Children's potential mobility and appropriation of transport options in an informal settlement:

The case of Ezbet El-Haggana

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Dipl. -Ing. Ahmed El-Dorghamy
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SUPERVISORS:
Prof. Barbara Lenz
Prof. Ahmed Mosa

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ABSTRACT

This study investigates the nature of children's actual and potential mobility in a case study of an informal settlement in a megacity of a developing country; namely Ezbet El-Haggana in Greater Cairo. People's mobility in the context of poverty is coincidently sustainable in certain aspects since poverty implies the choice of whatever cheaper collective transport service is available or resorting to walking or even reducing mobility altogether due to economic constraints. However, such coincidentally sustainable practices are likely to change towards the pursuit of 'modern' lives that are typically characterized by car-dependence. Global trends indeed indicate that with income growth, a typical trajectory of increasing car-dependence is expected, along with the accompanying nuances of air pollution and loss of public space and livability of cities. This study postulates that with the study of travel behavior in settlements that are in an early stage of such a trajectory, interventions can be better designed to avoid such future scenarios. The study aims to explore the nature of the childhood phase of developing mobility practices and habits, not only as enabled by children themselves as commuters, but also as enabled by parents and the surrounding community and society. Furthermore, mobility is looked upon from an interdisciplinary perspective, drawing on knowledge from behavioral sciences and sociology in order to discuss the accompanying behavioral and socio-cultural factors that play a role in enabling or inhibiting mobility. A theoretical framework was constructed through which children's mobility is investigated. It is based on Icek Ajzen's *Theory of Planned Behavior* and Vincent Kaufmann's conceptualization of *Motility*. The data was primarily collected through a field survey and focus groups. Results indicated high prevalence of child independent mobility (CIM) in the most frequent trip (to school), not only through active transport but also largely through different formal and informal transport services available. There are socio-cultural and socio-psychological factors among both the parents and the children that constitute the appropriation of mobility options that cater to children, either enabling or inhibiting their mobility. Through the experiences of children's mobility, the acquired skills and adaptive attitudes by both children and parents enhance children's potential mobility compared to children in wealthier communities that may be granted less mobility rights or have less competences among other factors. Nevertheless, inhibiting factors were also investigated. The specific case of acceptance of cycling for children was investigated as a case of an untapped potential of mobility, indicating prevalence of socio-psychological factors that overshadow practical and rational aspects of choice; it is articulated here as an *appropriation gap*. Results were finally associated with the conceptualization of appropriation to discuss implications for policy and for the discourses of mobility in disadvantaged communities, highlighting considerations necessary to facilitate the accommodation of interventions that aim to maintain and enhance sustainable mobility in the future.

ZUSAMMENFASSUNG

Die vorliegende Arbeit untersucht die tatsächliche und potenzielle Mobilität von Kindern aus einer informellen Siedlungsstruktur in einer Megacity des globalen Südens am Fall Ezbet El-Hagganas im Großraum Kairos. Die Mobilität von Menschen aus einem Armutskontext ist unter gewissen Gesichtspunkten nachhaltig, da wirtschaftliche Zwänge die Nutzung günstigerer öffentlicher Verkehrsmittel befördern und darüber hinaus zu einer insgesamten Verringerung von Mobilität führen. Allerdings ist bereits die Abkehr vom nachhaltigen Nutzungsverhalten im Zuge des Strebens nach einem „modernen" Lebensstil absehbar, da diese Entwicklung typischerweise durch steigende Abhängigkeit von Privatfahrzeugen charakterisiert ist. Globale Trends weisen in der Tat darauf hin, dass mit ansteigendem Einkommen eine steigende Abhängigkeit von Privatfahrzeugen entsteht und damit einhergehend verstärkte Luftverschmutzung, der Verlust öffentlichen Raumes und eine verringerte Lebensqualität in Städten erwartet wird. Diese Studie postuliert, dass die Untersuchung des Mobilitätsverhaltens in Siedlungen, die sich in frühen Stadien dieses Entwicklungspfades befinden, eine effektivere Konzeption von Maßnahmen ermöglicht, um die ebengenannte Dynamik zu vermeiden.

