the model of the characteristics of public sector IT-projects and knowledge created about them acts as a good basis for future research. Empirical research is vitally needed to alleviate the limitations mentioned above. Especially important would be ascertaining the characteristics existence, significance and mutual connections and correlations, especially in a multi-cultural context. This could probably be solved with structured equation modeling (SEM), utilizing the connections of the characteristics as the model. Each individual characteristic and its significance could also be further studied, to strengthen its connections to other characteristics or to find new connections not surfaced in this study.

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