# Predicting the Implications on Urban Planning of Women Drivers in Saudi Arabia

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# 1. Abstract

The Kingdom of Saudi Arabia is undergoing a process of substantial growth. It is projected that the total population is going to approximately be 40 million citizens in 2050. With such a rapid, substantial growth, an opportunity to improve the current conditions of the Kingdom is imminent. To ensure an efficient and sustainable growth, the equalization of genders must be thoroughly addressed. This requires a look into the existing gender gap and expectations of women in the Kingdom of Saudi Arabia, while introducing an idea of utilizing Call Detail Records, and how collecting and analyzing this data could start to address demographic issues, specifically gender in this case. For the purpose of this paper, the example of the hesitation towards allowing women to drive will be used. The aim of this paper is to provide a prediction of what could potentially happen if women were given the right to drive in the Kingdom of Saudi Arabia, and suggest methods of how to arrive to an accurate prediction.

# 2. Introduction

## 2.1 - The history of the driving ban

On November 6th, 1990, 50 women in Riyadh decided to challenge the ban on women driving. The women met in a supermarket parking lot, sent away their drivers, and drove their cars around the cities of Riyadh [1]. It was one of the first public defying protests addressing the ban of women driving, and it was not received well by the Kingdom. To the Kingdom, this was viewed as a potential start of a revolution, that only resulted in the increase in the suppression of women [2]. This was one of the first attempt to get the ban removed, but sparked other many attempts. This only goes to show that the people of the Kingdom of Saudi Arabia are demanding social change [3]. Even though it isn't officially illegal for women to drive today, the issuing of a drivers license to women is, limiting their ability to drive legally, which suggests that someone should investigate this question.

## 2.2 - Problem definition

Defining the problem can be viewed as controversial. The essential problem lies within the existing social structure of the Kingdom, which focuses on a belief of an ideology and an unattainable expectation of women. While having a lack of available public information that could be used to create and define urban solutions for the Kingdom. It's goes far more into just banning the act of driving for women, it goes into limiting and constricting the growth of the current population.

## 2.3 - Project objectives

The way the problem is addressed in this paper, is by firstly further understanding the gender gap and the expectations of women that currently exist in the Kingdom. By gaining this kind of understanding, we can start providing strong evidence, that if the social structure doesn't change in the Kingdom, then the growth of the city will not be sustainable enough.

Secondly, the problem is addressed by defining missing information, and what access to this information can provide, and how it can aid with the furthering growth of the Kingdom of Saudi Arabia? The information needed to make a concrete argument needs to be defined. What information do we really need to address demographic concerns, and to make the best argument on lifting the ban? If defined, how can we access it, or is it even accessible? And what can this information really tell us about the way the Kingdom of Saudi Arabia is currently operating, and how it should operate?

# 3. Gender Gap and The Expectation of Women in the Kingdom of Saudi Arabia

## 3.1 The Gender gap in the Kingdom of Saudi Arabia

To understand the implications of giving women the right to drive in the Kingdom of Saudi Arabia, the understanding of the existing gender gap must occur first. Gender gap is described as the attitudes that are attached to the definition of appropriate roles, rights, and responsibilities of men and women in a certain society. Basically this means that there is a pre determined definition of the role the men and women have in a society, and is a standard that is expected to be followed [4].

## 3.2 The expectation of women in the Kingdom of Saudi Arabia

The ideal women stands among other symbols which defines the national identity that is uniquely Saudi Arabian. To challenge the existing social structure, an understanding of the expectations and what constitutes the "ideal islamic women" has to be analyzed.This expectation of women in the Kingdom of Saudi Arabia is defined by their ability to be "ideal islamic women", which means that the value of a female lies in their ability to be a good wife and a good mother, while finding her place within the family, and accepting men to be her designated protector. The idealized women makes the ultimate dedication to protecting the family and guarding 'traditional values' and 'Islamic mortality' [6].

