IRIS Utrecht presenteert:

Citizens in Smart City Projects

Exploring the far-reaching role of citizens in Smart City projects and how to embrace this role in its planning

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Context van het rapport:
Het onderzoeksrapport is het eindproduct van het *Applied Economics Research Course* in academisch jaar 2019-2020, tevens slotstuk van de bacheloropleiding *Economics and Business Economics*. Het rapport is geschreven in opdracht van WP3.

Kernvraag:
To what extent and how can business model canvassing help determine the role of citizen engagement in smart city development?

Samenvatting:
Due to urbanization and increasing pressure on cities, the amount of smart city projects has grown rapidly over the past decades. This study researches the role of citizen engagement in these smart city projects and how business modelling can help determine the role of citizens. A case study analysis is presented based on two Utrecht-based, firm-led smart city project which are analyzed on their method of dealing with of citizen engagement. Next, it is determined whether and to what extent business modelling could have played a role in determining the citizen's role. It is found that business modelling can help determining the role of citizen in earlier stages by their call for market research. However, some adaptions should be made to the business model to better enlighten the role of the citizen.

Tags:
Citizens, Citizen Engagement, Smart City, Business Model Canvas

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Research paper applied economics research course

Academic year: 2019-2020

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Wordcount: 5665

Statement of Originality

I, Lenne Omlo 6112978, herewith declare to have written this document and that I am responsible for the content of it. I declare that the text and the work presented in this document is original and that no sources other than those mentioned in the text and its references have been used in creating it.

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Abstract

Due to urbanization and increasing pressure on cities, the amount of smart city projects has grown rapidly over the past decades. This study researches the role of citizen engagement in these smart city projects and how business modelling can help determine the role of citizens. In this paper, I firstly (1) introduce the role of user in project success and the growing importance of smart cities, after which I (2) build a theoretical framework on how and to what extent citizens should be engaged in smart city project, then (3) present a case study analysis based on two Utrecht-based, firm-led smart city project who will be analysed on their method of dealing with of citizen engagement and finally (4) conclude whether and to what extent business modelling could have played a role in determining the citizen's role. I find that business modelling can help determining the role of citizen in earlier stages by their call for market research. However, some adaptions should be made to the business model to better enlighten the role of the citizen, I propose adding the aspect of 'time allocation' and 'impact creation'.

Contents

1 Introduction

Over the past decennia, the importance of cities within the European Union (EU) area has grown significantly, as European cities are already said to be 'the engines of the economy' and their relevance might even grow further (Nabielek, Hamers & Evers, 2016). The past years have been characterized by constant urbanization, resulting in nearly 75% of the EU population living in cities in the year 2018 (World Bank, 2018). This pressure on cities highlights the urgency to ponder about the possible future dynamics of cities and how to handle these dynamics. The economic productivity, social stability, and environmental quality should be held up to standards and, in some cases, even be improved upon to cope with future challenges, in order to secure both the health and stability of the city.

Development of smart cities is a tool that can help maintain this health as a smart city is defined as a geographical area governed by a municipality (or another type of group stating the rules and policies for the city) in which technologies are used to the benefit of citizens, focusing on e.g. quality of life or environmental quality (Dameri, 2013). Smart city projects help cities become smarter on a small and local level. Within Europe, the project IRIS, funded by Horizon2020[1], is an example of effort to create more smart city solutions. It enables specific initiatives in three Lighthouse Cities: Utrecht, Gothenburg and Nice, to test (and improve on) smart city projects. The initiatives in the three lighthouse cities have a 5-year duration and begun in October 2017. The goal of the IRIS project is to improve urban life by stimulating and enabling organizations to work on smart city sustainability (Utrecht Sustainability Institute [USI], 2020). After laying a foundation of theory and practical experience based on the lighthouse city projects, a set-up of the projects should become more replicable to be used in other cities and districts.

[1] A European Union research and innovation program.

As smart city projects are in the end meant to improve the quality of life for citizens, taking the citizens into account in the planning and execution of these projects is crucial. The goal, the product or service, of the project should be aligned with the wishes of the citizen. The citizen is the end-user, and for them to use the product or service correctly and effectively, they must understand it and feel inspired to use it. This makes it crucial that the role of citizens should be considered a key component in smart city planning. Furthermore, research on project success factors emphasizes the importance of engaging the customer or end-user in order to bring a project to a good end (Clancy, 1995; Giffinger, Haindlmaier & Kramar, 2010; Pinto & Slevin, 1988), and that the involvement should be at the very start of the project process in order to increase the likelihood of the users' acceptance or satisfaction (Dvir, Raz & Shenhar, 2003; Slevin & Pinto, 1987).

This paper will explore whether a business model can help to ensure citizen engagement in smart city projects. A business model is a description of how a business creates, delivers and captures value to customers (Teece, 2010). A business model canvas can, thus, create a basis for customer engagement by guiding an organization in doing market research and getting to know their customers. To capture the fact that smart city projects do often not only focus on creating value for its customers, but also on creating value for the city as a whole, I will be using the Smart City Business Model Canvas (SC-BMC) proposed by Giourka et al., (2019), a BMC designed specifically to capture this complexity of smart cities. I will test the role of this BMC by an illustrative case study analysis based on two Utrecht-based, firm-led smart city projects of the IRIS project. I will present a bridge between real world, complex smart city projects and the use of a universal model in order to answer the following question:

'To what extent and how can business model canvassing help determine the role of citizen engagement in smart city development?'

This paper will answer the research question by (1) defining a theoretical framework, (2) researching two IRIS case studies in-depth, i.e. examining how they developed over time and how citizens played a role in this, and (3) interpreting the findings and considering the extent to which business modelling can enhance citizen engagement policies.

2 Theoretical background

Before diving into the case study analysis, it is important to set a theoretical and practical framework for the role of citizen engagement in smart city projects. This framework can lay a foundation for how and why business modelling can play a role in determining the role of citizen engagement.

When looking at citizen engagement for smart city projects, one must ask two questions, 'How should we engage the citizen?' and 'To what extent should the citizen be engaged in this project?'. *Section 2.1* will provide an answer on the first question in the form of a practical framework. *Section 2.2* will provide an answer on the second question by providing a theoretical framework.