Die vorliegende Arbeit untersucht die Entwicklung von Mobilitätsgewohnheiten in der Kindheitsphase und bezieht sich dabei nicht nur auf Kinder als Nutzer, sondern berücksichtigt zudem deren unmittelbares soziales Umfeld und den gesamtgesellschaftlichen Kontext. Darüber hinaus wird Mobilität aus interdisziplinärer Perspektive betrachtet und beruft sich auf verhaltenswissenschaftliche und soziologische Forschung, um auf dieser Grundlage begünstigende und hemmende Begleitfaktoren hinsichtlich Mobilität diskutieren zu können. Der theoretische Rahmen für die Untersuchung der Mobilität von Kindern basiert auf Icek Ajzens *Theorie des geplanten Verhaltens* sowie auf Vincent Kaufmanns Konzeptualisierung des Motilitätsbegriffes. Primärdaten wurden in einer Feldstudie und in Fokusgruppen erhoben. Die Ergebnisse deuteten auf eine hohe Prävalenz der unabhängigen Mobilität von Kindern (*child independent mobility*, CIM) auf deren am häufigsten zu bewältigenden Strecke (zur Schule) hin, zunächst durch nicht motorisierte Formen der Verkehrsteilnahme, aber weitgehend auch mit Hilfe von verschiedenen formellen wie informellen Nahverkehrsmitteln. Es wurden sozio-kulturelle und sozialpsychologische Einflussfaktoren seitens sowohl Kindern als auch ihren Eltern identifiziert, die die Verkehrsteilnahme von Kindern hemmen oder befördern können. Das Mobilitätspotenzial von Kindern wird durch Anpassungsfähigkeit und einschlägigie Kompetenzen gesteigert, die in früheren Erfahrungen bezüglich Mobilität der Kindern von ebendiesen sowie von ihren Eltern erworben wurden, im Vergleich zum Mobilitätspotenzial von Kindern aus wohlhabenderen Milieus, denen mitunter weniger Mobilität zugestanden wird und die somit weniger einschlägige Kompetenzen erworben haben. Gleichermaßen wurden hemmende Faktoren untersucht. Die Akzeptanz des Radfahrens von Kindern wurde als Fallbeispiel für unerschlossenes Mobilitätspotenzial untersucht und deutet auf die Prävalenz sozialpsychologischer Faktoren hin, die Entscheidungsfaktoren rationaler und praktischer Natur entgegenstehen und die die Verkehrsmittelnutzung von Kindern mindern; hier benannt als *Nutzungslücke* (appropriation gap). Die Ergebnisse wurden schließlich in Zusammenhang mit dem Konzept der Verkehrsteilnahme gestellt und erlauben die Diskussion von Implikationen für die politische Ebene und für den Diskurs von Mobilität in benachteiligten Gruppen der Gesellschaft. Dabei wurden insbesondere notwendige Überlegungen zur Ausgestaltung von Maßnahmen für die Förderung nachhaltiger Mobilität der Zukunft beleuchtet.

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CHAPTER 1: INTRODUCTION

1.1 BACKGROUND

Greater Cairo is one of the most dense and populous cities in the world. As the world's cities become increasingly compact and face similar environmental pressures, the study of dense areas within a megacity like Greater Cairo might offer a glimpse into the reality of much of today's world. The reality today is that the populations living in urban areas have long exceeded those living in the rural areas since 2008, making our world today predominantly and increasingly urban in nature (UNHABITAT, 2008). Furthermore, the vast majority of the existing and emerging megacities are found in developing countries, increasing in density and generally sharing similar socio-economic challenges, environmental pressures, and mobility challenges. The present research stems from a deep interest in understanding how mobility in the future can be understood from the study of today's dense urban pockets found in megacities and understanding what implications this would have on effective planning for environmental sustainability and social equality.

