Platform choice and co-production

Hulsen, Niels

TECHNOLOGICAL INNOVATION IN THE PUBLIC SECTOR

Platform choice and co-production

Author: Niels Hulsen
Supervisor: Dr. Matt M. Young
Second reader: Dr. Johan Christensen
Capstone: Technological innovation in the Public Sector
Wordcount: 16708

Leiden University
Faculty of Governance and Global Affairs
Program: Public Administration
Specialization: European and International Governance

Preface

Before you lies the thesis: Platform choice and co-production. The question "To what extent does the service request platform influence co-production and how is this influenced by income, ethnicity, education of citizens and the digital divide?" has been attempted to answer through statistical analyses. The use of somewhat familiar but not completely mastered methods has made this an experience with significant educative value. Hopes are these newly acquired skills can be built on in further ventures.

I am thankful for the help of many people in, what has become, a long adventure. Most of all, I'm thankful to my thesis advisor for his guidance, suggestions, and calm responses in situations where I risked losing sight of the main goal.

The experiences of the author in writing the thesis project can provide valuable information for not only the author himself, but also for the faculty and the process relating to the thesis capstone. Completing a master's program that should be finished within 1 year, in 3 years due to not finishing the thesis capstone is something that should not have to happen. For this, the author is solely responsible.

Even though the author accepts full responsibility for this, preparation for the thesis capstone could be structured differently to decrease the stress inherent to this project. Making students choose between a subject and supervisor without showing any articles related to the specific subject one has in mind could be improved upon.

Suggestions are threefold: 1. Assign one or two mandatory readings before a student can choose a capstone. 2. Have a speed dating event between student and supervisor, they can talk about the mandatory readings and see whether they understand each other. 3. Structure the capstone differently so that not all deadlines come together during the final week of the semester.

Another, out of the box and maybe unpopular option, is to stop with thesis projects altogether, or make it optional. Use the research design course to test students' skills in conducting and reviewing research and fill the gap in ECTS with real-life experiences and reviews about these experiences. Make students experience public administration more before asking them to write about it. The faculty in the Hague is in an excellent position to work with international organizations, the municipality, provinces or consultancy bureau's to provide students with real life and hands on experience.

Index

1. Introduction

Civil participation in government is seen as something that, if certain requirements have been met, will improve government services (de Jong et al., 2019, p. 490). Academic interest in this topic, specifically the topic of e-participation, e-governance, and public value co-creation/production has been rising over the past few years (de Jong et al., 2019, p. 491). Co-production and co-creation are situations in which citizens participate in the planning or production phases of governance to create public value. In the most basic terms the topics of e-participation and e-governance concern the participation of citizens through digital means and governance through digital means.

Participation initiatives through digital means were expected to make more citizens willing to participate in the policy or public value-creating processes (Zheng, 2017, p. 425). However, not all citizens are willing to engage in participation initiatives. This is one of the main problems found when governments try to consult citizens. To be able to build on participation initiatives response has to be representative. When only small parts of the electorate participate a small group has a large influence on the outcomes of the initiative. In offline participation initiatives, some groups still dominate. This also seems to be true for digital participation initiatives (Campbell, 2003; Gilens, 2012; N. Kang & Kwak, 2003). The promise, promoted by proponents of e-participation initiatives, of creating broader supported policies through public consultation has not yet been proven.

While the evidence seems to be lacking on the part of public participation initiatives providing broader supported policies, the evidence seems to suggest that crowdsourcing public services does hold potential. Crowdsourcing public services, co-creation or co-production, has a long history. The concept itself is not innovative. Elinor Ostrom published on the subject of co-production of public value during the 1980s. What makes the subject interesting and academically relevant is the promise new information technologies hold. Consider the following: There is trash in front of your home. By submitting a photo through a government platform a garbage truck is informed and comes to pick up the trash the same day. This is an example of crowdsourcing or citizen sourcing of public services (de Jong et al., 2019, p. 490). This holds potential, and not only for garbage trash recovery when it is considered, that even a small portion of a city's residents reporting through the government platform sees and knows more than the administration of that city logically can.

Public services provide public value. Public value can simply be understood as something that the public values; examples are safety, clean streets, public transit, and many more things. As explained above, the public can help the government through the crowdsourcing of public service requests. However; not all public domains that create public value are suited for civil participation in this manner. Safety, as provided by the military is a public value, however, one can easily understand why citizen participation is not to be desired. From the governmental perspective; a domain with complex problems or where a high level of expertise is needed, is generally found the be less suited for civil participation than domains that do not have these requirements.

The citizen side is also important; citizens have to be motivated to contribute to a project. If a certain project is flawed from the perspective of the citizen one can be motivated to contribute, and make sure the project does work out, or one can see a working project and be motivated to make this project even better. It is not only important to look at what drives citizens to participate in co-creation or e-participation initiatives, but also to look at what barriers exist for citizens to engage in these projects, for example; do governments have the participation requirements set too high; do citizens believe their input will have any influence at all; or are there differences in participation through online and analog means?

That there are differences in citizen participation between online and offline participation initiatives can have different reasons. Some people will feel that online initiatives are easier to use, while others will feel that digital means are harder to use. This may have to do with the digital divide. The digital divide is a situation that describes the difference between some people who are advantaged, and some who are disadvantaged by the digital developments of the last decades (Rogers et al., 2001, p. 96). Some people will be able to use the new digital initiatives, while others will not. This is a risk. As more and more services are digitalized those that are disadvantaged by the digital developments risk being excluded from the new digital initiatives.

A developing digital initiative is that of smart cities. IT projects are inherent and essential for the development of smart cities (Mora et al., 2017, p. 12). Within smart city projects, IT projects are essential to decision-making processes (Mainka et al., 2016). Examples are traffic-lights that are guided by a predictive algorithm that assesses which green light has the best effect on traffic mobility; Algorithms finding out where sustainability efforts in the city have the greatest effect, or medical apps that monitor patients and lessen the stress on health care professionals. These are not the only possible applications; Smart city projects thrive by using open innovation and knowledge to strengthen its applications. It is about more than using algorithms to predict

and act upon patterns found in large amounts of data (Mainka et al., 2016, p. 1). Open innovation, the free flow of ideas between internal and external stakeholders, is acknowledged as being an important concept within smart city projects (Schaffers et al., 2011). Using ideas from external and internal partners transforms a city to a *"collaborative innovation platform"* (Tukiainen et al., 2015). The benefit here is that cities can, and are more likely to use the information and ideas that are available to all stakeholders.

There are cities where the citizenry contributes to city decision making processes through online means. Citizens can inform and co-decide about initiatives within the city. As with smart cities is common, these decision and contribution making initiatives often find themselves to have a digital component. For those found on the negative side of the digital divide this can mean exclusion. Which is problematic as the goal of digital participation initiatives is often to engage in dialogue with more of the electorate, not less. If decisions within smart cities are made without the contributions of those that are excluded by digital developments, cities run the risk of losing out on the opinions of people that matter.

Not all people are able to contribute in the same manner. Some people, through experience or education, are better able to contribute than others. Whether or not someone contributes also depends on how simple it is to contribute. If one has to travel great distances, or has to fulfil difficult requirements before being able to contribute many people will logically not contribute. To prevent non-contributions, processes have to be designed while keeping user-friendliness in mind. Different designs will impact citizens differently. How a design impacts the willingness of citizens to contribute is, as of yet, uncertain. A number of authors (Clark et al., 2020; Young, 2021). Have already written about the impact that the service request platform has on service delivery by municipalities. What has not been researched yet is who chooses which service request platform, and why a certain service request platform is being chosen. This is a minor gap in our collective understanding of this issue, this project aims to address that gap.

This project will look into whether there is an association between co-production/service request platform choice, the digital divide and the topic of crowdsourced public value creation, which is *a situation where end-users are actively involved in different phases of the production process*" (Voorberg et al., 2015) It is yet unclear why some citizens participate more in e-co-creation/production initiatives than other citizens, and while the data is available, no research papers have looked into role the platform may have on the participation of citizens instead of the role the platform has on the service delivery itself. Therefore the question leading this

project is: **To what extent does the service request platform influence co-production and how is this influenced by income, ethnicity, education of citizens and the digital divide?**

The main theoretical concepts in this project are Co-creation and co-production. These topics are supported with findings from research into the topics of citizen participation, e-governance, the digital divide, and service request platforms.

Academically; this thesis is relevant by providing new insights in the influence that a service request platform has on the willingness of citizens to co-create. The *"Allen et al., (2020)* article *"Does Citizen Coproduction Lead to Better Urban Services in Smart Cities Projects?"* in which they mention this subject as having a gap in the literature surrounding service performance and co-creation is what inspired a further look into the literature surrounding the concepts of co-creation and citizen participation. While the articles by Seo and Bernsen (Seo & Bernsen, 2016) and de Jong (de Jong et al., 2019) provide insight in these subjects, they do not try to measure the impact that the platform has on public value creation, and they do not measure who chooses which platform.

These subjects have however been researched before, although that was done with different data. Clark et al., (2013) use geospatial analyses to find out in which demographic determinants of co-production exist in neighborhoods of Boston (Clark et al., 2013). They find that there are almost no significant differences between demographic groups in what drives them to co-produce. Before their analyses there were claims suggesting that, as with policing, city services were underperforming in neighborhoods with larger groups of social-economic less fortunate individuals (Clark et al., 2013). These claims have been refuted. Besides attempting to answer a gap concerning who chooses which platform, this project will provide an out of sample retest of prior work. This project will use individual level data, analyzed through multiple and binary logistic regression to solve its problems. Through this the project also aims to test the claims made by Clark et al (2013) on different data and through a different methodology, as Clark et al., (2013) use service request data that is not coupled with individual level characteristics and use geospatial analyses to answer its problems.

Societal relevance can be found in the proposal that will follow in the conclusion of this thesis. Crowdsourcing the creation of public value is something that with innovations in information technologies, will be seen more and more. It can provide a cost effective and efficient manner for local and national governments to gather information about where to invest in the services they provide. While 3-1-1 systems in the USA have been existing for a while, systems like these

do not exist in the Netherlands yet.[1] There are developments in these areas, especially in the context of smart city projects, which means that more and better information on which public administrators can base their decisions, can help to make the developing systems better by highlighting areas that need extra attention or showing which areas do not need extra attention. An example is this is when a mobile app version draws more crowdsourced citizen contributions than a digital platform accessible through a PC or laptop or even a phone number; municipal governments can choose to develop the app version instead, thereby making sure policies are more broadly discussed and maybe even more broadly supported.

Data from the 2017 San Francisco city survey has been used to determine the effects of the determinants of the digital divide on service request platform choice. Analyses was performed through the use of binary logistic regression, ordinal logistic regression and chi-square tests. Results were found to be largely insignificant, except for the variable age, which was found to be significant when explaining 3-1-1 phone frequency use.

[1] As far as the author is aware.

2. Theoretical foundation

Governments worldwide have been under constant pressure to make their services more efficient, effective, transparent and responsive (Bannister & Connolly, 2014, p. 119). Governments have tried to achieve (some of) these targets by digitalizing their services(Bannister & Connolly, 2014, p. 119; Fang, 2002). Some services were indeed provided in a more cost-effective manner (Fang, 2002)however, some projects were not, which, in some situations, can lead to a government reputation of information services mismanagement (RTL Nieuws, 2015). This reputation has not prohibited governments from engaging in new digital endeavors like the creation of smart-cities, government apps, or policy supporting it-programs. Digitalization is still largely seen as a way to increase efficiency, effectiveness, transparency and responsiveness.