2.1 Citizen engagement experience

To answer how citizens should be engaged in projects, smart cities have gained a certain interest by city developers overt the past years, many European cities have tried to implement smart city project in order to become a smarter city (Rodríguez-Bolívar, 2015). These case studies can provide some guidelines on what works and what does not work when engaging citizens. One noteworthy and seemingly successful method of addressing and engaging citizens is by using modern technologies. This has shown to work as both a channel to inform and a channel to receive feedback (Alawadhi et al., 2012; European Commission & UN-Habitat, 2016). Wagenet and Pfeffer (2007) have found factors that are of importance when addressing citizens: pro-actively selecting the citizens who will be affected the most;

making sure that the citizens understand the plans and why this solution was chosen; and giving a say in the projects for the citizens and then actually use their input to create a relationship of trust and respect. Similarly, the REZBUILD project found that the one of the most important elements in engaging citizens was communication ((REZBUILD, 2018). The lessons learned from this project are that communication towards the citizen should be complete, understandable, easily accessible, constant in accordance with movement between stages of the project, and bi-directional. Useful tools through which communication can happen are workshops, focus groups, co-designing of planning, forums and web-based engagement. Furthermore, they acknowledged that no size fits all, i.e. the strategy is to be adjusted to its specific context or environment, and that every strategy has its pro's and cons (REZBUILD, 2018).

2.2 Citizen engagement theory

For the extent to which citizens should be engaged, de Lange and de Waal (2013) argue that citizens should have 'ownership' over their city. This means that for them to engage in the projects, the structure should be right in between an absolute top-down participation model, in which individuals do not get a say, and the absolute bottom-up community model, in which an individual's opinion is lost to form unity (de Lange & de Waal, 2013). Within the IRIS project, theoretical frameworks are created based on a similar idea, Peekel and Renger, (2020) present a ladder of citizen engagement, with five progressive steps of citizen engagement, they argue that the extent to which citizens should be engaged depends on the influence they have on the impact of the project, for example by there usage. The five progressive ladder steps are, from bottom to top: informing of citizens; informing citizens through involved citizens; contributing citizens; and creating citizens (Peekel & Renger, 2020). Thus, when planning for citizen engagement, it is not just a matter of doing, but also a matter of customizing the right amount to the project's characteristics.

Pinto and Prescott (1988) develop a different perspective, in which they argue that the focus on user's involvement should change according to the stage of the project's plan, the user's role comes in mainly at the start and end of the project. This would have implication for the time spend on citizen engagement over the whole duration of the project.

3 Methods

3.1 Sample description & selection

The research question will be answered with an illustrative case study analysis on two Utrecht based, firm-led cases, both cases are a part of the IRIS project, see *Table 1*.

Table 1

Overview case studies

Case study	Description	Objective	Main executor(s)	Time period
1.NZEB refurbishment	Refurbishment of twelve apartment buildings in the district Kanaleneiland-Zuid, Utrecht. E.g. the apartments will receive better isolation.	Reforming the buildings to become 'Near Zero Energy Buildings', lowering the energy use and the CO2 footprint.[2]	Housing corporation/homeowner: Bo-Ex	Project duration: 5 years, starting 1 Oct 2017. Delay of schedule, length not determined yet.
2.XR-Experience[3]	An extended reality experience visualising the changes in the apartment buildings, both in terms of looks and in terms of energy use / CO2	Informing the tenants better on the changes that will happen & engaging them in an intriguing and approachable way.	Housing corporation: Bo-Ex & University of arts: HKU (design)	Project duration: 5 years, starting 1 Oct 2017.

[2] The 'Near Zero Energy Building' goal will be obtained by a combination of various projects, e.g. Bo-Ex also plans to implement solar panels.
[3] The XR-Platform was originally planned to be a Virtual Reality (VR) platform, this plan was eventually revised due to impracticalities of VR.

	footprint, the results of each measure can be explored separately, (e.g. the effect of adding solar panels specifically).

The first case study, the NZEB refurbishment, has already started, but has been delayed due to a lacking support of tenants. The second case study, the XR experience, is one that wishes to engage citizens more in the decision-making of various projects (such as the NZEB-refurbishment), and thus increasing citizen participation. The 'citizens' in these cases are the tenants, who can be characterized by a profile of lower income, ethnic diversity and social insecurity (IRIS, 2019). These particular case studies are chosen, because their analysis is relevant for future similar smart city projects for the following reasons.

Firstly, these case studies are relevant to be studied for their replicability, as the knowledge and experience drawn from them can be used for other energy transitions of similar apartment buildings. This particular type of post-war apartment buildings in need of renovation are common in European cities and so is the demography of the tenants, i.e. a profile of lower income, multiculturality and social instability (IRIS, 2019).

Secondly, the citizens play a distinctive role in the outcome of the project for each case study. For the first case study, the NZEB refurbishment, the tenants play an important role in the execution of the project as they determine whether the refurbishment will occur by showing their support in a poll[4]. The refurbishment needs at least the support of 70% of the tenants. For the second case study, the XR-Experience, the role of the tenants is different. The

[4] The poll is done per apartment building.

effectiveness of the project depends on the use of the project by the tenants. The use of the XR-experience is voluntary and, thus, whether it meets the tenant's wishes and needs is of high importance.

Lastly, the projects have goals of different natures. The NZEB refurbishment is a project that partially depends on citizen engagement, but in the end strives for a different goal: 'Sustainable housing'. Unlike the XR-experience, whose main goal is to engage citizens.

Concluding, the combination of the two projects will provide a diverse and relevant analysis of citizen engagement in projects, providing a good basis of research.