Transportation in Egypt is as old as its civilization. Over the years however, and with the advent of motorized transport, the means of non-motorized transport (NMT), including walking, cycling and animal-driven carts, have rather come to be associated with poverty and subject to social stigma. In the meantime, motorized vehicles have multiplied rapidly in its streets. Today, its capital Cairo, the city that was once characterized by its cultural heritage, has now become rather characterized by its vehicle traffic, air and noise pollution, and cars parked on sidewalks and on multiple lanes in its streets. Children are born into this reality and face the associated threats to their health and safety (Fellinger, 2015, Abbas et al., 1996).

As with current trends of the transportation sector worldwide, there is consensus among advocates of sustainability that a paradigm shift toward low-carbon mobility is needed, requiring investment in public transportation, facilitation of intermodal integration, and reduction of private vehicle use among other travel demand measures (Litman 2012, ITDP 2010, UNEP 2011). This is equally the case in Egypt, where one study showed that the period of 2001-2006 alone saw an increase in private vehicle licensing at a rate of 7.4% annually, of which 58% is in Greater Cairo (GC) alone (IDSC 2007, IDSC 2008). This is largely attributed to economic growth and the reform of the banking sector in that period facilitating access to car loans (Dorghamy 2015). Today there are more than 8.4 million vehicles in Egypt, and about half of them are in GC (CAPMAS 2015). More than half of all vehicles in Egypt are private cars; 4.4 million. However, despite the high congestion in the city's streets, the private car ownership rate actually remains among the lowest worldwide at 47 cars per 1000 inhabitants based on data of Egypt's Central Agency for Public Mobilization and Statistics (2015)[1]. This is an order of magnitude lower than all EU countries (Eurostat 2017). Bearing this in mind, it can be argued that Egypt still has a chance to avoid a

[1] Data for vehicles in 2016 or 2017 have not been issued by CAPMAS at the date of writing this study.

car-dependant development path, and possibly leapfrog into a future of sustainable mobility. However, firstly in depth understanding of mobility and travel behavior in the city is needed, which is significantly lacking. An adequate starting point is the study of informal settlements which constitute the *majority* of the city today rather than being a marginal phenomenon (Sims and Séjourné 2008). Furthermore, it is the informal settlement that is characterized by the lower vehicle ownership and higher building density compared to the formal residential sector and can be seen as more representative of present and future reality of the city.

It is of interest to planners in this context to understand how to maintain the elements of sustainable travel behaviour that are already found today and require attention to maintain, such as walking and using public transport. It is also of interest to understand deficiencies in sustainable travel behaviour, such as absence of cycling as a common mode of transport and increasing car dependence as noted in recent research on the topic (Puttrowait, 2014; Fellinger, 2015; Dorghamy, 2015). Notably, similar urban conditions in cities of other developing countries are often correlated with high dependence on cycling as one of the rationally chosen modes (UNHABITAT, 2013, Shengxiao and Pegnjun 2015).

1.1.1 Children's Mobility

A safe and enjoyable urban environment for children is among the key criteria for sustainable cities and communities. In the list of the Sustainable Development Goals (SDG) of the United Nations 2030 agenda for sustainable development (UN Resolution 70/1), the global commitment to provide sustainable transport for all is explicitly highlighted, with specific focus on the needs of vulnerable groups; women, children, persons with disabilities and elders.

> ***Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable***
> ...
> *Target 11.2: By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons*
>
> *Source: UN Resolution 70/1*

In the specific study of children in this context, current understanding is largely built on research conducted in developed countries (Buliung et al. 2012). The key trends subject to much attention are the observed decline in active school travel (AST) and the reduced physical activity among children and decreases in Child Independent Mobility (CIM) and safety (see e.g. Kyttä et al., 2015; Mitra and Buliung, 2015; Curtis et al., 2015; Fyhri and Hjorthol, 2009; Christie et al., 2011; Tranter and Sharpe, 2012), while such research in the context of developing countries is lacking.