In the following paragraphs the concepts of the following topics will be discussed, tied together and conceptualized in a way that makes them operationalizable. The introduction will focus on smart cities in which citizen contributions are essential, followed by the ways through which these contributions can take place: e-participation, co-production and co-creation. Those topics will be explained. A discussion between several views on technological adoption follows which serves as the basis through which an advice about the way municipal governments should follow on their e-participation/co-creation/co-production journey can be provided.

2.1 E-Governance

Digital innovations have been providing new possibilities for governments for some decades. Where forms first had to be filled in on paper and mailed to government offices, forms can nowadays be filled in online 24/7 and will reach the civil servant directly. A quick response from the civil servant is all that is needed to complete the request. This use of digital infrastructure makes governments more responsive to citizen requests. It can also make governments less likely to find themselves in situations of institutionalized bias against minorities. Automatically received and reviewed requests follow an algorithm, that, if set up correctly, does not base decisions on the basis of surname or appearance.

The use of algorithms to base decisions on has been becoming more and more common; this has also lead to situations where these algorithms have contributed to decision making in a negative way. An example is the Dutch Tax authority, where people with a double nationality or non-western migratory background have had their tax returns reviewed more structurally and harshly than those in opposite demographic groups. Digital innovations are not inherently

negative, to provide the benefits that are possible, algorithmic or data based decision-making has to be set-up correctly.

Correctly set-up digital innovations do provide benefits. Allen, Tamindael, Bickerton and Cho (2020) focus on a mobile app distributed by the Malaysian government: citizens fill out service requests in the app on which the government can directly anticipate (Allen et al., 2020). For example; a citizen sees waste on the street, makes a picture and filles in the online request form through the app, the city responds by sending a garbage truck directly to the waste and replies with a picture of the cleaned-up mess, request fulfilled. This is an empirical example of how technological innovations can create public value though citizen participation. Another example is when the sensors and camera's in modern cars provide feedback about road safety and maintenance necessity through road monitoring to governments, thereby crowd-sourcing information to an extent that is not possible with inspectors driving on the roads themselves (Arnaud, 2022).

2.2 E-participation

Creating public value through e-government is one of the possibilities that comes from a strong digital infrastructure through government digitalization. Citizens being able to provide live feedback and responses on and to government proposals can make for more responsive policies and services. Ideas in development can directly be criticized on by citizens, providing public servant with first-hand feedback. This can increase the trust citizens have in government (Irvin & Stansbury, 2004). Besides being able to offer advice and input on policy proposals and municipal projects, citizens can act as *sensors, detectors and reporters* through e-means (Clark et al., 2013, p. 697). Citizens can inform civil servants about issues in their area of responsibility. This is citizen sourced-information gathering. A benefit of this is that governments can leverage the quantity of citizens to inform themselves. There are also risks, governments that neglect to act on the feedback they receive, risk affecting the trust people have in the government in a negative manner (Halachmi & Holzer, 2010, pp. 378–379).

Including citizens in policymaking can increase the support and quality of those policies, as well as that sourcing information from citizens can inform governments about issues important to citizens. Having citizens participate and thereby creating public value raises the question of "How do we get those citizens to participate?" and "What do citizens participate in?" The example of Malaysian app shows that participation can be found at in the simplest means. For

more complex forms of citizens participation one can look at citizen consultation for traffic projects or construction projects.

The idea of including citizens in policymaking is not a new one. Government or municipalities, for example in the Netherlands, have been holding consultation evenings for neighborhood projects, or polder-conversations for larger decisions for decades (Goor, 1975). Digitalization of such meetings could change the status quo , granting citizens the ability to attend these meetings online could have a positive influence on attendance and thereby increase the basis that supports policies; those already involved in politics are more likely to reap the benefits of these forms of digitalization, as they are more likely to attend (Gainous et al., 2013, pp. 154–155).

Irving and Stansbury argue in favor of citizen participation in the policy process, they argue that community participation in governance has many benefits, and that dissent from that opinion is rare. This because it is hard to see anything but positives from citizens joining in the policy process, collaboration with government officials and other citizens, and trying to find consensus and create positive change in their environment (Irvin & Stansbury, 2004, p. 55). Even autocratic regimes, or flawed democracies have instances where citizens can participate through online means (Schlaufer, 2020), even though creation of a broadly supported policy is not the main goal in those countries.

Citizen participation has downsides in complex and high expertise problems. Elected representatives spend whole days on figuring out problems, capacities aside, someone working full time in a different field simply does not have the time to assess all legislative issues directly. Deciding where to go without listening to an electorate can lead to non-supported measures, so a middle way has to be found. In municipal politics, where electoral interest is lower compared to national politics (Hajnal & Lewis, 2003, pp. 645–646), and where electoral interest seems to be declining, an example of this are the turnout rates in municipal elections in the Netherlands, which have recently been the lowest in recorded history, therefore different means will have to be used to peak and sustain the interest of the electorate.

E-initiatives have been seen as being able to change this problem, and come to a more representative group that engages in participation than offline means (Albrecht, 2006, p. 62). However it is still often found that higher educated, older men are the most participative. Those who have a greater trust in their national and local government are also inclined to participate more; and when one is weakly tied to offline social groups, one also is more likely to participate

through e-means (Lee & Kim, 2018, p. 873). The strongest effect seems to come from the expectation that participation will have an effect, one expecting that an opinion or vote will have some influence is most likely to participate (Lee & Kim, 2018, p. 873). Wijnhoven et al., (2015) concur on this; of all factors influencing citizens to participate through online means the belief that this participation will have an effect has the largest influence on whether citizens will participate or not (Wijnhoven et al., 2015, p. 30).

2.3 Forms of public participation

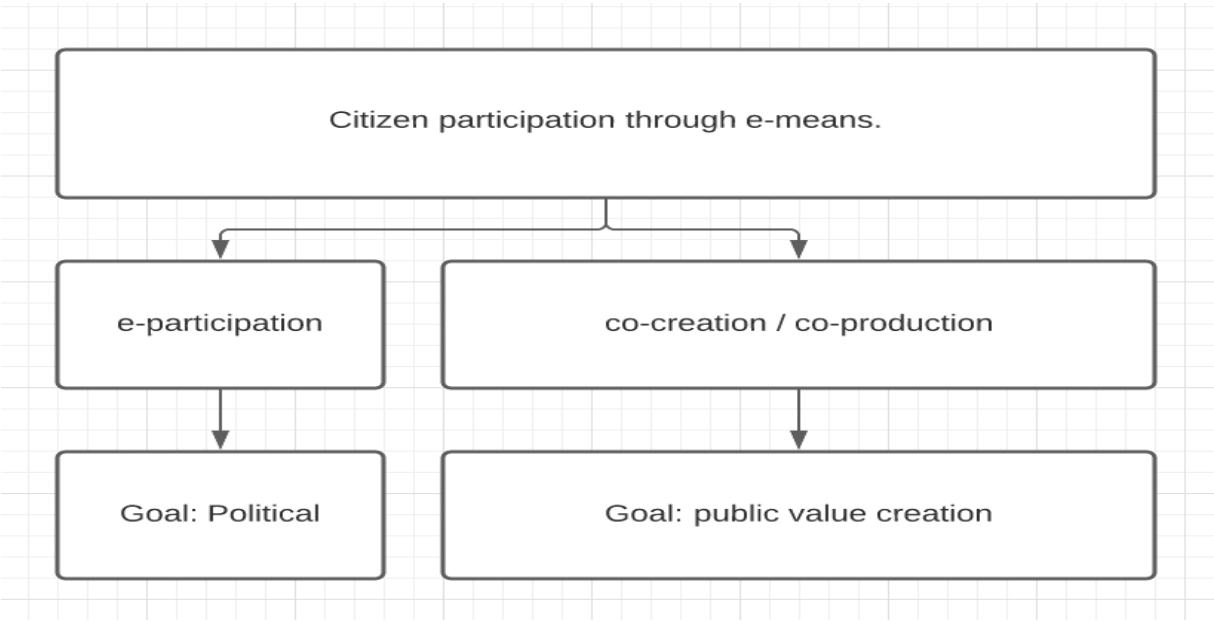


Figure 1. Goal differences between e-participation, co-production and co-creation.

Different forms of public participation exist. Among these are the e-participation in government forms that Korthagen et al., (2018, p. 9) distinguishes. She states that there are 6 means through which citizens can participate in public matters through digital means; e-consultations, e-petitions, e-deliberation, e-budgeting, e-voting and social media usage (Korthagen et al., 2018, pp. 9–10). These different forms of e-participation will be explained below. However, these are not the only ways citizens can participate in public matters. There are also the co-creation and co-production forms of participation. A schematic explanation of these three main groups of citizen participation in public matters will be shown below, as well as a complete explanation of all forms mentioned above.

The first form that will be explained is the form of e-consultations, which have been mentioned before, this is when governments ask advice of citizens though online means. This can be achieved through the use of questionnaires, open formats and even crowdsourcing. Well-designed e-consultation processes have the ability to contribute to higher legitimacy of policy

agenda's (Korthagen et al., 2018, p. 9). There is a caveat, "e-consultations" that only seem to be participative but in reality are just a avenue through which an organization communicates decisions that have already been made risk damaging the trust in the organization. E-consultations with the goal of improving policies and increasing public value fit within the scope of co-creation/co-production. E-consultations have as a goal assessing the support of citizens for certain policies fit within the e-participation group.

E-petitions are online petitions about subjects that interest civilians. Citizens can make a petition and others can sign this digitally. Petitions with enough autographs can then be given to representatives. The representatives are then supposed to act on the petition. However, this does not always happen. According to R. Rustema, founder of the Dutch site "petities.nl", petitions are becoming more popular, however a majority of petitions are *"received with a smile but ignored afterwards"* (Algemeen Dagblad, 2017; Rathenau Instituut, 2019) E-petitions can be seen as a form of e-participation.

E-deliberation is when citizens discuss different proposals through online means. It mostly functions as a text based chat. A large advantage here is that anonymity can be guaranteed, and people can say what they want. E-deliberation can be moderated to keep quality high, however, this can be understood as a form of censure. The success of e-deliberation is largely dependent on the deliberative skills of those participating. This is a skill that has to be taught and developed, therefore risking exclusion in the deliberation for those who do not possess the means, or haven't been able to develop this skill. E-deliberation is not fitted for issues of high complexity, as inclusiveness is lacking when high expertise is needed(Korthagen et al., 2018, p. 10).

E-budgeting have, according to Korthagen et al., (2018, p 10), produced some of the strongest results of the e-government ways through which civilians can influence decision making. Citizens here can decide, to a certain extent, on which projects money is spent, citizens can, in some situations, also alter the amounts spend on certain projects. Civil servants can grasp where the focus of the public lies and improve policies in different manners, examples are improves public services, increased legitimacy and enhanced responsiveness(Korthagen et al., 2018, p. 10).

E-voting is where civilians vote on government proposals through online means. This still has several ongoing challenges such as turnout rates, security aspects, user friendliness and trust. Criticism on this form of e-participation in the literature is common. This form of e-

participation is generally not seen as a solution for the European democratic deficit, for which it was hailed. Voting convenience is stated not be decisive in whether civilians are voting or not, especially when comparted with political interest and general satisfaction with the political system(Korthagen et al., 2018, p. 10). E-voting is a form of e-participation.