Social conventions and religiously based attitudes supporting sex segregation, female domesticity and dependence on men have all been incorporated into public policy. Under the Sharia Laws, men have the upper hand. Men retain prerogatives in marriage, divorce and child custody. Men also have the ultimate control of many aspect of women's lives one being the control of simply being able to leave the house [7].

Women are not allowed to leave their homes or travel anywhere without the permission of a Mahram, a male guardian ( usually either a father, or a husband) [8], a policy that is enforced in the streets of the kingdom, at airports, railways even hotels. Many view this permission as a way to 'protect' the women in their lives, but many women view it as a constriction of growth. So the real issue is not really about giving women the right to drive, it's about a social status that is not ready for change. By allowing women to move around freely and easily will impact the society and ultimately, will change the kingdoms way of life. Since giving women the right to drive is expected to change the way of life in Saudi, Is there a way to actually evaluate and predict the impacts using Call Detail Records.

# 4. Call Detail Records and Usage

## 4.1 What is a call detail record (CDR)?

A CDR is a form of meta data that telecom companies record for billing purposes. It is a way to gather information that is related to telephone calls made by individuals using mobile phones. This file can give you access to information such as the date and time the call was made and received, the duration of the call, the location of the caller, the type of connection (Call, SMS, internet query etc.) and the type of service [8]. In addition to this information a separate file is given with the geographic coordinates of the existing cell towers to cross reference with the CDRs allowing for accurate location of the caller. An example of the CDRs format is as follows:

*The Date of the call, The time the call was place, The Duration of the call, The Caller ID, The Callee ID, A, B*

Where A and B determine the location of the cell tower.

*(A x 1000) + B = Index Number*

This index number is the identification number of the cell tower location.

## 4.2 How is a CDR used?

There is a lot of work that goes into making a set of CDRs viable enough to utilize for research. The first thing that happens to a CDR set is the anonymization of the callers, usually done by the telecom companies before giving the information to researchers. This is done to protect the privacy of the callers, which gives the callers a unique, surrogate security ID. The second thing done to the CDRs is defining how the information is going to be analyzed and what it is going to be used for.

The SENSEable City Lab at MIT uses CDRs as a way to map real time urban patterns and mobility. In the labs UTS (Urban Traffic System) project in the city of Riyadh, a series of matrices where created to utilize CDRs to map out the mobility patterns of the people in Riyadh. The matrices uses CDR information as an input into a method which the project calls the human mobility model. This model is used to analyze the patterns of human mobility, by analyzing the existing road network and how they are used. The Human mobility model uses the origins and destinations of daily trips as well as locating the places around the city that have the most CDR activity, identifying the denser areas in the city. The findings of this analysis, is an accurate representation of how the people of Riyadh use the existing traffic infrastructure and their mobility behaviors [9]. Initially the MIT project focuses on mobility of the city, while this research focuses on the introduction of addressing gender issues utilizing this model.

## 4.3 What can analyzing CDRs tell us?

Each city has an urban fabric. This urban fabric is defined as the physical aspect of urbanism in cities, this includes emphasizing building types, open space and streetscapes, and has recently

been used to address issues that cities face when growing and how these urban fabrics benefit or not when a city grows [10]. CDRs can start to address how an urban fabric of a city is being used, which is ultimately the most efficient, powerful, real time sensing method that is currently available. " They become a method of applied research that can help explore human communications, urban dynamics, and human mobility patterns. [11]"

CDRs can be used to model current and past behaviors that can help with the predetermination of how a city can grow and what would need to be achieved to allow the city to grow sustainably and efficiently. It allows us to understand spatial utilization, and how people move and commute around the city becomes a system that can be applied and used in urban mobility planning and management. In general it's the most accurate information we have available to us, that can help address social issues, demographic issues, and can help with the planning of the infrastructure in cities.