Although this might be seen as a virtue in many developed countries, in other countries this might not be a symptom of a child-friendly environment but rather as a symptom of captivity, where absence of other transport options along with other poverty-related constraints may be the driver of either active travel and CIM. Furthermore, in developing countries, social and cultural aspects have been found to play a significant role in defining the nature of mobility and accessibility. Due to prevalent informal elements in the provision of transport services characterizing cities of developing countries such as Cairo, there is a larger role fulfilled by social and cultural norms in governing transport services provision

and usage compared to contexts where transport services are highly formalized and regulated. Furthermore, social and cultural norms are suspected to be substantially influential in affecting the use of transport options, not only in enabling mobility but in inhibiting it. This is noted in observed stigmatization of various modes for certain segments in society, such as noted in research on children's use of bicycles in Ghana (Amoaki-Sakyi and Owusu, 2011; Porter et al., 2011), or of bus services in cities of developing countries associated with an image of poverty (e.g. Chalak et al. 2016; Witter 2010).

1.1.2 Context of informal settlements in Greater Cairo

The majority of Greater Cairo, more than two thirds of its inhabitants, reside in informal settlements and are growing at higher rates than the formal counterpart in the city (Sims and Séjourné 2008). There were no informal settlements around Cairo up to 1950 (Sims 2010). Rapid growth started afterward through a series of historical developments, starting with the industrialization policies in the 1950s attracting male migrants and continuing rural-urban influx in the 1960s along with profitable urbanization of agricultural land and squatting in state-owned desert land in the periphery of Cairo (Séjourné 2009). Inadequate housing plans and policies, coupled with stifled state investments during the 1967 and 1973 wars characterize this phase of development in the city and its growing population. Among the key reasons for the failure of public housing was the lack of accessibility to job opportunities and other mobility needs. On the other hand, informal settlements satisfied such basic needs. Informal settlements, whether on former agricultural land or desert land have grown to become a norm. Furthermore, there is a wide diversity of types of informal housing, spanning from well-built high-rises in some areas to rare tin-shacks in others, but most informal housing today are typically structurally sound multi-floor red-brick buildings with reinforced concrete foundations, frames, and floor slabs. Development is dense to make maximum use of available space and the typically poorly-paved or unpaved streets are narrow and missing sidewalks.

Despite being renowned for its traffic problems, the rate of car ownership in Cairo is low and dependence on walking and use of formal and informal collective transport services is high (Dorghamy, 2015). Cycling as a mode of transport in specific is however very low despite the dense and mixed-use nature of the urban environment and the predominantly flat topography of the City (Puttrowait, 2014). Similar to many other developing countries, semi-formal and informal transport services meet much of the transport demand due to the deterioration of public transport and limited state investment in its development. Similar lack of investment in public infrastructure in informal settlements led to further deterioration of the commuter's experience as well, where streets are unpaved or poorly paved and full of potholes, construction debris, and in many areas suffering repeated episodes of overflowing sewage. The majority of housing in peri-urban Greater Cairo are situated on streets that have no paving at all (Sims, 2010). Furthermore, the threats of future impact of rapid motorization and accompanying intensification of air pollution and loss of public space are not internalized in present plans and policies (Dorghamy, 2015).

There is another side to this image however. Although the quality of the built environment is poor, there are nevertheless several virtues to informal settlements that have driven their growth and enabled them to continue to thrive as they do today. The virtues are not only limited to proximity to job opportunities, but also features that make them highly walkable (in terms of land-use mix and density), affordable, socially vibrant, and enjoying alternative forms of safety that compensate for the lack of formal policing, which was described by one researcher as "natural surveillance" (Shehayeb, 2009). Observation of social, cultural, and behavioral aspects of communities in informal settlements often provide valuable

insight about their successes and failures, as well as insight about the common pitfalls found in the planning of public housing and formal transport that has rarely been effective in meeting the growing demand and needs of people.

1.2 PROBLEM STATEMENT AND RESEARCH OBJECTIVE

The study of mobility and travel behavior worldwide has been rapidly benefiting from the domains of behavioral sciences and sociology, which provided new tools in the domain of transport research that can be applied to better understand new contexts with unique cultures. This knowledge is however not yet sufficiently applied to the study of mobility and accessibility in disadvantaged communities to support tailored approaches for promotion of sustainable mobility and travel behavior compared to the extent to which it has been applied in developed countries and advanced cities.