The final form of e-participation is the use of social media. Research on this topic tend to agree that social media plays a significant role in civilian and political life, though research is not in agreement how large this impact is (Korthagen et al., 2018, p. 10). Social media can and has been used to deter civilians from participating in elections, making it a double edged sword. An example of this is the Cambridge Analytica scandal, where civilians belonging to a (ethnic)minority, were dissuaded or influenced in their voting by manipulating the advertisements which they were shown on Facebook (Heawood, 2018, pp. 429–430). This concretely means that the trust people will have in the safety of the digital product can also have an effect on whether people will or will not use the proposed platform. While the use of social media in itself is just a form of e-participation, it can also be used as a part of the process of co-creation/co-production, and example would be where citizens could report issues through social media on which governments can act.

2.4 Co-creation and co-production

Among the forms of civil participation initiatives there are co-creation and co-production. Thus far, both forms have been used interchangeably. This is in accordance with the use in prior work (Ansell & Torfing, 2021, p. 215). However, there are differences between both forms of civil participation. Both forms will be defined and explained below as will the use of these concepts for this research project.

The definition of co-creation differs between authors; "*a situation where end-users are actively involved in different phases of the production process*" is how Voorberg et al., (2015) define co-creation (Voorberg et al., 2015, p. 1334). Torfing, Sørensen, & Røiseland (2019) define co-creation as "*the process through which a plethora of public and private actors are involved – ideally on equal footing – in a collaborative endeavour to define common problems and design and implement new, better, yet feasible, public solutions"* (Torfing et al., 2019). Both articles mentioned above agree on the fact that co-creation can happen in different phases of the creation of public value. Not all political acts of citizens are a form of co-creation. Brandsen and Honingh (2016) argue that there is a difference between advocacy and co-creation; They argue that co-creation is *"the direct input of citizens* [not organizations] *in the individual design and*

delivery of a service during the production phase". This differs with advocacy, as that relies on indirect mechanisms to influence a target (Brandsen & Honingh, 2016, pp. 427–429) and therefore has a more political intent than co-creation does, as well as that Weberian styled administrations are preferred to be independent on political issues, making the co- in co-creation and co-production impossible.

The definition by Torfing et al., (2019) differs on several aspects with the definitions as stated above; Torfing et el., (2019) propose that organizations or organized groups of people can also co-create; as well as that co-creation can also exist during other phases than just solely the production phase. The phases among where we can find co-production according to Tofing et al., (2019) are also the planning and design phases of projects, not solely during the production phases. De jong et al., (2019, p. 490) define co-creation as follows; "*Co-creation can be seen as an intensive type of citizen participation, involving active collaboration between government and citizens on specific policy issues"* (de Jong et al., 2019, p. 490).

All definitions concur on the following; *Co-creation is found where end users are actively involved in creating public value through collaborative means with government officials*. As this is almost completely similar to the definition proposed by de Jong et al., (2019), and does not conflict the other definitions it is therefore the definition that will be used in this project, it mimics the definition of Torfing et al., (2019) while also concurring with the definitions by Voorberg et al (2015) and de Jong et al (2019).

2.5 Co-Creation, E-participation and Co-Production

In government matters co-creation thus entails actively involving the citizen in the policy-process, decision making process or during the creation and implementation of a new idea. This is one of the differences between co-creation and participation. Both concepts are intertwined, but one of the differences is found in the role the end-user has; in co-creation the end user is actively involved, while in participation the end-user can be passively involved (Voorberg et al., 2015, p. 1335).

There is a difference between co-creation and co-production. Three types of views on the differences between co-creation and co-production can be distinguished in the literature: Both concepts mean roughly the same and connote any citizen involvement in public services; Co-creation is a more all-round term, it refers to different citizen inputs in services, whereas co-production is more specific; or the last view where both concepts mean something different, they refer to a different kind of citizen input (Brandsen et al., 2018, p. 10).

Many authors use co-creation and co-production interchangeably(Ansell & Torfing, 2021, p. 215). According to Ansell and Torfing this led to a stretching of the co-creation concept. More and more acts were seen as co-creation, and the definition therefore became less clear. A strong and clear definition, supported by actively formulating and explaining differences with similar concepts, strengthens the conceptualization and following thereon the operationalization of the concepts. It thereby adds to the value of the research project. Torfin (2019, p. 217) shows the differences between the concepts of co-creation and co-production, this table can be found in appendix 1a.

A widely accepted definition on co-production comes from Ostrom, she argues that co-production is *"the mix of activities that both public service agents and citizens contribute to the provision of public goods"*(Ostrom, 1999). Herein the citizen or citizen group contributes voluntarily while the public agent contributes professionally to enhance the quality and quantity of public goods that is being produced. This definition does not distinguish between co-creation and co-production. Voorberg et al., (2015) distinguish these two concepts based on three factors; citizens as co-implementer: which is about citizens being involved in transferring activities formerly carried out by governments to citizens. Citizens as co-designer: citizens helping governments develop service processes. And situations where citizens function as initiator: citizens offer suggestion for new services. Co-creation is seen as citizen involvement as co-initiators of services. Co-production is seen as the involvement of citizens in the implementation of public services (Voorberg et al., 2015, p. 1347).

The example that was provided by Allen et al., (2020) where a citizen sees waste on the street, makes a photo that is send through an app after which a garbage truck is informed and cleans the mess would connote co-production. An example provides by de Jong et al., (2019, p. 499) Where citizen make use of a platform through which they can post, discuss, vote-on an alter ideas for public services, a park for example, is a form of co-creation.

Not all of the manners through which citizens can e-participate fit the definition of co-creation. The proposed definition of co-creation for this project was as follows: *Co-creation is found where end users are actively involved in creating public value through collaborative means with government officials.* This means that several ways which are seen as e-participation are not seen as co-creation. The e-participation means earlier described were; e-consulting, e-petitions, e- deliberation, e-budgeting and e-voting. To be considered as a possible form of co-creation the method has to have the following three factors; active citizen involvement, collaboration with government officials and creation of public value. Most of the e-participatory

means can end up in creating public value, the main essential that excludes e-participatory means as possible co-creation are collaboration with government officials and [debatable] active citizen involvement. E-petitions serve as an agenda setting method, they do not require collaboration with government officials and are therefore not seen as a form of co-creation, it is also debatable how active the participation of citizens truly is in this form, as all that is required is an online autograph. Whether e-voting is to be accepted as a form of co-creation is debatable, but as no collaboration with government officials is needed this e-participatory method will also be excluded from the co-creation means studied in this project. E-voting also has the same limitation as e-petitions have, besides voting no other actions are required, therefore it is debatable how active the citizen involvement truly is. The other means: e-consulting, e deliberation and e-budgeting inherently all need collaboration with government officials, create public value and need active citizen involvement, these e-participatory means are therefore understood as being possible ways through which citizens can co-create with government officials.

According to Torfin et al., (2019) differences between co-creation and co-production are found in the scope, actors, power relations and outcomes of the act of co-creating or co-producing. Co-production is more small scale, is mainly found when public service providers and service users work together, has a highly asymmetrical vertical power relation and has an outcome the efficient delivery of pre-designed services. Co-creation is about the design of service systems (large scope), has a larger scope of relevant actors, has horizontal power relations (with possible unequal power resources) and in mainly used for the development of new and better solutions through innovation and improvement (Torfing et al., 2019). 3-1-1 systems, where citizens can inform governments through a platform about necessary repairs, actions or other instances of public service delivery is a form of co-production of public value.

The general problem with public value creation through e-means is finding the balance between inclusiveness, structure, expertise and complexity. Before e-government means like e-voting can be used representatively, a solution must be found for the fact that young white males with a higher level of attained education are overrepresented in e-participation pilots (Korthagen et al., 2018, p. 11). Mobilization efforts have been attempted; they unfortunately ran into the fact that people were hard to mobilize because of the low trust civilians have for civic-participation initiatives. The critique on smart city projects revealed that broad participation of citizens is needed to protect smart city projects from business interests and to keep them in line with the goals they were set up for in the first instance.

The following problem is to be answered, does the difference in participation between demographics in e-participation initiatives transfer to co-creation and co-production initiatives? In other words: Do we see an overrepresentation of young, highly educated white males in co-creation/co-production environments? And do we see an underrepresentation of minority groups in co-creation/co-production environments?

According to Korthagen et al., the lack of participatory projects that truly end up having influence on public policy explains the low trust people have in e-participation initiatives (2018, p. 10). One other important factor is whether citizens are able to engage in online behaviors. Not all people today are able to. This mainly concerns poorer people, who will have less access to computers, and older people who are not used to working with computers at all. These groups are part of what is called the digital divide.

2.6 The digital divide

Variables relating to the digital divide are one often controlled for in research into the topic of e-governance (Myeong et al., 2014). Governments find it harder to reach people, so they try new methods to reach those they were not able to reach in the first place. Some governments see e-means as a possibility to address the democratic deficit. As stated above, many governments find e-initiatives to be what is needed. Results confirm this, e-means do indeed have the ability to reach other people than normal methods do. However, not everyone is able to use these e-means. Therefore the benefit of reaching other people can turn into something detrimental, as groups within society can find themselves to be distanced more from governance and politics than they were in the first place.

The digital divide is defined as a situation that describes the difference between some people who are advantaged, and some who are disadvantaged by the digital developments of the last decades (Rogers et al., 2001, p. 96). DiMaggio et al., (2001) define the digital divide as the inequality in access to the Internet, how often the digital services are used, differences in knowledge of search strategies, the quality of technical connections and social support for digital endeavors, the ability to evaluate information quality, and the diversity of use (DiMaggio et al., 2001) . Becker et al. (n.d.) include four groups in their model that assesses the digital divide in different empirical situations, these four groups are: Senior citizens, citizens with low education, citizens from thinly populated areas and unemployed citizens (Becker et al., n.d.). These are all groups that have a higher probability of being disadvantaged by the digital

developments of the last decades compared to younger citizens, citizens with higher education, citizens from urban areas and those who are employed.

When looking at a population, this makes that the expectation is that there will be an overrepresentation of people from the ethnic majority, highly educated people and younger people among the group of e-participators. This expectation is based on results from previous studies into the subject of e-participation that concluded that groups that are normally associated with the digital divide are socially-economic less fortunate, lower educated, older people and people living in rural areas compared to those living in cities (Becker et al., n.d.). As the project focusses on 3-1-1 systems, which are used within cities, data about the rural vs urban divide is unavailable. Based on these determinants, the question based on this factors focusses on education, ethnic group, income and age:

S1: To what extent are demographic groups normally associated with the digital divide underrepresented in co-creation/co-production environments?

2.7 Platform use and 3-1-1 non-emergency systems

This project focusses on 3-1-1 related data. 3-1-1 systems are non-emergency systems from municipalities that function as portals through which citizens request municipal services. Citizens can call, use an app or use the web based version of 3-1-1 to request services. The systems were originally developed to alleviate the overburdened 9-1-1 emergency system in Baltimore, Maryland in 1996 (Clark et al., 2020, p. 316). Among the requests which 3-1-1 is used for, many quality of life factors are found; like potholes, abandoned cars, light outages and more. A citizen reports his or her request through the portal which is assigned to the correct municipal department, after which the request is, hopefully, solved. In this sense 3-1-1 systems function as a basis on which technologically enabled co-production happens.