3.2 Data collection & analysis

I analyse the case studies by qualitative research, both in the form of interviews and desk research. Reports and files from the IRIS project helped to get a basic understanding of the strengths, weaknesses, challenges and progress of the two projects. Additional interviews were needed in order to (1) get a deeper understanding of the processes, communication and teamwork in both case studies, and to (2) triangulate the data, by getting a second opinion on findings. Interviews are done with representatives of all actors involved in the case studies. A detailed list and descriptions of the interviews and reports can be found in *appendix table 1*. Transcriptions can be found in *8.2 interviews.* The interviews are semi-structured, however due to the different position of each interviewee in the project, the structure differs per interview. But, generally, I asked questions along the line of the interviewee's (1) position in the project, (2) input in the project, (3) opinion on the process of the projects so far and (4) view on tenant engagement.

I analysed the interviews by sorting and coding. First, I categorized the interviews apart from each in order to minimise biases towards eventual drawn-up conclusions and to stay open to different findings. Then, I moved on to summarise the categories in (1) a Smart City

Business Model for each case, in which the report and interview data are used, see *appendix table 2* and *3*; and (2) a table summarizing the topics related to citizen engagement that were discussed during the interviews, see *appendix table 4*. Through the recognition of patterns and differences, the tables serve as the base on which my findings are built.

4 Findings

I will present my results in two steps that I identified in my case study analysis. First, I will briefly discuss the general development of both projects so far and emphasize the significant role tenant engagement has had in this. For the second part, I move on to discuss some of the tenant engagement complications found along the way and I attempt to identify underlying causes.

4.1 General development

The description for both projects is done along the line of both the Smart City Business Model, *appendix table 2* and *3*, and the process descriptions from reports and interviews, *appendix table 1.*

4.1.1 NZEB refurbishment

The NZEB refurbishment is a project led by Bo-Ex that is a part of a larger package (Work package 1). All projects in the package work together to achieve a reduction of energy use and CO2 emission of twelve social housing apartment buildings. This particular project receives no IRIS funding, but other projects in the package do. For the tenants, all projects are presented as one package of refurbishment and renovation. The initial goal was to finish twelve apartment buildings within the five-year deadline, however delays have come up due to problems with tenant engagement. The project needs at least 70% of the tenants to agree upon the plans made per building, however, for the first building on the agenda, this 70% was not achieved and it became clear that the construction plans for the building could not start.

After this, Bo-Ex started a period of reconsideration of tenant strategies with the help of the USI and HKU. Together they scrutinized the problems that came up in the first building and how they could be solved. At the moment, new strategies have been put into action for multiple buildings and the next support assessment will most likely take place in October 2020. The expectation is that three out of twelve buildings will be completed within the five-year plan, the other nine will be done afterwards. Hence, the delay is both an effect of the shortage of support in the first building and the extra time spend on tenant engagement for the future buildings in order to secure getting enough support. The consequences of this delay, and, thus, some of the apartment buildings' refurbishment not fitting within the IRIS project time, are unknown so far. Even though the NZEB refurbishment does not rely on funding, the funding is necessary to complete work package 1 and maximise the reduction in energy use and CO2 emission.

4.1.2 The XR Experience

The idea of using extended reality to visualise the future building came from Bo-Ex as a part of work package 5, the work package dealing with citizen engagement. Initially, it was meant to be a virtual reality experience, making use of VR-glasses the tenants could 'walk' through their future home. Bo-Ex recruited the HKU for the design and creation, the HKU pointed out some drawbacks from VR, it being impractical as older people might feel uncomfortable using it and people often get nauseous while in VR. So, a different plan was proposed and accepted, to use extended reality instead of virtual reality, the XR will be in the form of a box with a screen in which the user can see the effects of all measurements, that are a part of work package 1, by playing around with enabling or disenabling measurements. The effects will be shown both in terms of energy use and energy costs. So, the tenant, if using the XR experience, will get an understanding of the (positive) effect of each measurement.

Also this case shows the importance of citizen engagement, firstly in understanding the needs of the tenants, in terms of not only getting to see the looks of the future building but also the effects, and secondly, the fact that one must think about the attractiveness of the experience to get the tenants to use it. The XR experience is not in use yet, so whether this experience works well for the tenants is unknown, but the needs and skills of the tenant are considered.

4.2 Citizen engagement complications

I identify three main themes during the interviews, *appendix table 4*, that have had a significant impact on the project process. The complications are categorized in the topics of communication, a lack of flexibility and an initially missing mediator role. For this section, the focus is less on the different case study projects and more on the general development of tenant engagement during the IRIS project, as the complication are widely applicable, to all projects involving the tenant.

4.2.1 Communication

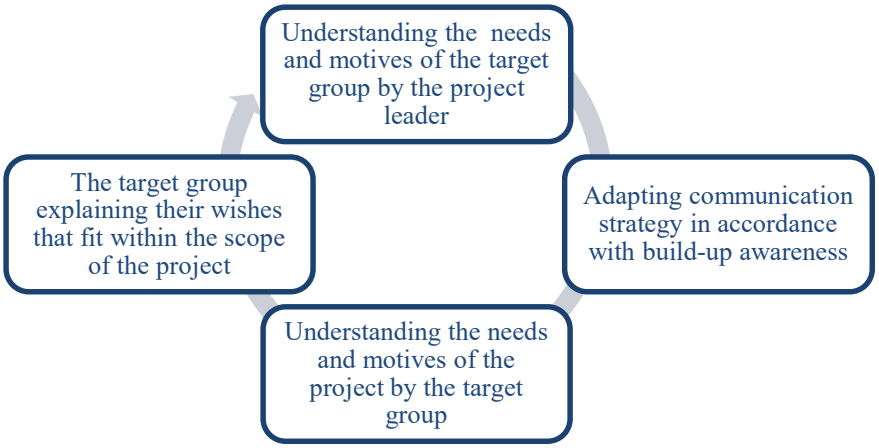
In interview 1, 2, 3, 4 and 6 difficulties in communication has been pointed out as one of the main barriers in realizing tenant engagement. It is even believed that the factor communication was the main cause of the disapproval of the refurbishment in the first building. This awakening had such a significant impact that communication strategies have shifted completely after the first building. Bo-Ex has always dealt with communication internally, but now different actors are involved to give advice on the communication and tenant engagement in general. The actual use of the advice is still Bo-Ex's responsibility. The difficulties found during the first apartment building can be summarized in four main elements. Firstly, a difference in interests, the tenants are less concerned with the sustainable refurbishment, and wish to see more practicable refurbishment, while the project also focuses on these type of changes, some wishes lay outside of the scope, such as a new elevator.