Cairo is a good example of an under-studied city in the developing world characterized by informal settlements, which constitute the majority of the city. As with many other megacities in the world, it strives to transition to a future of sustainable mobility, but current trends however indicate movement away from sustainable travel behaviour and toward the traditional trajectory of increasing car dependence in tandem with economic development and growth.

The younger demographic segment is of specific interest in recognition of the impact of childhood experiences in forming representations of travel modes and in socialization of travel behavior.. Limited understanding of children's mobility in the informal settlements leads to ineffective planning for maintenance and promotion of sustainable travel behavior in this under-studied context. With lack of such local insight, planners and policy makers often superimpose solutions that are based on knowledge irrelevant to the local situation of the built environment and of the social and cultural nature of the inhabitants.

Accordingly, a case study area, Ezbet El-Haggana is selected as the subject of this research, being an example of a dense informal settlement with much promising potential insight about such gaps in knowledge as well as opportunities to learn from the means by which children's mobility needs are met in their respective contexts.

The objective of this research is therefore to conduct an in-depth investigation of the nature of children's travel behavior and appropriation of transport options in the selected informal settlement in Greater Cairo, and to also investigate how mobility options and enablers are appropriated by their parents for them. The study aims to explore this understudied topic to contribute to the understanding of mobility-related aspects of children's welfare, and explore potentials for enabling sustainable mobility in such a community in an early stage of motorization.

1.3 RESEARCH QUESTIONS AND HYPOTHESES

The phenomena studied is children's mobility and their interaction with available transport services and mobility options in a major informal settlement in Greater Cairo; Ezbet El-Haggana (hereinafter referred to as *Haggana*).

The following questions and respective hypotheses represent the research purpose:

Q1 - Characteristics: Can children in the informal settlement have distinctly different travel behavior than children in the formal areas in terms of appropriation of mobility options? What are the key features of their mobility and what framing suits the analysis of this context?

Hypothesis: Child Independent Mobility (CIM) characterizes the informal settlement due to necessity, and both children and parents adapt in different ways to maintain the mobility of children and their access to needs in the context of various poverty-related constraints (e.g. adapting the acceptability, strategizing for alternatives, acquiring new/necessary skills, innovating in travel planning and use of resources, etc).

Q2 - Framing: Can children in the case study area, known to be a *disadvantaged* area in the traditional sense, be alternatively seen as at an *advantage* in terms of acquired skills and exposure to diverse mobility options and decisions?

Hypothesis: Children's mobility in Haggana exemplifies a social segment that is at an advantage from two perspectives: (a) At an advantage for their own sake, in terms of both actual and potential to be mobile, and (b) At an advantage from a sustainability point of view, in terms of elements of sustainable mobility that already characterize them, as well as ability to adapt to potential sustainable mobility related interventions.

Q3 - Affective and socio-cultural factors: How do affective and socio-cultural factors affect parents' acceptance of the mode choice of cycling for children?

Hypothesis: Affective and socio-cultural factors dominate society's acceptance of cycling for children in Haggana in ways that inhibit parents' socialization of cycling among children.

Furthermore, the wider implications of the research findings are discussed: What lessons and inspiration can be gained through the study of a case study such as the dense informal settlement of Haggana? What are the implications for the discourse of sustainable mobility in similar contexts in developing countries and for intervention design? These questions are addressed in the final discussions of the research finding. The case study of children in an informal settlement can provide insights on sustainable mobility solutions, either for themselves or also for their formal counterparts in the city, illustrating an alternative and novel framing compared to the common discourse of victimization and clienthood associated with the mainstream study of informal settlements.