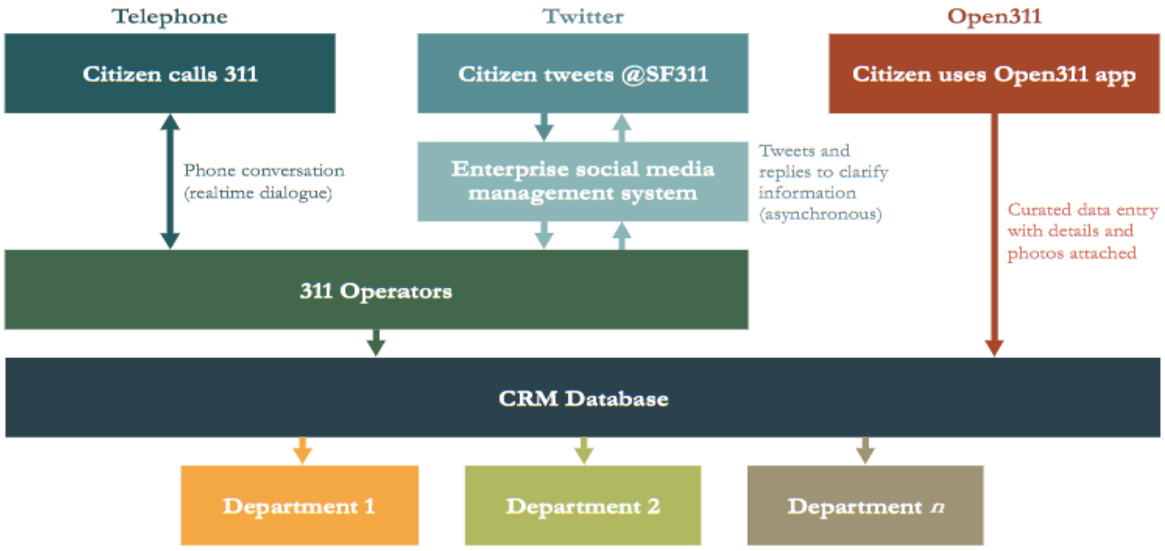
3-1-1 systems have been around since 1996 (Clark et al., 2020, p. 316). Access to these systems has developed over time. The first systems relied on call centers; city citizens were able to call phone numbers and make their service request through that platform. This had certain benefits: most people were able to use a phone, and were thus able to use this way of requesting city services. During the 2000's a new way to administer 3-1-1 service requests came about; people were now able to fill out online forms through which they could request city services. This new way was more efficient for cities. Instead of having to pay for a whole call center that needed to administer request for a whole city, automated forms could be used to optimize the process. However, not everyone was able to use these new online means. A small part of the population

risked being excluded. The final innovative step being taken in the context of 3-1-1 services is the mobile revolution. Almost everyone owns a smartphone through which the citizens are able to fill in requests directly. Almost everyone has a phone with the ability to use 3-1-1 related app services, however, not everyone does.

Older, lower educated, socially-economic less fortunate and rural groups belong to the group normally associated with the digital divide. Consequently, individuals within these groups will be less frequent users of services that challenge their capabilities. Therefore among older and less educated groups, it is expected that the amount of web and app based service requests will be significantly lower than requests made through call centers. Out of this problem the following question has to be answered: **S2: To what extent are demographic groups connected with the digital divide associated with different frequencies of use of 3-1-1 services?**

Citizens that use 3-1-1 systems are more likely to have a positive view the public services provided by the city compared to those that do not use 3-1-1 services (Wu, 2021, p. 671). What remains unclear is whether the platform through which citizens request their 3-1-1 city services has an influence on their satisfaction with those city services. This is a gap in the literature that has not gotten enough academic interest. The process of filing a 3-1-1 request in the San-Francisco context is schematically shown below.

Figure 2. Process diagram of 3-1-1 by submission technology. From (Young, 2021, p. 8)**.**



The platform through which citizens file requests for city services is part of the total process of co-production that starts with citizens detecting a situation, filing it through either telephone,

web or app and consequently the responsible city department responding to the request. As part of the complete experience, the platform logically has an influence on the overall satisfaction citizens have with the response to their request. If certain demographics use certain platforms less or more than others, and platforms lead to significantly different satisfaction rates, then further research in the reasons why people use these platforms and reasons why they are or are not satisfied with the platform is needed. This can help to provide insight in where to invest time and money as well as how to better reach certain demographics in co-production processes. Research into the differences in time needed to fulfil requests between the different platforms has been performed. Proof was found that ethnic minority-majority neighborhoods received slower responses from municipalities than ethnic majority-majority neighborhoods, however, proof of this was found before the emergence of 3-1-1 systems (Clark et al., 2020, p. 315).

Besides defunding a complete platform, one cannot force citizens to use a certain platform over another. Therefore information about which platforms result in general service satisfaction and which do not is useful to base decisions on. As of yet it is unclear whether the use of a 3-1-1 web/app versus the 3-1-1 use through the phone is associated with a different general satisfaction with city services. While filing service requests through the phone requires contact with a call center employee, filing requests through the app requires filling in the same form for everyone. In this case the call center employee is the only differing variable, some employees function perfectly while others function less. The distribution of satisfaction with the 3-1-1 services is therefore expected to be larger for phone 3-1-1 services than web/app 3-1-1 services. This also provides the option of finding out whether the platform choice influences general satisfaction with city services. The question that logically follows is;

S3: To what extent is the use of 3-1-1 through a web/app associated with a higher general satisfaction with city services compared to the use of 3-1-1 services through the phone.

2.8 Confounders and other important variables

Whether or not citizens will participate depends on several factors besides the availability of participatory initiatives. E-participation initiatives have not all been found to be successful in engaging citizens to participate (Naranjo-Zolotov et al., 2019, p. 365; Zheng, 2017, p. 423). E-participation is inherently placed in a context that also depends on political, social and other factors (M. Kang, 2014; Venkatesh et al., 2000, 2003). therefore studying this phenomenon through a perspective that considers this is important.

Not all factors that influence citizens' co-production have to relate to the digital divide. To pursue a strong and robust model for explaining co-production the omitted variable bias has to be taken into account, as well as that some possible confounding variables have to be distinguished and controlled for. Authors on the subject of co-production in public services, especially through 3-1-1 related data, have found that several variables, not mentioned in this thesis before, have a probability of influencing results. Clark, Brudney and Jang (2013) find that ethnicity, average household income, education level and whether one is a house owner or renter matter (Clark et al., 2013). In another publication Clark, Brudney, Jang and Bradford (2020) again select education, income and ethnicity as possibly influential variables, this time omitting whether someone is a renter or buyer (Clark et al., 2020). Clark and Brudney (2022) test the association between the use of public transport and the frequency of co-producing and find significant results (Clark & Brudney, 2022, p. 6), to ensure a robust model it is important to also control for this variable.

Whether a respondent is a house owner or renter is important when looking at co-production according to Clark et al., (2013, p. 692). This may have to do with the positive influences home ownership can provide. In their article "*Home ownership and access to opportunity"* Rohe et al., (2002) explain this possible influence. Home owner have a longer tenure, and seem to be more willing to invest in their neighborhoods compared to those renting a home (Rohe et al., 2002). Investing in a neighborhood, in the case of co-production, could be making sure neighborhoods are safe, street lights are working and garbage is being picked up in time. Therefore home owners are expected in be more willing make use of 3-1-1 systems than those that rent a home.

In the analyses of Clark et al., (2013) data from the American community survey is used. The unit of measurement is a census block: a unit of grouped 3-1-1 service requests based on neighborhoods. Clark et al., (2013) therefore do not use individual level data about whether a claimant is a home owner or renter. Their analyses is based on home ownership averages in a census block. The San-Francisco city survey, which is used in this project, does provide information about individual level home ownership, and therefore makes it possible to include this individual level data in the explanatory models.

Whether or not someone uses public transport can have an influence on whether someone co-produces or not. Clark and Brudney (2022, p. 3) argue that public transport users are more directly connected to the quality of public services compared to those that do not use public transport, car and para-transport users such as Uber and Lyft users. They find a significant

association between the using of public transport and whether someone co-produces or not. This variable is included in the San Francisco city survey, it will be controlled for in the models used to answer the questions put forward in this thesis.

3. Methods

In this chapter, the methods that are used to answer the research question and sub questions are documented, starting with the selection of the sample and the data collection strategy. Through the concepts offered during the literature review the sub questions will be operationalized. After operationalization testable hypotheses will be formulated, which will be used to answer the sub questions and finally the main research question. This chapter will further be used to explain the data-analysis strategy that will be followed to test the hypotheses, as well as that the chapter will be used to discuss methodological risks and solutions for these risks.

The main research question of this research project is as follows: **To what extent does the service request platform influence co-production and how is this influenced by income, ethnicity, education of citizens and the digital divide?**

3.1 Sub questions and hypotheses

The first sub question is as follows: To what extent are demographic groups normally associated with the digital divide underrepresented in co-creation/co-production environments? This sub question will be answered using the following hypotheses:

H1: The distribution of ethnic groups among claimants of 3-1-1- systems is different from its population distribution; the respondents group contains relatively more Caucasians.

H2: Claimants of 3-1-1 systems are not distributed equally among the different age groups compared to their demographic averages.

H3: There are significant differences in 3-1-1 use between different education levels.

H4: Age is positively associated with 3-1-1 use.

H5: Income is positively associated with 3-1-1 use.

The second sub question is as follows: to what extent are demographic groups connected with the digital divide associated with different frequencies of use of 3-1-1 services? Four different hypotheses will be used to answer this sub question. These hypotheses are:

H6: Age is positively associated with the frequency of 3-1-1 use through the web/app to connect with 3-1-1 services; Older people will use it more frequently than younger people.

H7: Age has a significant association on the frequency of 3-1-1 use through the phone to connect with 3-1-1 services. Older people will use it more frequently than younger people.

H8: Yearly income has a significant association on the frequency of 3-1-1 use through the phone. Those in higher income brackets will use 3-1-1 services more than those in lower income brackets.

The Final sub question is: To what extent is the use of 3-1-1 through the web/app and phone are associated with a higher general satisfaction with city services.

H9: Use of 3-1-1 services through the web/app are significantly associated with a higher general satisfaction with city services.

H10: Use of 3-1-1 services through the phone are significantly associated with a higher general satisfaction with city services.

3.2 Data collection and case selection

The current study is focused on the use of 3-1-1 systems in the United States. To be able to test the hypotheses, data from several publicly accessible databases needed to be gathered. However, not all databases sufficed when it comes to answering the research questions of this study. Also, it had to be taken into account that not all databases were representative of the concept of co-production. To be able to use the datasets to answer the questions data about social-demographic factors and 3-1-1 requests had to be available for each individual claimant. Datasets with 3-1-1 service requests provide anonymity by decoupling the data from the claimant and request, this however is necessary to be able to test the hypotheses of this study. A dataset containing the necessary information is the San Francisco City Survey. This dataset does not contain specific requests themselves. It does however contains answers regarding questions about the frequency and satisfaction with 3-1-1 services. The city survey assesses San Francisco residents' use of and satisfaction with various city services, among those are the city's 3-1-1 services (San Francisco, 2017). All data is included in the city survey dataset. The questions asked to respondents for the 2017 publication are the best fit for this project. Therefore the analysis has been executed solely on data from the 2017 publication.

Based on the abovementioned considerations, the inclusion and exclusion criteria of this study are as follows. Inclusion criteria: Datasets have to be large enough to be representative; Datasets have to be freely available. Datasets have to include gender, ethnicity, income, age, education level, use of 311, frequency of 311 phone use, frequency of 311 web/app use, general satisfaction with city services, whether a respondent has used public transport during the past 12 months and whether someone is a home owner or renting.