Secondly, language barriers, the tenant population is highly multicultural and many of the tenants do not have a high understanding of the Dutch language, this has made it more difficult to get information across. Thirdly, distrust towards Bo-Ex, the tenants often feel like they do not get enough value for their money and refer to other housing corporations that offer more for less in the same area. Likewise, some of the tenants have little trust in the information fed to them, they feel anxious about what the refurbishment might mean, e.g. a possible rent increase. Lastly, the tenants feel left out in the decision making, because the plan was already developed before introduced to them, this advances the distrust even more.

For this case, the core of the problem can be described as a mutual lack of understanding between the project leader, Bo-Ex, and the target group, the tenants. Mutual understanding would lead to better communication and more trust, a process described in *Figure 1.* For the tenants, awareness around the goal and purpose of these project is important, the tenants seem unaware of Bo-Ex' intentions in these projects, i.e. the fact that they do not wish to make profits, but wish to increase the tenant's quality of living and to lower the environmental footprints of the buildings. However, the tenant will not grasp this idea if the information given to them is unclear or not trusted. Thus, Bo-Ex needs to grasp an understanding of their target group first, in order to deliver the information effectively. The information should not be written down in a formal difficult language and should possibly even be translated into other languages in order to reach a larger share of the tenants. Furthermore, it needs to be acknowledged that this specific group needs more time and attention, as the problems of distrust need to be overcome. The involvement of advisors has created better understanding of the target group, e.g. with the help of the HKU, Bo-Ex realized that the former VR experience did not match the needs of the tenants, it would only visualise the looks and not visualise the valuable information. If this awareness is translated into better communication, a better relationship between the two parties can be build.

Figure 1

Circles of communication improvement



4.2.2 Flexibility

As described in the former section, initially, too little time was planned for tenants to get engaged. For the first building in which the NZEB refurbishment was to take place, the whole execution of the plan was set up step by step and did not take into account what the citizen might think of the project and the duration. The project plan for all apartment buildings was set to be five years and with the tight schedule of these five years, the plan was ready for execution before they asked the citizens for feedback and votes. Within the project, there was some room for the tenants' wishes, as the project is also created to improve the tenant's quality of life, next to lowering the environmental footprint. However, the wishes would be considered per apartment building as customization per apartment would be far too costly. Thus, the citizens would have to prioritize together what they would like to see changed and send a unified message to Bo-Ex to ask for these changes to be implemented in the project. Of course, while understandable that the wishes will be granted for all apartments in the building and not just one, it is a difficult job for the many tenants to organize and create a list of unified wishes that fit within the boundaries of the projects. The tenants would need some structured guidance to do so. Such a process takes time and requires flexibility.

Furthermore, as pointed out in interview 1,3 and 5, when engaging citizens it is crucial to start with the involvement as early as possible, so that they do not feel left out in the decision making process and will have more trust in the project and the organization. This is also applicable in the NZEB refurbishment and the package it belongs to, when the plans were presented, many of them were set and not up for discussion. This led to the tenants not grasping the idea behind all the measurements, and thus to disapproval. If tenants had more sight and feedback possibilities on the decision-making process, they would be more likely to understand and approve the plans.

I argue that from the start of the project there has been a lack of flexibility due to systemic faults. About one year before the start of the project, a five-year plan was designed to send to the European Commission as a funding application. The plan shows different stages that Bo-Ex will go through in terms of the execution of the refurbishment, and its results after the five-year deadline. For such an application to be attractive for funding, the planned impact should be high, i.e. the reduction in energy use and CO2 emission should be significant, so that the funding would be lucrative. Furthermore, when applying for the funding, the European Commission is looking for a certain security, meaning that your plans need to be well thought through so that the planned impact can actually be realized after the completion of the project. This structure thus leads to little flexibility, with a strict five-year plan. However, the EU should take into consideration that citizen engagement can be an important factor for projects success. The project leaders should be granted the time to make sure the users are involved and understand the importance of the project, and for them to have this a certain level of flexibility is necessary.

4.2.3 The mediator role

Even though *section 4.2.1* and *4.2.2* provide insight on what could be changed to improve tenant engagement, they are often long-term solutions that require time and/or

systematic change. The solutions are, thus, long lasting and robust, however, some of the problems concerning tenant engagement are more urgent and should be dealt with in the moment in order to move on and execute the project. An important one of these projects is the distrust, although establishing a better relation between the tenants and Bo-Ex, as described in *section 4.2.1*, is of importance and should definitely be on top of the agenda, this cannot happen overnight, and for present projects an extra immediate solution should be added. As described in Eisenhower matrix of time management, urgent and important problem should be dealt with and not just planned for (Mckay & Mckay, 2013).

Having said that, the role of a mediator can help solve distrust in project like these. A mediator has been implemented in this project widely after distrust was shown in the first building. A mediator is someone who delivers an independent view of the project to both the tenant and Bo-Ex, they are, thus, not involved in the project and mediates between the two parties. The mediator can be used widely, they can be used, for example, to (1) talk with the tenants one-on-one about the project and their wishes, and then deliver their knowledge to Bo-Ex; (2) present the XR experience with the tenants personally and to show how it works, and what the refurbishments will mean or (3) organize and present information during meetings of Bo-Ex and the tenants.

The need of mediator will exist as long as significant distrust exists. Because Bo-Ex will not be taken for their word as the tenants will feel like they can bend the information to their benefit or hide certain information, as was the case with the tenant engagement at the first building.