1.4 THEORETICAL FRAMEWORK

Understanding the individual's affective reality, and not only movement, is fundamental to travel behavior research. This understanding grew with the evolution of transportation research that came to consider a more holistic approach with time, in what some researchers describe as a 'mobility turn' or 'new mobilities paradigm' as articulated in the works of sociologist John Urry, in which the playing field for interdisciplinary research on mobility expanded to new horizons (Sheller, 2014; Sheller and Urry, 2006). Jones (2009) describes the series of developments as an evolution or expansion of the transportation research paradigm spanning through several stages of evolution: from vehicle-based to a *Person Trip-based Perspective*, which catered to person-movement rather than vehicles, and then the

Generalized Cost perspective, whereby various time and cost components of travel are combined into one, giving a more holistic meaning to 'costs' of travel, followed by the *Activities-based perspective* recognizing how travel is a derived demand based on needs. This was succeeded by the *Attitude-based* perspective incorporating subjective aspects of decision-making. It was much inspired from advancements in behavioral sciences and refinement of theories and conceptual frameworks that are essential to understanding travel and activity behavior. One of the prominent advancements in this respect was the introduction of the Theory of Planned Behavior (TPB) among other relevant behavioral theories, which have been instrumental in analysis of travel behavior (e.g. Anable, 2005; Jones, 2012; Eriksson and Forward, 2011; Jakobsson, 2007). Furthermore, much aligned with John Urry's concept of the new mobilities paradigm, the concept of *potential mobility* has been advanced in the work of urban sociologist Vincent Kaufmann, which looks into actual and potential mobility (*motility)* from the perspective of the commuter. Advancing the notion of motility offers a new discourse that better accommodates the disciplines of sociology and psychology and other disciplines of humanities in the study of transport and travel behavior. This study draws on both behavioral sciences and the advancements in the articulation of the paradigm of motility to develop the theoretical framework of the research as deemed suitable for the research questions and scope.

1.4.1 Theory of Planned Behavior

The Theory of Planned Behavior (TPB) is among the widely used theories to model, explain, and predict deliberated travel behavior (Ajzen 1991). TPB suggests that intentions to perform behavior are a function of three determinants: attitudes towards a behavior (positive or negative), subjective norms (opinions of significant referents such as family, friends and peers), and perceived behavioral control (Ajzen 1991). An additional construct of a*ctual* behavioral control was later added to explain whether or not the behavior intention is actually carried out, i.e. with all the prerequisite cognitions, the actual control is the final determinant to enable a formed intention to be translated into actual action (Ajzen and Fishbein, 2005). Background factors influencing these determinants are individual factors (personality, mood, experience, etc), social factors (education, age, religion, etc), and information factors such as information through media (Ajzen and Fishbein, 2005). The theory has been found instrumental by many transportation researchers to investigate choices related to travel behavior and mode choices (e.g. Anible 2005; Jones 2012; Eriksson and Forward 2011; Jakobsson 2007). It has therefore been used in the present research to dissect the underlying subconstructs behind specific intentions affecting certain travel behavior and mode choice. Other relevant theories are further reviewed in the literature review for reference and to facilitate the discussion of research results through the use of an expanded 'toolbox' of commonly used behavioral theories.

Furthermore, extended forms of TPB have been frequently used in research to include other constructs, such as habit strength to further improve explanatory power and account for the influence of past behavior that contributes to a partial automaticity in behavior and reduced deliberation (e.g. Hashim et al. 2014; Nordfjaern et al. 2014; Brujin 2011*;* Murtagh et al. 2012).

1.4.2 Motility

Behavioral theories such as TPB, or others such as norm-activation and habit formation theories and models, are instrumental in the cases of in-depth analysis of a certain individual behavior, such as the decision or intention to chose a certain travel mode, or to wear a helmet, etc. They do not provide a tool for the analysis of higher levels of abstraction to allow the accommodation of greater complexity in

comprehendible form. There are research questions for which wider generalization is needed to adequately describe a complex phenomenon. In this respect a powerful tool that provides a wide conceptual framework for studying spatial mobility with incorporation of affective factors is the concept of motility (Kaufmann et al., 2004; Flamm and Kaufmann, 2006).

Motility, as an abstract notion, is defined as actual and potential socio-spatial mobility, and is comprised of all factors that determine an individual's potential to move; skills, appropriation, and access (Kaufmann et al. 2004; Kaufman, 2014). It is also specifically suitable to put into perspective discussions about mobility in the context of urban poverty (UNHABITAT, 2013).