Based on these in- and exclusion criteria, it appeared that the city of San Francisco provided all the data needed to pursue the project. The city survey datasets was obtained online; the city survey (2017).The city survey is a demographically representative dataset of the city of San Francisco, oftentimes used in research projects. The data is available through the open data portal of the city of San Francisco.[2] Other data, like demographic averages, were collected through the webservice of the U.S. Census Bureau. The U.S. Census Bureau provides data about demographic averages for U.S. states, counties, cities and other governmental levels. These data are freely available online through their website. Census data from the 2020 Census was used for the purpose of this study.

The data provided through the city survey of San Francisco is useful to provide insight in individuals who use city services and to determine the satisfaction of people with the city services. However, the data is self-reported. This means that there is a possibility of bias. Respondents can be inclined to offer answers they think are socially acceptable or provide a better view of them as an individual. The dataset with 3-1-1 requests does not have this limitation, however due to the guaranteed anonymity inherently connected to the dataset it is impossible to distinguish individual level demographic data. Service requests are geotagged, therefore some researchers choose to relate the geotag of the request to a neighborhood and use neighborhood level demographic data to extrapolate answers from. This is however unfeasible for this research project due to time constraints. For this reason the city survey data is the best option to be used for the current study.

3.3 Operationalization

The following paragraphs will detail how the necessary information is operationalized, which problems arose during the operationalization and how they have been solved. The goal was to provide clear details so that the project can be replicated by other researchers and lead to similar results.

Included with the openly available data through the open data portal of San Francisco is a data index, which lists the different questions, their answers, and how they have been coded in the data export file. This eases the required research effort, however the data index holds several mistakes that make manual validation of questions and answers necessary. The data index

[2] https://data.sfgov.org/browse?q=city%20survey&sortBy=relevance and https://sfgov.org/sfc/citysurvey/about-city-survey

shows that during the 2017 city survey, questions regarding the 3-1-1 subject were asked to city inhabitants, therefore data from 2017 has been selected for this research project.

The table below, table 1, shows how the different variables in the dataset have been coded. In the case of the ethnicity variable this diverges from the city survey codebook, as the proposed coding included some mistakes. The table below shows how the variables can be coded for replication purposes.

Variable name	**Variable category**	**Coded as**	**Missing**
Gender	Binominal	0= Female 1= Male	All other values
Ethnicity *Has also been dummy coded with Caucasian White as reference.*	Nominal	1= African American/ Black 2= Asian 3= Arab / Middle Eastern 4= Caucasian White 5= Hispanic 6= Native American 7= Other	8, 9, 10
Income	Ordinal	1= <10.000 2= 10001-25000 3= 25001-35000 4= 35001-50000 5= 50001-100000 6= 100001-200000 7= >200000	8,9
Age	Ordinal	1= 18 – 24 2= 25 – 34 3= 35 – 44 4= 45 – 54 5= 55 – 59 6= 60 – 64 7= 65+	8
Education level	Ordinal	1= Less than high school 2= High school	5

		3= One to four years of college 4= More than 4 years of college	
Use of 311	Binary	0= no 1= yes	All other values
Frequency of 311 phone use	Ordinal	1= Never 2= Once or twice a year 3= Several times a year 4= At least once a month 5= At least once a week	6
Frequency of 311 web/app use	Ordinal	1= Never 2= Once or twice a year 3= Several times a year 4= At least once a month 5= At least once a week	6,7
General satisfaction with city services	Ordinal	1= F-Failing 2= D-Poor 3= C-Average 4= B-Good 5= A-Excellent	6,7
Has used public transport during the past 12 months	Binary	0 = no 1= yes	All other values
Home owner or renting	Binary	0 = Renting 1= Home owner	All other values

Table 1: Operationalization of variables

Some variables had to be created based on other variables in the dataset. The variable whether the participant had used 3-1-1 systems was not available. Based on several other questions regarding the use of 3-1-1, namely ‘how often have you used 3-1-1 by phone’ and ‘how often

have you used 3-1-1 through the web/app' with answering categories (never, once or twice a year, several times a year, once a month, at least once a week) a new variable was created that indicated whether the respondent had used any 3-1-1- system. All answers that referred to a "no" were recoded as a 0, and all answers of both variables that constituted the use of 3-1-1 systems by phone or by web/app were coded as a 1.

Income was measured through self-reported income. This contained some risks: reported income can be overexaggerated, the home situation of someone does not have to reflect the income, and it often appears that mainly higher income respondents are inclined to refuse to give their income level, which can lead to missing data that are not missing at random. As this is the best data available on the individual level, the choice has been made to pursue measurements through the use of self-reported income.

Some problems were found during the preliminary analysis of the data, first: Not all questions return in the data export with a similar name to the one they were provided with in the data export; examples of these are the variables "phone311" and "web311". Other mistakes were found within the variable "dethnic" that is essential to test the hypotheses. These mistakes were discovered during frequency analysis of the responses to the city survey. Following the codebook led to concluding that 44,4% of respondents in a demographically representative dataset were of Native American heritage. This is not in line with the data provided by the U.S. Census Bureau (United States Census Bureau, 2021), as the expectation for this group is to be about 0,7% of the total replies. Table 1 shows how this problem has been solved and how the variables have been recoded

The city of San Francisco does provide the questionnaire online it gives to the participants (San Francisco, 2017). By recording some variables according to the questions and possible answers one can give to the survey mistakes in the data export file were eliminated, results for "dethnic" are shown in appendix 3A. "phone311" "web311" were determined to mean: *"How satisfied are you with requesting 3-1-1 services through platform X"*.

3.4 Data-analysis

Among the methods applied will be ordinal logistic regression, chi-square tests and binary logistic regression The following paragraph will be used to describe the required test and analysis per hypotheses.

H1: The distribution of ethnic groups among claimants of 3-1-1- systems is different from its population distribution; the respondents group contains relatively more Caucasians.

H2: Claimants of 3-1-1 systems are not distributed equally among the different age groups compared to their demographic averages.

For this hypotheses the percentage of Caucasian respondents said to have used 3-1-1 services will be compared to the percentage of Caucasian inhabitants of the city of San Francisco through the use of chi-square tests. This will also be performed for other ethnicities as an overrepresentation of a single ethnicity automatically means that another ethnicity will have less than expected respondents. Analyses in this manner makes it possible to see whether there are statistically significant differences between the amount of participants based on ethnicity that *say* they have used 311 systems and the amount of people that is expected to use 311 systems based on the demographics of San Francisco.

H3: There are significant differences in 3-1-1 use between different education levels.

H4: Age is positively associated with 3-1-1 use.

H5: Income is positively associated with 3-1-1 use.

From this point onwards, data will be weighted before being analyzed further. To test the H3, H4 and H5 hypotheses data from the city survey itself will be used. The influence of education level, age and income on the use of 3-1-1 services will be measured through binary logistic regression analyses. The dependent variable for this hypotheses is coded in a binary manner. Therefore the choice has been made to use binary logistic regression. Several variables have to be controlled for. These variables are: whether someone has used public transport during the past 12 months and whether someone is a home owner or renting.

H6: Age is positively associated with the frequency of 3-1-1 use through the web/app to connect with 3-1-1 services; Older people will use it more frequently than younger people.

H7: Age has a significant association on the frequency of 3-1-1 use through the phone to connect with 3-1-1 services. Older people will use it more frequently than younger people.

H8: Yearly income has a significant association on the frequency of 3-1-1 use through the phone. Those in higher income brackets will use 3-1-1 services more than those in lower income brackets.

H9: Yearly income has a significant association on the frequency of 3-1-1 use through the app/web. Those in higher income brackets will use 3-1-1 services more than those in lower income brackets.

To test the H6, H7, H8 and H9 hypotheses, data from the city survey itself will be used. The influence of the independent variables age, income, ethnicity, gender, education level on the frequency of platform use will be analyzed through ordinal logistic regression. This is because the dependent variable is categorical and ordered. Therefore this statistical method is appropriate. A benefit of ordinal logistic regression is that it provides the ability to see what is happening within the different groups of a variable. If the data was treated as continues one could say "Age" is significant. Ordinal logistic regression provides the ability to see which age groups are significant. Based on the literature there are several variables that have to be controlled for. These are: whether someone has used public transport during the past 12 months and whether someone is a home owner or renting.

H10: Use of 3-1-1 services through the web/app or phone are significantly associated with a higher general satisfaction with city services.

The H10 hypotheses will be tested through ordinal logistic regression. The influence of platform choice on satisfaction with city services will be determined. The same variables will be controlled for as with the other hypotheses: whether someone has used public transport during the past 12 months and whether someone is a home owner or renting. The following table (Table 2) summarizes the hypotheses and proposed analytical methods.

Hypotheses	Proposed analytical Method
H1	Chi-Square test
H2	Chi-Square test
H3	Binary logistic regression
H4	Binary logistic regression
H5	Binary logistic regression
H6	Ordinal logistic regression
H7	Ordinal logistic regression
H8	Ordinal logistic regression
H9	Ordinal logistic regression
H10	Ordinal logistic regression

Table 2: Summary of hypotheses and proposed analytical methods

All data will be controlled for assumptions of binary logistic regression and where applicable ordinal logistic regression. For logistic regression these assumptions are: a binary dependent variable, independent observations, no multicollinearity, no extreme outliers, a linear relationship between independent variables and the logit of the dependent variable and a large enough sample size. For Ordinal logistic regression these assumptions are a ordinal dependent variable, one or more independent variables that are either continuous, categorical or ordinal, no multicollinearity of independent variables and proportional odds (St Andrews University, n.d.). The analyses will be performed through the use of SPSS. A cut-off value for significance of $p = 0.05$ (95% confidence interval) will be used.

4. Results

In this chapter the results of the analyses will be reported and interpreted. Table 3,4,5 and 6 are used to test the distribution of respondents compared to the expected distribution based on the complete population of San Francisco. Table 3 and 4 concern the Ethnicity of respondents and table 5 and 6 concern the age of the respondents.

Table 3: Ethnic distribution of respondents, empirical and expected.

Ethnicity	Observed N	%	Population distribution[3]
Black / African American	**59**	**7,76**	**4.90**
Asian	**127**	**16,71**	**34.00**
Caucasian White	**463**	**60,92**	**39.80**
Hispanic / Latino	**76**	**10,00**	**15.20**
Other			
Arab / Middle Eastern	**19**	**2,50**	**1.90**
Native American / pacific islander	**5**	**0,65**	**0.80**
All else: Missing	**11**	**1,45**	**3.40**
N	**760**	**99,9**	**100**

A larger percentage of white respondents automatically means that another ethnicity has a lower response rate, therefore one cannot test for each ethnic response expectation on its own, they have to be controlled completely in group form. This has been done by testing the expected population distribution compared to the observed distribution through a nonparametric chi-square test with expected values.

Table 4: Ethnic distribution of respondents, empirical and expected (non-parametric chi-square test results).

Ethnicity	Expected N	Residual
Black / African American	**37**	**21,8**
Asian	**258**	**-131,4**
Caucasian White	**303**	**160,5**
Hispanic / Latino	**116**	**-39,5**
Other		
Arab / Middle Eastern	**14**	**4,6**
Native American / pacific islander	**6**	**-1,1**
All else: Missing	**26**	**-14,8**
N	**760**	

[3] https://data.census.gov/cedsci/table?g=1600000US0667000&tid=ACSDP5Y2020.DP05

The nonparametric chi-square test results in the following: (Chi-Square 188,39; DF 6; p<0,001). Therefore it has been shown that the ethnic distribution of respondents differs significantly from the expected ethnic distribution based on their distribution in the complete population.

Table 5: Age group and population distribution, empirical and expected.