However, the role of the mediator should not be overestimated, whereas the solution can be practicable as it deals with distrust instantaneously, it does not solve the problem, it is merely a temporary solution. The citizen might trust the mediator, but this does not mean they

will trust the project leader. For this to happen, and thus, to ease the process in future projects, the communication should still be improved with a long-term view, for example as described in *figure 1.*

5 Discussion

5.1 The use of business modelling

Tenant engagement has shown to affect the development of both case studies significantly so far, both in terms of the project's process and the project's content. I identified three main elements that influenced the tenant engagement in the case studies: Communication, flexibility and mediators. The goal of this study is to see whether business modelling can help determining the role of citizen engagement in smart city projects, the used tool to research this is the SC-BMC. To answer the research question, we must see whether the SC-BMC could have helped identifying the citizen engagement that came up in this specific case study and whether it would have guided the project leader towards engaging the citizens the right amount, in terms of the HKU ladder, and the right way. Both factors are needed to determine the role of citizen engagement in smart city projects.

For the first question, one must ask themselves whether the business model asks the right critical questions, and thus pinpoint the problems that should be solved. The business model could have helped to guide the project developers in foreseeing some problems with citizen engagement. The sore goal of a business model is to guide upcoming businesses in defining their value proposition and to do market research on these parts. In these projects, too little knowledge and understanding on the position of the tenants led to communication difficulties. With the help of market research, this factor could be avoided. Setting up the business model for the smart city project would require the project leader to think in terms of what the citizen wants, needs and which type of communication is best. For example, the SC-BMC asks which

channels are used to talk to the citizen and if this matches the channels they would prefer. In order to answer such a question, the project leader is forced to think in terms of what the citizens want and to do research on this. This market research would have meant that they would already understand the position of the tenant beforehand. However, as the structure of the SC-BMC comes from a business perspective, the element 'time' of projects is less reflected in such a business model. Projects often deal with deadlines and plans, meaning that not only the allocation of money but also the allocation of time/effort should be looked at. As shown by Pinto & Prescott (1988), different elements of the projects require a certain effort spend in different stages of the project. As this specific element is less underlined in business modelling, it is less likely that the canvas will direct project leaders to think in term of time planning and flexibility.

For the second question, the 'how' of determining the citizen engagement role, one must ask themselves whether the business model canvas leads the project leader to the right amount and correct method of citizen engagement. The market research, discussed in the last paragraph, already addresses research on preferred methodology of addressing or engaging citizens. But different projects require different extends of involvement, just as different groups require different involvement methods. The amount to which citizens should be engaged depends on how much the project's success or impact is depended on the citizens use (Peekel & Renger, 2020). The SC-BMC does focus on the actions the citizen has to take for the project to be realized, however the impact after the project is less focused on. But since many of these projects, like the XR platform, are not just successful by the completion of product or service, but require a right usage, the success also relies on impact after completion. In order for project leaders to direct their policies to the right amount of citizen engagement, additional questions should be asked, questions along the line of which actions the citizen has to take for the project to become meaningful and achieve its smart city goal.

With this knowledge, the project planner could use the citizen engagement ladder (Peekel & Renger, 2020) could be used to determine which level of citizen engagements fits.

5.2 Limitations and suggestions for future work

Due to the nature of my analysis, conclusions concerning citizen engagement should be interpret with caution. My sample group is categorized by very distinct demographics, tenants of social housing buildings who often come from a multicultural, lower income background. Even though, as I described before, the research is valuable to be used on groups with similar demographics, for citizens characterized by different demographics one has to take into account that different factors could play a role. More research on citizen engagement would be valuable in examining both the differences in citizen engagement among different groups, and to extent knowledge on citizen engagement in general.

Furthermore, this research is focused on citizen engagement, but there may exist smart city project that have different actors than citizens as their end-users, such as firms or governments. Additional research could be done on the end-user engagement with these types of actors, and whether the use of business modelling is valuable in these cases.

5.3 Implications

This research builds on knowledge of citizen engagement and provides insight on how to deal with this in the planning phase. Previous studies suggest that citizens should be engaged for a certain amount based on their impact (Peekel & Renger, 2020) and that the citizen engagement should be implemented in the planning (Slevin, & Pinto, 1987). This paper argues that business modelling can be used to identify communication difficulties and methods to overcome these, furthermore it proposes two elements by which the Smart City Business Model Canvas enables citizen engagement more. The first one proposition is to add the factor time management in the canvas, as smart city projects often deal with a certain

timeframe in which they have to allocate time spend on different aspects, this addition can help ensure more time spend on citizen engagement (if necessary). Secondly, I propose for more question guided to the impact after the completion of the project, which is an important element in smart city projects and in which citizens often play a role as end-user.

With these propositions in mind, business modelling could prove a valuable tool to ensure the important role of citizens in smart city projects.

6 Conclusion

Citizen engagement proved to be an important factor in the development of the two proposed case studies, this role was only fully recognized after problems with citizens led to a delay of projects. After the recognition, plans were adapted to improve citizen engagement. To smoothen this process in the future, this paper argues that business modelling can enable project leaders in the future to deal and acknowledge the role of citizens earlier on in the project plan, if (1) the business model canvas is adapted for smart city use and (2) recognizes the roles of citizen engagement.

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8 Appendices

8.1 Documents

Appendix Table 1

Overview of interviews and reports

Organization / Actor	Interviewee	Date of interview
1.HKU	Willem-Jan Renger	18-06-‘20
2.Tenant representative	Anouk Ticheler	18-06-‘20
3.Bo-Ex	Martijn Broekman	18-06-‘20
4.USI	Arno Peekel	22-06-‘20
5.Municipality of Utrecht	Roel Massink	23-06-‘20
6.Tenant representative	Amina Berkane	24-06-‘20
Report name	**Publisher**	**Publish date**
1.Launch of T.T. #1 Activities on Smart renewables and near zero energy district	IRIS	31-12-‘19

2. Baseline, ambition, activities, and barriers & drivers for Utrecht lighthouse interventions	IRIS	30-05-'19
3. Launch of T.T. #5 Activities on Citizen Engagement and motivating feedback	IRIS	31-12-'19
4. Report on Citizen Requirements from the Transition Track #5 Solutions	IRIS	30-05-'19
5.Webinar: A Paradigmatic Shift in Citizen Engagement: the good, the bad… the ugly?	IRIS by Arno Peekel & Willem-Jan Renger	23-06-'20