Both the wider perspective and the focused perspective were used throughout the research and in the analysis and interpretation of results. The process involved an exploratory research of travel behavior followed by identification of a key theme of travel behavior in a case study area that elicits insightful feedback. The theme investigated in more depth is cycling, specifically the parental support for cycling for short trips and as a feeder mode. The selected theme serves as one proxy to elucidate the nature and the role of behavioral aspects in influencing appropriation of transport options and appropriation of the various enabling factors. Throughout the research, exploring children's mobility is not only done through studying children but also their parents as well as the surrounding community through which mobility enablers and inhibitors are investigated.

1.5 METHODOLOGY

The research has been predominantly conducted through an exploratory approach and using relevant qualitative and quantitative research methods found suitable for the case study area. These involved field observation, focus group discussions (FGDs), interviews with community leaders and influential stakeholders, and interception interviews throughout the settlement with the local community including a questionnaire survey adapted to the local context and culture.

All data has been gathered in first hand by the author with approaches based on established methodologies and further adapted based on iterations of trials and consultations with the local community as well as peer researchers that have previously conducted field research in the same settlement. In an early stage of the research, key characteristics of the informal settlements in Cairo that dictate certain adaptation of the way research methodologies are implemented were identified as follows:

- **Difficulties of the social context addressed with suitable techniques:** High prevalence of illiteracy, limited education and understanding of questions that may involve abstract thinking and conceptualization, and the challenge of avoiding context-specific biases suspected (e.g. context-specific strategic bias in pursuit of potential financial support, or association with political interests, etc), as well as people's resistance to what they sometimes see as "research for the sake of research" void of a vision for practical implementation that would benefit them, and therefore being a cause for discouragement from participation.

- **Positive features that are leveraged:** Such features include availability of NGO's experienced in facilitating access to the local communities, high accessibility to all parts of the settlements through available formal and informal transport services due to the compact urban form, as well as high

accessibility to people due to the high physical presence of passerby in streets where most public space functions are met.

In this respect, the qualitative research was first conducted in an exploratory phase, followed by quantitative research tailored to the local context and using appropriate proxies to answer the research questions in a resourceful manner.

The qualitative research process was conducted with guidance in social analysis techniques by Krueger et al. (2001). It was also in alignment with approaches advisable in Clifton and Handy (2003), which advocate qualitative methods in travel behaviour research in the case of context that is unfamiliar to the researcher or lacking background information in the literature. Data was collected through notes and audio and video recordings as well as interview transcripts, and was analyzed through mixed methods content analysis. The qualitative research provided the foundation for the development of the quantitative component of the research design.

The quantitative research process was conducted through a questionnaire-based interception interview in random locations in the street network of Haggana and at different times of the day and night. It addressed parental factors and details of children's most frequent trip as well as an in-depth TPB-based set of questions related to the parent's perception about cycling as a mode of transport for their children. The questionnaire analysis was conducted both through descriptive statistics and correlation analysis, as well as in-depth analysis of the investigated behavioral constructs through Structural Equation Modeling (SEM) for the TPB-based questions. All survey forms were delivered individually in the form of an interview. This personalized survey approach was chosen since a substantial number of residents are illiterate or semiliterate, so self-administered questionnaires would not be feasible and would under-represent the poorly educated segment.

Ethical considerations with regards to anonymity of stakeholders involved and consent from parents in the case of the FGDs with children were ensured and also conducted in compliance with the norms followed by the local NGOs in the case study area.

1.6 SIGNIFICANCE OF THE RESEARCH

The significance of the study is represented by the following contributions:

- **Expanding understanding of CIM:** The study exposes and analyzes a phenomenon (Children's Independent Mobility) that is understudied in the context of developing countries, and specifically in informal settlements of megacities, thereby adding to the body of knowledge, and adding new meanings to the vocabulary of the field and the discourses used.

- **Tailored framework for analysis and problem articulation:** Providing a more holistic framework for policy makers and planners to guide them in articulating mobility and accessibility needs of children in informal settlements of similar context. The holistic problem identification developed as a result would better inform planners and policy-makers to improve children's actual and potential mobility and improve the design of interventions aiming to promote sustainable mobility practices.