## 4.4 How can CDRs be applied to predicting the implications of women driving & demographic concerns?

One of the largest telecom companies in Saudi has given the SENSEable City Lab access to a full months CDRs. Combining the CDR and other information  the lab has been able to develop a model that indicates the mobility and activity patterns of the residents of Riyadh. This model achieves this by collecting the information available for a caller, and pinpointing the callers location on a system of intervals throughout out the day. When the callers locations have been determined, the points create a "path" which represents the way the individual has been moving around the city. This is then done on the millions of callers information that is available in the CDR, which leads to a macro-scale analysis of mobility patterns, and points of density [12].

The initial thought after learning about the process, was could this system be utilized to not only gather information on a macro-scale, but could this information be categorized in way where smaller mobility models and behavioral models can be created that address demographic groups? for example gender? From the millions of Call Detail Records, is there a way that the caller IDs can be categorized by gender, creating a mobility pattern model for the women in the Kingdom of Saudi Arabia?

Answering that question provided complications. The first and most important complication is the anonymization of the subscribers information. Even though the information that you could get from analyzing CDRs can get pretty specific, privacy still opposes some challenges. Due to privacy the names of the callers, which could help with the categorization of callers into gender groups, is kept private, therefore making it more of a challenge to actually create models the are demographically specific. Even if we did have the names of the subscribers, in the Kingdom of Saudi Arabia most women are not allowed to sign up for phone line. Their male "supervisor" would sign up for the phone under his name, and give it to them to use. So even if we did have the names of the subscribers, the information would be not accurately representative.

Another complication that comes from trying to answer this question, is the lack of detailed demographic information available to the public. If we had an accurate breakdown of demographic information in a region, by cross referencing this information with the analysis we get from the set of CDRs, we could get closer to distinguishing percentages of possible demographic groups. This could lead to substantial information that could help with future urban planning.

Although there is an obvious lack of access to demographic information, the Kingdom of Saudi Arabia does have a certain benefit that other countries might not, spatial segregation. In the Kingdom of Saudi Arabia, places of education and places of work for men and women are separate entities , so theoretically by locating these places, we could get an estimation of some of the mobility patterns of certain callers. This method does have it's uncertainties, but it could be a step closer to distinguishing models that are demographic specific. This method could also be used in places that are known to be specific to different callers, addressing other demographic groups, such as churches, which are known to be congregational spaces for the non-saudi population, as most saudis tend to be muslim.

For example the CDR set that the UTS group has access to, is for the city of Riyadh. Princess Nora bint Abdul Rahman University is located in Riyadh. This school is known for being one of the top ten largest universities in the world, has a total of 42,000 students, 15 different colleges and offers a variety of degrees[13]. Since that's the case, it's probably safe to say that any Cellular Activity that happens in the locations of these schools is representative of a substantial

number of the mobility patterns of women in hand. Theoretically a collection of all the security IDs of the cellular activity that occurs in these areas can then be analyzed to reach a conclusion of a gender specific mobility model. Once this analysis is made, we can further understand the mobility of women, allowing us to more understand the urban needs of women, and allowing us to accurately predict the implication on traffic flow of allowing women to drive.

Other analysis strategies can be put together for defining CDR gender, one being the understanding the cultural norm and cultural patterns. For instance, taking time as a factor and documenting either the time of the calls, or the length of the call. Since the preconception of calls that women make, tend to be viewed as longer, and at certain times of the day, we could make a calculated assumption that those calls would belong to women.

# 5. Conclusion

Due to time limitations of this internship, no definite answer has been produced on what would happen if women were given the right to drive, we know that by understanding the existing gender ideology and expectation of women, a change that is very much needed can be made. The focus on allowing women to drive, not only addresses the need for gender equality, and the response to gender concern, it also addresses the beginning of a demographic movement.

By utilizing modern technology, specifically access to Call Detail Records, we can start to distinguish and understand the urban needs that different demographic sub groups have, and establish methods to addressing them. This is all part of creating a way of analysis that moves towards a more efficient urban infrastructure. This will allow policy makers to understand the implications of their decisions, and have the tools to help make policies that will allow the Kingdom to grow more efficiently and sustainably.

# Acknowledgments

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