Appendix Table 2

Smart City Business Model: NZEB refurbishment

Topic	Question	Actor	Answer	Source	Validation[5]
Actors	Key description and role within the project	Municipality of Utrecht	Iris Project head leader and involved in all kind of matters in the district	Report 1	n/a
		Tenants	End-user of the refurbished apartments	Report 1	n/a
		BO-EX	Social housing corporation, landlord of the buildings and coordinator of the projects	Report 1	n/a
		USI	Utrecht Sustainability Institute, linking pin with other work packages and initiatives	Report 1	n/a
		HKU	School of Arts Utrecht, advisor in problem solving	Report 1	n/a
Key activities	Which key activities are required to realize the NZEB refurbishment (and by whom)? I.e. Build distribution channels, customer	Municipality of Utrecht	Overseeing the operation, linking this project to others of Iris	Interview 5	Municipality
		Tenants	Approving the plan, this entails the tenants getting involved in the project (& decision making) to make up their mind	Report 1 & interview 2, Webinar	Multiple sources
		BO-EX	Internal investigation, constructing a financial plan, informing tenants	Report 1 &	Bo-Ex

[5] If referred to one of the actors as a validation, the interview with the representative of the actor/organization is meant.

	relationships, revenue streams, build products/services/ platforms, or instalment equipment			Interview 2	
		USI	Keeping track of progress, guiding where needed	Report 1, interview 4	USI
		HKU	Guiding in communication between Bo-Ex and tenants	Interview 1	HKU
Value proposition	What value does each actor deliver? In what way is this helping the end-user?	Municipality of Utrecht	Creating solutions by linking this project to others	Interview 5	Municipality
	I.e. Offering a	Tenants	n/a		
	certain product or service while satisfying the end-users need of	BO-EX	Offering the opportunity to get the apartments refurbished by funding and finding a contractor	Report 1 & Interview 2	Bo-Ex
	performance, customization, price, cost reduction,	USI	Providing guidance in the set-up phase from a broader perspective, creating a smoother process	Interview 4	USI
	efficiently, risk reduction or accessibility.	HKU	Providing creative solutions and guidance in communication, aiming for better relations	Report 1,2 & Interview 1,4	HKU
Actor Relationships	What type of relationship does each actor expect within the network?	Municipality of Utrecht	Not necessarily involved in the project, keeping track of all projects from above, a role that was planned in the Iris set-up	Interview 5	Municipality
	What type of relationship exists right now?; Does the expectation fit within the model? (i.e.	Tenants	What they have (mainly): A limited contribution part in which they are updated, informed and get a small say on the project. What they would like: A larger say in what the refurbishment will entail.	Report 1 & Interview 1, 2, 3, 4	Independent tenant, multiple sources

	costs, need of input, etc)		However, the wishes often fall outside of the spectrum of the project (e.g. a new elevator)		
		BO-EX	Leader of the project, chairman of the meetings, fits within model as Bo-Ex is the only executive partner	Report 1 & Interview 2,4	Bo-Ex
		USI	Occasionally involved in advice-giving, not directly involved but giving guidance if the process is troubled. The role is as described in the Iris plan	Interview 4	USI
		HKU	Contributively role in meetings about tenant engagement, expected to work with tenants directly but involvement is indirect, and input is needed this way	Interview 1	HKU
Network beneficiaries	Which target users is the NZEB refurbishment created for? How is this delivered to them and what are their needs?	n/a	The target user of the NZEB refurbishment are the tenants, they live in the apartments and will be the end-users of the made changes. The refurbishment, along with other plans, is delivered as a proposition on which they get room to change it to their wishes (limited) and eventually get to vote 'YES' or 'NO.'	Report 1 & interview 1,2	Bo-Ex confirms delivery

	How do the target users benefit from the NZEB refurbishment, does it satisfy their needs?	n/a	The tenants most likely benefit directly as their energy usage goes down and so do their energy bills, it is however not guaranteed that their rent will not go up. The tenants are characterized by lower incomes, so less costs per month is in their interests, however there is insecurity in these lower costs. They benefit indirectly from a cleaner environment. Most of the tenants do not feel the need to clean the environment and thus are more or less indifferent.	Report 1 & interview 2,3	Independent tenant & Bo-Ex
Key actors' offerings	What offerings does each actor deliver? I.e. Technology, development of products/processes/services, R&D or citizen engagement	Municipality of Utrecht	n/a		
		Tenants	n/a		
		BO-EX	The actual refurbishment of the apartment is organized entirely by Bo-Ex, the funding is theirs.	Report 1 & Interview 2, 4	Bo-Ex
		USI	The offering of research and solutions as the USI gets involved in solving problems.	Interview 4	USI
		HKU	Offering design methods to deal with tenant engagement, an offering of knowledge and experience	Interview 1	HKU
Key actor's co-creation operations	Which key operations do the key actors perform? I.e. Sourcing of materials, system's design,	Municipality of Utrecht	Providing links to other stakeholders and financers	Interview 5	Municipality

	operation and impact monitoring of the NZEB refurbishment, deliver value, city coverage or links to other stakeholders	Tenants	n/a		
		BO-EX	Sourcing of materials, the plan and the funding	Report 1 & Interview 2	Bo-Ex
		USI	Operation monitoring	Interview 4	USI
		HKU	Providing design methods to deal with problems	Report 2 & Interview 1	HKU
Key resources and infrastructure	What key resources are required to realize the NZEB refurbishment? I.e. Deployment channels, actor relationships or revenue streams to realize e.g. buildings, vehicles, machines, systems, point-of-sale system, distributions and networks	Municipality of Utrecht	The municipality does not offer resources but does offer connections with funding from IRIS, which is not used for this project specifically, but for some of the projects that are a part of the work package.	Report 1 & Interview 4,5	Multiple sources
		Tenants	Payback of investment via rent	Interview 2,4	Bo-Ex
		BO-EX	The financing (of NZEB specifically)	Report 1 & Interview 2,4,5	Multiple sources
		USI	Networks to enhance dealing with problems	Interview 5	USI
		HKU	Design methods and canvasses	Interview 1	HKU