Age group	Observed N	%	Population distribution[4]
18 - 24	**31**	**3,63**	**5,54**
25 - 34	**86**	**10,07**	**23,47**
35 - 44	**176**	**20,61**	**15,79**
45 - 54	**199**	**23,30**	**13,18**
55 - 59	**97**	**11,36**	**5,80**
60 - 64	**82**	**9,60**	**5,80**
65+	**183**	**21,43**	**15,43**
Refused/Other/ Missing			**14,99**
Total	**854**	**100,00**	**100,00**

In table 5 the distribution of respondents based on their age is reported. In the last column the distribution of age in the general population of San Francisco is shown. There are differences between the groups and the expected amount based on their distribution in the population of San Francisco. To test whether to observed group differs significantly from the population distribution a non-parametric chi-square test has been used. The results are shown below in table 6.

Table 6: Age group and population distribution, empirical and expected (non-parametric chi-square test results).

Age group	Expected N	Residual
18 - 24	**56**	**-25**
25 - 34	**236**	**-150**
35 - 44	**159**	**17**
45 - 54	**132**	**67**
55 - 59	**58**	**39**
60 - 64	**58**	**24**
65+	**155**	**28**
Total	**854**	

The nonparametric chi-square test results in the following: (Chi-Square 181,93; DF 6; p<0,001). Therefore it has been shown that the age distribution of respondents differs significantly from the expected age distribution based on their distribution in the complete population.

[4] https://data.census.gov/cedsci/table?g=1600000US0667000&tid=ACSDP5Y2020.DP05

The table below shows the binary logistic regression of education, age, income and ethnicity on whether someone has or has not used 3-1-1 (through phone or web and app). The variables education, age and income are treated as categorical variables.

Table 7: Binary Logistic regression 1: Explanation of having or having not used 3-1-1.

	Binary Logistic Regression 1:
Constant:	-0.24
	(0.346)
Highest education completed: (Ref: Less than High School)	
High School	-0.601
	(405)
One to four years of college	0.293
	(0.260)
Four or more years college	0,136
	(0.191)
Age (Ref: Age 18-24 years old)	
Age 25-34 years old	-0.561
	(0.353)
Age 35-44 years old	-0.396
	(0.241)
Age 45-54 years old	-0.045
	(0.241)
Age 54-59 years old	0.318
	(0.248)
Age 60-64 years old	0.286
	(0.303)
Age 65+ years old	0.469
	(0.329)
Income (Ref: Income <$10000)	
Income $10001-$25000	0,022
	(0.411)
Income $25001-$35000	-0.350
	(0.329)
Income $35001-$50000	-0.030
	(0.341)
Income $50001-$100000	-0.240
	(0.277)
Income $100001-$200000	0.092
	(0.229)
Income $200000+	-0.051
	(0.214)
Ethnicity (Ref Caucasian/White)	
Asian	-0.378*
	(0.041)
Arabian / Middle eastern	0.424
	(0.413)
Black / African American	-0,024

	(0.933)
Hispanic	0.307
	(0.219)
Native American	1.196
	(0.314)
Other	0.315
	(0.563)
Gender (Ref: female)	0,240
	(0.090)
Use of Public transport	0.324
(ref: not used past 12 months)	(0.168)
House owner	0,443**
(ref: renting)	(0.006)
Nagelkerke R Square	0,079
Df	24

*Note: Binary logistic- regression coefficients with standard errors between parentheses. ***p < 0,001, **p < 0,01, * p < 0,05*

In table 7 a binary logistic regression is used to help explain the use of 3-1-1. Different variables are entered as categorical variables. Two variables are shown to have a significant explanatory effect. Being from Asian ethnicity has a negative effect of -0.378, which is significant on the p = 0,05 level. Meaning that being from Asian ethnicity decreases the probability of using 3-1-1 measured on a scale from zero to one with 0,378 compared to someone from Caucasian white ethnicity. Being a house owner also has a significant effect: it increases the probability of using 3-1-1 measured on a scale from zero to one with 0,443. This is significant on the p = 0,01 level.

The following table is table 8. Table 8 shows Ordinal logistic regression 1 and 2; Frequency of use in two situations. It shows the ordinal logistic regressions of education level, age, ethnicity and income on the use of 311 systems through calling with the 3-1-1 call center and regression 2: education level, age, ethnicity and income of the use of 311 systems through using the 3-1-1 services through the web/app. The controlling variables; *Gender, Use of public transport and House Ownership* are included. The Ethnicity variable has been codes as a dummy, with reference category *Caucasian White*. This table continues on the following page. Odds ratios and significance of the Wald test are reported.

Table 8: Ordinal logistic regression 1 and 2; Frequency of 3-1-1 use in two situations.

	Model 1: Frequency of 3-1-1 use through phone	Model 2: Frequency of 3-1-1 use through web/app
Constant: (Ref: Use 3-1-1 several times a week)		
Exp (β): Never use 3-1-1	1,338	5,226***

	(0,297)	(<0,001)
Exp (β): Use 3-1-1 once or twice a year	5,114 *** (<0,001)	13,887*** (<0,001)
Exp (β): Use 3-1-1 several times a year	19,899*** (<0,001)	32,945** (0,001)
Exp (β): Use 3-1-1 at least once a month	65,033 (<0,001)***	82,341** (0,001)
Highest education completed: (Ref: Four or more years college)		
Less than High School	0,578 (0,124)	0,451 (0,115)
High School	1,408 (0,105)	0,816 (0,453)
one to four years of college	1,099 (0,540)	0,761 (0,162)
Age (Ref: Age 65+ years old)		
Age 18-24 years old	0,456* (0,030)	1,810 (0,181)
Age 25-34 years old	0,518*** (<0,001)	1,807* (0,019)
Age 35-44 years old	0,716 (0,081)	2,085** (0,003)
Age 45-54 years old	1,017 (0,928)	2,403*** (<0,001)
Age 54-59 years old	1,107 (0,646)	1,812* (0,039)
Age 60-64 years old	1,319 (0,234)	1,241 (0,507)
Income (Ref: Income $200000+)		
Income <$10000	1,536 (0,209)	0,669 (0,345)
Income $10001-$25000	1,208 (0,487)	0,563 (0,094)
Income $25001-$35000	1,539 (0,115)	0,497 (0,052)
Income $35001-$50000	1,192 (0,447)	0,582 (0,052)
Income $50001-$100000	1,209 (0,297)	0,900 (0,619)
Income $100001-$200000	1,103 (0,570)	0,757 (0,164)
Ethnicity (Ref Caucasian/White)		

Asian	0,728*	0,925
	(0,043)	(0,682)
Arabian / Middle eastern	1,669	1,098
	(0,203)	(0,846)
Black / African American	1,027	1,535
	(0,909)	(0,124)
Hispanic	1,712**	1,381
	(0,007)	(0,172)
Native American	1,817	2,665
	(0,393)	(0,204)
Other	0,748	1,400
	(0,541)	(0,518)
Gender (Ref: female)	1,184	1,015
	(0,141)	(0,912)
Use of Public transport	1,338	1,486
(Ref: not used past 12 months)	(0,131)	(0,112)
House owner	1,551***	1,012
(Ref: renting)	(<0,001)	(0,938)
-2 Log likelihood Chi Square	77.221***	46,778**
Df	24	24

*Note: Ordinal logistic-regression Exp(*β) reported *with significance of Wald' test between parentheses. ***p < 0,001, **p < 0,01, * p < 0,05*

The significant results from table 8 will be interpreted. The non-significant results will be largely ignored. Model 1: Frequency of 3-1-1 use through the phone is a significant improvement over de null-model: [$\chi^2(24)=77.221$, $p<.0001$]. Age 18-24 years old was a significant predictor (OR = .456, p = .030) of the frequency of use of 3-1-1 by phone. This can be interpreted as that the probability of someone from the youngest age group to use 3-1-1 through the phone more frequently is (1 / 0.456 =) 2.19 times smaller compared to the probability that someone from the reference category, which is the 65+ age group.

Age 25-34 years old was a significant predictor (OR = .518, p < 0.001) of the frequency of use of 3-1-1 by phone. This means that the odds of someone from this age group to use 3-1-1 through the phone more frequently is (1 / 0.518 =) 1.93 times smaller compared to the probability that someone from the reference category, which is the 65+ age group.

No significant differences were found for the other age groups. No significant results were found for the different income brackets. The analyses shows two significant results for ethnicity; for people of Asian ethnicity (OR = .728, p = 0.05) and for people of Hispanic ethnicity (OR = 1.712, p < 0.01). Meaning that people with an Asian ethnicity have a (1 / 0.728 =) 1.36 times smaller probability of using 3-1-1 services more frequently and people with a

Hispanic ethnicity have a 1.712 higher probability of using 3-1-1 services. Both groups are compared to the reference category, which is the Caucasian white group.

The last significant result is found among the controlling variables. This is the houseowner variable. Owning a house (OR = 1.551, $p < 0.001$) results in a 1.551 higher probability of using 3-1-1 services through the phone more frequently compared to those renting a house. The other controlling variables were found to be non-significant.

Table 8 also includes model 2; Frequency of 3-1-1 use through web/app. The model is a significant improvement over the null-model: [$\chi^2(24)=46.778$, $p<.001$]. All significant predictors of this model are found in the categorical variable age. Every age group, excluding the youngest and oldest group show are significant difference from the reference category which is the 65+ group. Age 25-34 (OR = 1.807, $p = 0.05$), Age 35-44 (OR = 2.085, $p = 0.01$), Age 45-54 (OR = 2.403, $p < 0.001$), Age 55-59 (OR = 1.812, $p = 0.01$) are all significant predictors of frequency of 3-1-1 use compared to the reference category.

The other variables, including owning a house, which was significant in model 1, are not found to be significant. Only the age variable showed significant results.

The table below shows ordinal logistic regression 3: the association between the frequency of 3-1-1 use through phone, web or app and the general satisfaction people have with city services. Other explanatory variables, like *education, age, income and ethnicity* (dummy coded with Caucasian white as reference category) are included in the table, as well as the controlling variables *gender, use of public transport and house ownership*. Odds ratios and significance of the Wald test are reported.

Table 9: Ordinal logistic regression 3: Effect of 3-1-1 use by phone or web/app on general satisfaction with city services.