Data	What data will be made available from the services designed? To whom and under what conditions?	n/a	Data on reduction in energy use measured by TOON, plus reports on 'lessons learned' from the process that can be used by future similar (Iris) projects. Data is publicly accessible.	Report 1 & Interview 1,2,4,5	Multiple sources
Deployment channels	Through which channels do the customers want to be reached?	n/a	Tenants seem to appreciate 'being heard', i.e. so preferred channels are smaller, personal meetings in which there is room for discussion.	Interview 1,2,3,4	Multiple sources, independent tenant
	Which channels are in use now?	n/a	Information is given via letters, during information evenings for all tenants led by a small group of informed tenants, and personal meetings can be planned.	Interview 1,3,4	Multiple sources
	What works best?	n/a	Personal contact works best to build more trust, also the meetings organized by other tenants work well to solve current distrust. However, this scheme is time consuming.	Interview 1, 2, 3, 4	Multiple sources
Budget cost	What are the most important costs included in the NZEB refurbishment? In terms of key resources and key activities	n/a	Everything related to the refurbishment.	Report 1 & interview 2	
	What costs can be covered by each actor?	Municipality of Utrecht	No public funding for this specific project, but funding from IRIS for the package (not paid by the municipality but they are the linking pin).	Report 1 & Interview 2,4,5	Multiple sources, municipality
		Tenants	Rent increases to earn back investments is not planned for, but not ruled out.	Interview 2	Bo-Ex

		BO-EX	Bo-Ex will finance the refurbishment by paying the contractor(s) who deliver the work.	Report 1 & Interview 2	Bo-Ex
		USI	n/a		
		HKU	n/a		
	Is there an opportunity of actors cooperating in funding?	n/a	Actors are cooperating in financing when it comes to the whole package, some bits are financed by Bo-Ex, some by IRIS, e.g. the TOON.	Report 1 & Interview 2,4,5	Multiple sources
Revenue streams	For what value and how much are the tenants willing to pay?	n/a	Tenants have lower incomes and are unwilling to pay more, however they would like to see the investments go to apartment approvements, such as new curtains or the implementing of an elevator.	Interview 2,3,4	Multiple sources, independent tenant
	For what and how are they currently paying?	n/a	Without a rent increase, the current refurbishment plans are able to happen, with some flexibility for tenants' input.	Interview 2,4	Bo-Ex
	Where does the overall revenue come from and to whom does it go to?	n/a	This project does not aim for profits, Bo-Ex invests and earns back the investment without raising rents over a longer period of time.	Interview 2	Bo-Ex
	What are the non-monetary revenues?	n/a	The value of the apartment buildings will go up when the refurbishment is done.	-	-
Environmental Impacts: Costs and Benefits	What is the ecological cost of the NZEB refurbishment? I.e. greenhouse gas emissions, land use, energy and water use	n/a	With the refurbishment of the building a certain amount of energy and other elements will be used, but this is only temporary.	-	-

	What is the ecological benefit of the NZEB refurbishment? I.e. % reducing the environmental footprint, % reducing the environmental footprint	n/a	The refurbishment will lead to lower energy use due to better isolation, with the whole package the energy label should at least get to A. The actual reduce of energy use will be measured with the help of TOON after the first building is finished.	Report 1 & interview 1, 2, 4	Multiple sources
Social Impacts: Value and Costs	What is the negative social value generated by the NZEB refurbishment? I.e. social exclusion, digital illiteracy, accessibility to advanced services etc	n/a	Noise pollution in the execution of the refurbishment.	-	-
	What is the positive social value generated by the NZEB refurbishment?	n/a	All tenants will receive a newer, higher quality apartment.	-	-

Appendix Table 3

Smart City Business Model: XR experience

Topic	Question	Actor	Answer	Source	Validation
Actors	Key description and role within the project	Municipality of Utrecht	Iris Project head leader and involved in all kind of matters in the district	Report 2,3	n/a
		Tenants	End-user of the XR experience	Report 2,3	n/a
		BO-EX	Social housing corporation, landlord of the buildings and coordinator of the projects	Report 2,3	n/a
		HKU	School of Arts Utrecht, designer of the experience	Report 2,3	n/a

Key activities	Which key activities are required to realize the XR experience (and by whom)? I.e. Build distribution channels, customer relationships, revenue streams, build products/services/ platforms, or instalment equipment	Municipality of Utrecht	Overseeing the operation, linking this project to others of Iris	Interview 5	Municipality
		Tenants	n/a		
		Bo-Ex	Leading the project, hiring designers and providing the concept	Report 3 & Interview 4	Multiple sources
		HKU	Designing the XR-experience	Interview 1	HKU
Value proposition	What value does each actor deliver? In what way is this helping the end-user? I.e. Offering a certain product or service while satisfying the end-users need of performance, customization, price, cost reduction, efficiently, risk reduction or accessibility.	Municipality of Utrecht	Creating solutions by linking this project to others	Interview 5	Municipality
		Tenants	n/a		
		BO-EX	Offering the XR experience so that the tenant gets a better picture of the impact and so that there are less insecurities.	Report 3 & Interview 1,2,4	Bo-Ex
		HKU	Making the XR experience user friendly, useful and understandable for (nearly) everyone.	Report 3,4 & Interview 1	HKU
Actor Relationships	What type of relationship does each actor expect within the network? What type of relationship exists right now? Does the	Municipality of Utrecht	Not necessarily involved in the project, keeping track of all projects from above, a role that was planned in the Iris set-up	Interview 5	Municipality
		Tenants	The tenant's role is on the side-line, they are the end-users but the use is voluntary. Due to	Report 3	-

	expectation fit within the model? (i.e. costs, need of input, etc)		voluntary use, a say in the projects is not necessary.		
		BO-EX	Leader of the project, fits within model as Bo-Ex is the main executive partner.	Report 3 & Interview 2	Bo-Ex
		HKU	Expectation: Design the 'looks' of the experience Reality: Designing the whole experience & conceptualizing it as the original plan had to be changed	Interview 1	HKU
Network beneficiaries	Which target users is the XR platform created for? How is this delivered to them and what are their needs?	n/a	The target user of the XR experience are the tenants, they live in the apartments of which the XR-experience is created. The XR-experience is presented as an extension of information of which the tenant can determine whether they want to use it.	Report 1 & interview 1,2	Bo-Ex confirms delivery
	How do the target users benefit from the XR experience, does it satisfy their needs?	n/a	The tenants who feel uncertainties or do not understand the refurbishment plans will benefit from the experience if they use it, as the experience can take away the uncertainties by providing clear information.	Report 2,3 & interview 1,2	Multiple sources
Key actors' offerings	What offerings does each actor deliver? I.e. Technology, development of products/processes/services,	Municipality of Utrecht	n/a		
		Tenants	n/a		
		BO-EX	The investment and planning of the XR-experience	Report 3	-

	R&D or citizen engagement	HKU	Offering XR design knowledge, the technical design of the service	Interview 1,2,4	HKU
Key actor's co-creation operations	Which key operations do the key actors perform? I.e. Sourcing of materials, system's design, operation and impact monitoring of the XR experience, deliver value, city coverage or links to other stakeholders	Municipality of Utrecht	Providing links to other stakeholders and financers	Interview 5	Municipality
		Tenants	n/a		
		BO-EX	Funding of service development needs	Report 3 & Interview 2	Bo-Ex
		HKU	Advising on what should be included in the XR experience	Report 2 & Interview 1	HKU
Key resources and infrastructure	What key resources are required to realize the XR experience? I.e. Deployment channels, actor relationships or revenue streams to realize e.g. buildings, vehicles, machines, systems, point-of-sale system, distributions and networks	Municipality of Utrecht	n/a		
		Tenants	n/a		
		BO-EX	A method/location to spread the use of the XR experience, such as going door by door or having small meetings.	Report 3 & Interview 1,2,4	Multiple sources
		HKU	Design methods and technology.	Interview 1	HKU
Data	What data will be made available from the services designed? To whom and under what conditions?	n/a	For the tenant's data on reductions in energy use, CO2 reduction and costs will be displayed on the XR experience.	Report 3 & interview 1	Multiple sources

Deployment channels	Through which channels do the customers want to be reached?	n/a	Tenants appreciate door to door visits or meetings with just a few.	Interview 1,3,4	Multiple sources, independent tenant
	Which channels are in use now?	n/a	For this particular project, no channels are in use yet.	-	-
	What works best?	n/a	Personal contact with mediators works best to build more trust.	Interview 1, 3, 4	Multiple sources
Budget cost	What are the most important costs included in the XR experience? In terms of key resources and key activities	n/a	The costs of design the technology and creating the 'box'.	-	-
	What costs can be covered by each actor?	Municipality of Utrecht	No public funding for this specific project, but funding from IRIS for the package.	Report 2,3	Multiple sources
		Tenants	No cost related for the tenant	Interview 2	Bo-Ex
		BO-EX	Bo-Ex will be the financer of the XR experience	Report 2 & Interview 2	Bo-Ex
		HKU	n/a		
	Is there an opportunity of actors cooperating in funding?	n/a	No	-	-
Revenue streams	For what value and how much are the tenants willing to pay?	n/a	No costs are included for the tenants	-	-

	For what and how are they currently paying?	n/a	n/a	-	-
	Where does the overall revenue come from and to whom does it go to?	n/a	The project is meant to increase the likelihood of the refurbishment taking place, it does not aim for revenue streams	-	-
	What are the non-monetary revenues?	n/a	More aware tenants on the benefits of the refurbishment, more support for the refurbishment	Interview 1,2	Multiple sources, Bo-Ex
Environmental Impacts: Costs and Benefits	What is the ecological cost of the XR experience? I.e. greenhouse gas emissions, land use, energy and water use	n/a	No significant costs.	-	-
	What is the ecological benefit of the XR experience? I.e. % reducing the environmental footprint, % reducing the environmental footprint	n/a	Nothing directly, but indirectly if this project helped making refurbishments possible, energy use and CO2 pollution will be reduced	Report 1,2,3 & interview 1, 2, 4	Multiple sources
Social Impacts: Value and Costs	What is the negative social value generated by the XR experience? I.e. social exclusion, digital illiteracy, accessibility to advanced services etc	n/a	None, service will be freely accessible	Interview 1	-

	What is the positive social value generated by the XR experience?	n/a	Tenants using the XR experience will understand the plans better and what effect it will have for them. This information is given fully by visuals, so illiterate (in Dutch) tenants can also access the information	Report 3 & Interview 1,2,3,4	Multiple sources

Appendix Table 4

Categorized results on interviews

Interviews	Category 1			Category 2		Category 3
	Communication			Flexibility		The mediator role
	Before building 1[6]	Problem statement	After building 1	Planning	Role of IRIS	
1.HKU	Communication did not fit with the target group.	Acknowledging that there should be a focus on solving the negative emotions. Tenants need to get a real say in the projects.	Positive change was implemented using design methods.	Little space for tenants to have an opinion due to planning ahead	Pressure to predict the future in 5-year plan is too high, little room for flexibility.	Having an independent individual talk to the tenants solved distrust issues.
2.Bo-Ex	Things needed to be changed.	Giving the tenants a voice is important, but barriers exist, not everything is possible.	Progressive steps were taken in language and method of communication.	In planning, time for tenant engagement was underestimate.	-	-

[6] Building 1 is referring to the event in which building 1 got a lack of support and refurbishment could not take place as scheduled.

3.Tenant representative	Communication did not fit with the target group.	Tenants' wishes are often not realizable.	Personal conversation improved the communication.	-	-	Distrust towards Bo-Ex exists, less towards mediators
4.. USI	Communication needed to be improved.	Fault was only seen after building 1.	Language barriers are overcome.	Some level of planning is needed to realize impact	-	A group of citizens as informants solved distrust issues.
5.Municipality of Utrecht	-	Knowledge on target group is key.	-	-	Making changes in a plan is not made easy.	Social workers can help smoothen the process.
6.Tenant representative	-	Distrust starts when information does not come across clearly.	-	-	-	People that have experience with the target group can help mediate and create trust.

8.2 Interviews

Interviews are left out for discretion.