	Ordinal Logistic Regression 3:
Constant: (Ref: Excellent general satisfaction with city services)	
Exp (β) Failing satisfaction	0,067*** (<0,001)
Exp (β) Exp (β) Poor satisfaction	0,245*** (<0,001)
Exp (β) Average satisfaction	2,140 (0,056)
Exp (β) Good satisfaction	32,569** (0,001)

Use of 311 through the phone (Ref: at least once a week)	
Never	1,748*
	(0,036)
Once or twice a year	1,766
	(0,035)
Several times a year	1,365
	(0,261)
Once a month	0,979
	(0,946)
Use of 311 through the web/app (Ref: at least once a week)	
Never	1,1225
	(0,411)
Once or twice a year	1,155
	(0,587)
Several times a year	1,145
	(0,639)
Once a month	1,577
	(0,153)
Highest education completed: (Ref: Four or more years college)	
Less than High School	1,644
	(0,069)
High School	1,177
	(0,292)
One to four years of college	0,775*
	(0,025)
Age (Ref: Age 65+ years old)	
Age 18-24 years old	2,349***
	(<0,001)
Age 25-34 years old	1,436*
	(0,033)
Age 35-44 years old	1,435*
	(0,035)
Age 45-54 years old	1,303
	(0,119)
Age 54-59 years old	1,076
	(0,675)
Age 60-64 years old	0,919
	(0,644)
Income (Ref: Income $200000+)	
Income <$10000	2,065**
	(0,002)
Income $10001-$25000	1,308
	(0,158)
Income $25001-$35000	1,219
	(0,314)
Income $35001-$50000	1,308

	(0,103)
Income $50001-$100000	1,132
	(0,359)
Income $100001-$200000	1,284
	(0,048)
Ethnicity (Ref Caucasian/White)	
Asian	0,885
	(0,281)
Arabian / Middle eastern	1,231
	(0,468)
Black / African American	0,596**
	(0,002)
Hispanic	0,915
	(0,545)
Native American	0,523
	(0,218)
Other	0,775
	(0,495)
Gender (Ref: female)	0,805**
	(0,010)
Use of Public transport	1,199
(ref: not used past 12 months)	(0,339)
House owner	0,891
(ref: renting)	(0,234)
-2 Log likelihood Chi Square	101,213***
Df	32

*Note: Ordinal logistic-regression Exp(*β) reported *with significance of Wald' test between parentheses. ***p < 0,001, **p < 0,01, * p < 0,05*

The model in table 9 is shown to be a significant improvement from the null model without any predictors [$\chi^2(32)=101.213$, p<.0001]. Several variables were shown to be significant predictors of general satisfaction with city services. Among these there is never having used 3-1-1 through the phone on the $p < 0.05$ level. Which can be interpreted as someone never having used 3-1-1 through the phone having a (OR = 1.748, p = .036) 1.1748 times higher probability of having a higher general satisfaction with city services compared to someone using 3-1-1 services through the phone several times a week.

One to four years of college is a significant predictor of general satisfaction with city services (OR = 0.775, p = 0,025). Someone having done one to four years of college has a (1 / .775 =) 1.29 lower chance of having a higher general satisfaction with city services compared to someone that has completed more than four years of college.

Age 18-24 years old is found to be a significant predictor of having a higher general satisfaction with city services compared to someone from the reference group, which is those of 65+. The

association is significant (OR 2.349, $p < 0.001$). Age 25-34 (OR 1.436 $p = 0,05$) and age 35-44 (OR = 1.435, $p = 0,05$) are also significant compared to the reference group. Income (OR = 2.065, $p = 0.01$) is also a significant prediction compared to the reference group. Ethnicity: Black / African American (OR = 0.596, $p = 0.01$) shows that someone with a Black / African American background has a (1 / 0.596 =) 1.67 times lower probability of having a higher general satisfaction with city services. From the controlling variables gender is found to be significant (OR = 0.805, $p = 0.01$), being female is the reference category, being male is associated with a (1 / 0,805 =) 1.24 lower probability of having a higher general satisfaction with city services.

5. Discussion

This chapter will be used to discuss the results of the empirical analysis. The hypotheses and main research question will be answered.

Hypotheses	Rejected / Failed to reject
H1	Failed to reject
H2	Failed to reject
H3	Rejected
H4	Rejected
H5	Rejected
H6	Rejected
H7	Failed to reject
H8	Rejected
H9	Rejected
H10	Rejected

Table 9: Summary of results of hypotheses testing

H1: The distribution of ethnic groups among claimants of 3-1-1- systems is different from its population distribution; the respondents group contains relatively more Caucasians.

H2: Claimants of 3-1-1 systems are not distributed equally among the different age groups compared to their demographic averages.

For H1 and H2 a significant difference between the population of respondents and the complete population of San Francisco citizens was found. Therefore the hypotheses were failed to be rejected.

H3: There are significant differences in 3-1-1 use between different education levels.

H4: Age is positively associated with 3-1-1 use.

H5: Income is positively associated with 3-1-1 use.

H3, H4 and H5 were used to test the determinants of the digital divide. The model in table 7 shows no significant effects of those variables on the use of 3-1-1 services. Therefore the hypotheses are rejected. Finding significant results would have meant failing to reject the hypotheses.

H6: Age is positively associated with the frequency of 3-1-1 use through the web/app to connect with 3-1-1 services; Older people will use it more frequently than younger people.

The test for H6 is shown in model 2, Table 8. Multiple age groups are shown to have a significant association. Roughly, the model shows an increase in the odds of using 3-1-1 more frequently through the web/app when someone is younger. This means the hypotheses, that stated older people will use it more frequently, is rejected.

H7: Age has a significant association on the frequency of 3-1-1 use through the phone to connect with 3-1-1 services. Older people will use it more frequently than younger people.

The test for H7 is shown in model 1, table 8. There is a clear trend showing in the logit odds of being in a group with higher frequent use when being in a higher age group. The higher the age group, the higher the probability of being a more frequent 3-1-1 phone user. This hypotheses has therefore failed to be rejected.

H8: Yearly income has a significant association on the frequency of 3-1-1 use through the phone. Those in higher income brackets will use 3-1-1 services more than those in lower income brackets.

No significant results were found on the income variable, therefore this hypotheses is rejected.

H9: Yearly income has a significant association on the frequency of 3-1-1 use through the app/web. Those in higher income brackets will use 3-1-1 services more than those in lower income brackets.

For H9 no significant results were found and no trend was visible in the data. Therefore this hypotheses was rejected.

H10: Use of 3-1-1 services through the web/app or phone are significantly associated with a higher general satisfaction with city services.

For both variables, use of 3-1-1 services through the phone and use of 3-1-1 services through the web/app, no significant results were found in the model with controlling variables, therefore the hypotheses stated above is rejected.

Each hypotheses was used to create insight in the sub question it belonged to. The first sub question: To what extent are demographic groups normally associated with the digital divide underrepresented in co-creation/co-production environments? Was answered using H1, H2, H3, H4 and H5. The first two hypotheses were failed to be rejected; a significant difference between the research population and the San Francisco population based on two demographic characteristics was found. An underrepresentation of those belonging to the digital divide was found. H3, H4 and H5 were failed to be rejected. No significant differences were found between the categories within these variables.

The following was the second sub question: to what extent are demographic groups connected with the digital divide associated with different frequencies of use of 3-1-1 services? H5, H6, H7 and H8 were used to answer this question. All but H7 were rejected. H7 measured the association between age and use of 3-1-1 phone services. Those in older groups were more likely to use the phone more frequently.

The Final sub question is: To what extent is the use of 3-1-1 through the web/app and phone are associated with a higher general satisfaction with city services. H9 and H10 were used to test the final sub question. Both hypotheses were rejected. There was no significant association found of use of 3-1-1 services and general satisfaction with city services in a model with controlling variables.

All variables were tested in models including a number of controlling variables. There were some significant results, but not much. Age has in multiple models regarding the use and frequency of use of 3-1-1 services been shown to be significant. The influence of age is specifically clear in the model 1, table 8, where a clear trend is visible.

6. Conclusion

This chapter reiterates the motivation and goals of this project. The main research question and the findings will be discussed, as well as that the strengths and limitations of this research project will be critically assessed. This chapter will also be used to assess the factors that might be interesting for further research.

The goal for this project was to further look into mechanisms surrounding the concepts of co-production. The influence of the platform through which people co-produce in 3-1-1 situations has been assessed. There were differences between the platforms, however, these results were insignificant. Through an randomized experimental study the effects of platform choice on the willingness to co-create are better assessed.

The main research question: **To what extent does the service request platform influence co-production and how is this influenced by income, ethnicity, education of citizens and the digital divide?** Has been answered using multiple sub questions. Determinants of the digital divide were found to be inconclusive on their influence on co-production. The groups making up the digital divide are complex and should be researched separately. Platform choice is found to be insignificant in deciding whether people do or do not co-produce. In the case of co-production through telephone, age has been found to have a significant effect, while in the case of co-production through the web/app it has been found to be insignificant. All data used for this project was categorical, this is the nature of the San Francisco city survey. More robust associations can possibly be extrapolated by using interval data.

This study does not encompass the whole subject of co-production. It does not use service requests themselves, as Clark et al., (2013) do. This study uses the city survey. The reader should bear in mind that this is self-reported data. Even though that a large sample size like the one used in the study limits the influence outliers can have on the project one should carefully use the results of this project.

Some groups mentioned during study are too small to make reliable statistical inferences from. An example of this is the Native American group or pacific islander group. Results from these groups are included to show that they are too small to continue with, and therefore have been decided not to influence the project further.

Economic standing, one of the determinants of the digital divide, has been measured using self-reported income. This was the data that was available. There are some caveats with measuring

economic standing through income. First: people can have the feeling that they need to overreport their income as to look more successful even in situations where data is collected and anonymized. Second, income does not inform about the debts one has. Someone going through a divorce or just having lost his/her job has a lower economic standing while the reported income of the previous year could still be high.

Self-reported data can be faulty. Compared with the data of the service requests themselves this data can be seen as lacking. Researchers have been able to link service request data to neighborhoods, and researchers have thereby been able to make inferences on neighborhood level through a combination of census data and the service requests. This project, although it relies on self-reported data, has been able to use individual level data to test existing hypotheses. This individual level data makes it better able to distinguish differences based on demographics. It would however have been better is the data was interval instead of grouped in categories.

This project has relied on survey data made available by the city of San Francisco. The data is stated to be representative of the population of city of San Francisco. Research continuing the subject of co-production would benefit from combining data sources from multiple cities inside or outside the United Stated to see whether these findings are still valid. Another possible issue with data about San Francisco is that is it an edge case. San Francisco is a very high cost of living city and a center for technological developments. This means that group behavior of those living in San Francisco may differ from how these groups act in other parts of the country.

One comment by Clark et al., (2013) is that smartphone use has possibly been responsible for bridging the digital divide. Smartphones have been becoming an nearly essential part of the life of many people. One way to test the statement by Clark et al., (2013) is to compare data over time. If data about 3-1-1 use is available from the time before smartphones became common, one can assess their influence by comparing it to data from a period where smartphones fulfil the role they do now. Another possibility is to compare 3-1-1 results of cities that do have a smartphone app to cities that do not have a smartphone app to complete 3-1-1 requests through. If smartphones have truly been able to bridge the digital divide differences in claimants of 3-1-1 services between those cities should be visible.

Literature research for this study has aimed at finding out most influential variables on co-production that are known. The methodology has aimed to include all of those. Still, there is a large possibility for omitted variable bias. This makes the results highly suspect, and those wishing to build on this project should be aware of that. Further research could aim at addressing

these issues. Other possibilities for further research can be about which cities do and which do not develop 3-1-1 services. Does this have to do with the political landscape within a city or do other factors matter?

To conclude this thesis, the data being from an edge case city, the insignificance of results and the fact that the dependent variables do not measure the whole spectrum of co-production make this thesis somewhat unrepresentative and therefore ungeneralizable. Insights were provided in the sense that the effect of the variable age was clear. Determinants of the digital divide, excluding age, were largely not significant.

7. Bibliography

Albrecht, S. (2006). Whose voice is heard in online deliberation?: A study of participation and representation in political debates on the internet. *Information Communication and Society*, *9*(1), 62–82. https://doi.org/10.1080/13691180500519548

Algemeen Dagblad. (2017). *Aantal petities groeit explosief, maar effect blijft vaak uit*. https://www.ad.nl/groene-hart/aantal-petities-groeit-explosief-maar-effect-blijft-vaak-uit~a78b71b8/

Allen, B., Tamindael, L. E., Bickerton, S. H., & Cho, W. (2020). Does citizen coproduction lead to better urban services in smart cities projects? An empirical study on e-participation in a mobile big data platform. *Government Information Quarterly*, *37*(1), 101412. https://doi.org/10.1016/j.giq.2019.101412

Ansell, C., & Torfing, J. (2021). Co-creation: the new kid on the block in public governance. *Policy and Politics*, *49*(2), 211–230. https://doi.org/10.1332/030557321X16115951196045

Arnaud, H. (2022). *Mercedes scant de weg voor de Nederlandse overheid*. https://www.vroom.be/nl/nieuws/mercedes-scant-de-weg-voor-de-nederlandse-overheid-23596/

Bannister, F., & Connolly, R. (2014). ICT, public values and transformative government: A framework and programme for research. *Government Information Quarterly*, *31*(1), 119–128. https://doi.org/10.1016/j.giq.2013.06.002

Becker, J., Niehaves, B., Bergener, P., & Räckers, M. (n.d.). Digital Divide in eGovernment: The eInclusion Gap Model [Bookitem]. In *Electronic Government* (pp. 231–242). Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-540-85204-9_20

Brandsen, T., & Honingh, M. (2016). Distinguishing Different Types of Coproduction: A Conceptual Analysis Based on the Classical Definitions. *Public Administration Review*, *76*(3), 427–435. https://doi.org/10.1111/puar.12465

Brandsen, T., Steen, T., & Verschuere, B. (2018). Co-Production and Co-Creation. In *Co-Production and Co-Creation* (p. 322).

Campbell, A. L. (2003). *How policies make citizens: senior political activism and the American welfare state*. Princeton University Press.

Clark, B. Y., & Brudney, J. L. (2022). Transportation and coproduction: looking for vulnerabilities to boost and enhance co-assessment. *Public Money & Management*, 1–8. https://doi.org/10.1080/09540962.2022.2080358

Clark, B. Y., Brudney, J. L., & Jang, S. G. (2013). Coproduction of government services and the new information technology: Investigating the distributional biases. *Public Administration Review*, *73*(5), 687–701. https://doi.org/10.1111/puar.12092

Clark, B. Y., Brudney, J. L., Jang, S. G., & Bradford, D. (2020). Do Advanced Information Technologies Produce Equitable Government Responses in Coproduction: An Examination of 311 Systems in 15 U.S. Cities. *American Review of Public Administration*, *50*(3), 315–327. https://doi.org/10.1177/0275074019894564

de Jong, M. D. T., Neulen, S., & Jansma, S. R. (2019). Citizens' intentions to participate in governmental co-creation initiatives: Comparing three co-creation configurations. *Government Information Quarterly*, *36*(3), 490–500. https://doi.org/10.1016/j.giq.2019.04.003

DiMaggio, P., Hargittai, E., Russell Neuman, W., & Robinson, J. P. (2001). *Social Implications of the Internet*. www.annualreviews.org

Fang, Z. (2002). E-Government in Digital Era: Concept, Practice, and Development Related papers A Novel DSS Framework for E-government. *International Journal of The Computer, The Internet and Management*, *10*(2), 1–22.

Gainous, J., Marlowe, A. D., & Wagner, K. M. (2013). Traditional Cleavages or a New World: Does Online Social Networking Bridge the Political Participation Divide? *International Journal of Politics, Culture and Society*, *26*(2), 145–158. https://doi.org/10.1007/s10767-013-9130-2

Gilens, M. (2012). Affluence and influence: economic inequality and political power in America. In *Affluence and influence*. Princeton University Press.

Goor, H. (1975). Macht, participatie en inspraak op lokaal niveau: enige recente Nederlandstalige publikaties. *Sociologische Gids*, *22*(5), 383–393.

Hajnal, Z. L., & Lewis, P. G. (2003). Municipal institutions and voter turnout in local elections. *Urban Affairs Review*, *38*(5), 645–668. https://doi.org/10.1177/1078087403038005002

Halachmi, A., & Holzer, M. (2010). *Citizen Participation and Performance Measurement: Operationalizing Democracy through better accountability*. *34*(3), 378–399.

Heawood, J. (2018). Pseudo-public political speech: Democratic implications of the Cambridge Analytica scandal. *Information Polity*, *23*(4), 429–434. https://doi.org/10.3233/IP-180009

Irvin, R. A., & Stansbury, J. (2004). Citizen Participation in Decision Making: Is It Worth the effort? *Public Administration Review*, *64*(1), 55–65. https://doi.org/10.1111/j.1540-6210.2004.00346.x

Kang, M. (2014). Understanding Public Engagement: Conceptualizing and Measuring its Influence on Supportive Behavioral Intentions. *Journal of Public Relations Research*, *26*(5), 399–416. https://doi.org/10.1080/1062726X.2014.956107

Kang, N., & Kwak, N. (2003). A multilevel approach to civic participation: Individual length of residence, neighborhood residential stability, and their interactive effects with media use. *Communication Research*, *30*(1), 80–106. https://doi.org/10.1177/0093650202239028

Korthagen, I., van Keulen, I., Hennen, L., Aichholzer, G., Rose, G., Linder, R., & Goos, K. (2018). *Prospects for e-democracy in Europe Science and Technology Options Assessment* (Issue February). http://www.europarl.europa.eu/RegData/etudes/STUD/2018/603213/EPRS_STU(2018)603213_EN.pdf

Lee, J., & Kim, S. (2018). Citizens' e-participation on agenda setting in local governance: Do individual social capital and e-participation management matter? *Public Management Review*, *20*(6), 873–895. https://doi.org/10.1080/14719037.2017.1340507

Mainka, A., Castelnovo, W., Miettinen, V., Bech-Petersen, S., Hartmann, S., & Stock, W. G. (2016). Open innovation in smart cities: Civic participation and co-creation of public services. *Proceedings of the Association for Information Science and Technology*, *53*(1), 1–5. https://doi.org/10.1002/pra2.2016.14505301006

Mora, L., Bolici, R., & Deakin, M. (2017). The First Two Decades of Smart-City Research: A Bibliometric Analysis. *Journal of Urban Technology*, *24*(1), 3–27. https://doi.org/10.1080/10630732.2017.1285123

Myeong, S., Kwon, Y., & Seo, H. (2014). Sustainable e-governance: The relationship among trust, digital divide, and E-government. *Sustainability (Switzerland)*, *6*(9), 6049–6069. https://doi.org/10.3390/su6096049

Naranjo-Zolotov, M., Oliveira, T., & Casteleyn, S. (2019). Citizens' intention to use and recommend e-participation: Drawing upon UTAUT and citizen empowerment. *Information Technology and People*, *32*(2), 364–386. https://doi.org/10.1108/ITP-08-2017-0257

Ostrom, E. (1999). Crossing the great divide. Co-production, synergy & development, polycentric governance and development. In *M. D. McGinnes (Ed.) Reading from the workshop in political theory and policy analysis*. Ann Arbor, MI: University of Michigan Press.

Rathenau Instituut. (2019). *Digitaal burgers betrekken*. https://www.rathenau.nl/nl/kennisgedreven-democratie/digitaal-burgers-betrekken

Rogers, E. M., Licklider, J. C. R., & Taylor, R. W. (2001). The Digital Divide. *Convergence*, *7*(4).

Rohe, W. M., van Zandt, S., & McCarthy, G. (2002). Home ownership and access to opportunity. *Housing Studies*, *17*(1), 51–61. https://doi.org/10.1080/02673030120105884

RTL Nieuws. (2015). *"Duurste ICT-project overheid ooit is fiasco."* https://www.rtlnieuws.nl/nederland/politiek/artikel/1203396/duurste-ict-project-overheid-ooit-fiasco

San Francisco. (2017). *San Francisco City Survey 2017*. https://sfgov.org/sfc/sites/default/files/City%20Survey/2017%20San%20Francisco%20City%20Survey%20Questionnaire.pdf

Schaffers, H., Komninos, N., Pallot, M., Trousse, B., Nilsson, M., & Oliveira, A. (2011). Smart cities and the future internet: Towards cooperation frameworks for open innovation. *Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, *6656*, 431–446. https://doi.org/10.1007/978-3-642-20898-0_31

Schlaufer, C. (2020). Why do nondemocratic regimes promote e-participation? The case of Moscow's active citizen online voting platform. *Governance, July*, 821–836. https://doi.org/10.1111/gove.12531

Seo, D. B., & Bernsen, M. (2016). Comparing attitudes toward e-government of non-users versus users in a rural and urban municipality. *Government Information Quarterly*, *33*(2), 270–282. https://doi.org/10.1016/j.giq.2016.02.002

St Andrews University. (n.d.). *ordinal logistic regression*.

Torfing, J., Sørensen, E., & Røiseland, A. (2019). Transforming the Public Sector Into an Arena for Co-Creation: Barriers, Drivers, Benefits, and Ways Forward. *Administration and Society*, *51*(5), 795–825. https://doi.org/10.1177/0095399716680057

Tukiainen, T., Leminen, S., & Westerlund, M. (2015). Cities as Collaborative Innovation Platforms. *Technology Innovation Management Review*, *5*(10), 16–23. https://doi.org/10.22215/timreview933

United States Census Bureau. (2021, July 1). *San Francisco County, California*. https://www.census.gov/quickfacts/sanfranciscocountycalifornia

Venkatesh, V., Morris, M. G., & Ackerman, P. L. (2000). A Longitudinal Field Investigation of Gender Differences in Individual Technology Adoption Decision-Making Processes. *Organizational Behavior and Human Decision Processes*, *83*(1), 33–60. https://doi.org/10.1006/obhd.2000.2896

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User Acceptance of Information Technology: Toward a Unified View. *MIS Quarterly*, *27*(3), 425–478.

Voorberg, W. H., Bekkers, V. J. J. M., & Tummers, L. G. (2015). A Systematic Review of Co-Creation and Co-Production: Embarking on the social innovation journey. *Public Management Review*, *17*(9), 1333–1357. https://doi.org/10.1080/14719037.2014.930505

Wijnhoven, F., Ehrenhard, M., & Kuhn, J. (2015). Open government objectives and participation motivations. *Government Information Quarterly*, *32*(1), 30–42. https://doi.org/10.1016/j.giq.2014.10.002

Wu, W. N. (2021). Does Citizens' 311 System Use Improve Satisfaction with Public Service Encounters?—Lessons for Citizen Relationship Management. *International Journal of Public Administration*, *44*(8), 665–673. https://doi.org/10.1080/01900692.2020.1744644

Young, M. M. (2021). The impact of technological innovation on service delivery: social media and smartphone integration in a 311 system. *Public Management Review*. https://doi.org/10.1080/14719037.2021.1877794

Zheng, Y. (2017). Explaining Citizens' E-Participation Usage: Functionality of E-Participation Applications. *Administration and Society*, *49*(3), 423–442. https://doi.org/10.1177/0095399715593313

8. Appendix

The variable ethnicity (dethnic) had some coding mistakes. These were found out during frequency analyses of the ethnicities of claimants of 3-1-1 systems. The table below shows how this variable has been recoded.

Original coding of dethnic	Nominal	1 = Black/African American 2 = Asian or Pacific Islander 3 = Latino/Hispanic 4 = Native American/Indian 5 = White/Caucasian 6 = Other 7 = Mixed Ethnicity 9 = Don't know 10 = Refused/No answer 11 = Pacific Islander 12 = Arab / Middle Eastern /North African 13 = Mixed Unspecified 14 = Caribbean	
Ethnicity recoded (dethnic)	Nominal	1= African American/ Black 2= Asian, pacific islander 3= Arab / Middle Eastern 4= Caucasian White 5= Hispanic 6= Native American 7= Other (all others)	8, 9, 10

Table 10: Technical appendix, recoding of dethnic.