- **Challenging a mainstream discourse:** The alternative framing of the case study exposes different perspectives from which the settlement may be viewed to be at an advantage compared to formal

counterparts in the city in terms of adaptability to sustainable mobility practices and in terms potentiality of mobility in certain aspects. This is exposed through incorporation of social, psychological, and cultural factors inherent in the settlement that contribute to their empowerment and compensate for their economic constraints. The demonstration of the validity of this framing implies a necessary shift in mindsets among planners and policy makers to acknowledge, to support, and leverage the identified features while pursuing urban development.

- **A promising new domain for children empowerment:** Prerequisites for empowering children through improved actual and potential mobility is found to be largely inclusive of non-material aspects, much of which may be acquired by the children and their parents themselves regardless of poverty. This expanded perspective gives much hope for development and improvement of the mobility-aspects of children's welfare. In this respect, this gap can be addressed through education and training activity targeting both children and parents based on the framework suggested in this study.

- **Inspiring sustainable mobility and de-motorization:** Poor urban areas are expected to steadily follow the typical trajectory of increased motorization with increased income levels over time. However, through dissecting the enabling conditions for meeting mobility needs in the context of economic constraints in the study area, and with focus on children, valuable insight is produced relevant to this challenge. Results can support planners to better design interventions that may decouple economic growth from motorization for future generations. Further to the items described above, the study may inspire other analogous arguments related to other threats of consumerism and other forms of poverty and resource scarcity in domains other than transport.

1.7 OUTLINE OF THE THESIS

This sections presents the outline of the thesis and a summary of its chapters.

Chapter Two: Literature Review
In the literature review, the topic is partitioned into several components that together provide the necessary background for the research. It firstly presents relevant discourses that form the background for the research and development of the evolving paradigms in which mobility is studied as well as related interdisciplinary development of social and behavioral theories and discourses applied to transport research. This is followed by an review of the state of knowledge about children's mobility in developed countries as well as developing countries and impoverished areas. Mobility in informal settlements in Cairo is then discussed along with a review of existing relevant research shedding light on the nature of the communities, their challenges and constraints, and the ways by which they meet their needs and fill the gaps of deficient services and infrastructure. The specific case of Haggana is discussed with a review of the scarce literature on the settlement that was used as background information for developing the suitable theoretical framework and research methodology to suit the context.

Finally the review is concluded with a discussion linking the various topics in the literature review to form an overall context and framework adapted to the research objectives. The conclusion crystallizes a new perspective about the study of children's actual and potential mobility in informal settlements

constructed through the literature review and tailored to the case study of Haggana and similar contexts.

Chapter Three: Theoretical Framework

In this chapter, relevant behavioral theories and concepts found suitable for the study of the case study are reviewed in the context of travel behavior research. A conceptualization of motility and the interrelation between its three facets of access, skills and appropriation is developed. The nature of appropriation in specific is discussed, where a concept of an 'appropriation gap' is developed to articulate the difference between what an actor appropriates and what a further expansion of appropriation can offer, such as through overcoming behavioral barriers, alteration of perceptions and beliefs, or other forms of altering affective and cognitive factors that enable an actor to appropriate available resources. Appropriation is framed as a manifestation of a behavioral process and is in turn analyzed as such, where the proposed appropriation gap can accordingly be analyzed based on behavioral theory, mainly being the Theory of Planned Behavior for the scope of this study and based on the literature review. Validity and applicability to the research context is discussed as well as implications for future research into such framing from a theoretical viewpoint, for which further refinement or expansion is foreseeable.

Chapter Four: Methodology

In this chapter, based on the literature review and discussion, the research methodology is presented, explained, and justified in detail. Firstly the exploratory phase and the process of refining the methodology in the earlier phase of research is explained and then the research procedures are detailed, including research design for conducting the interviews, FGDs and questionnaire survey, sample selection and delimitation, data collection, and data analysis through mixed qualitative and quantitative approaches including structural equation modeling for the exploration of behavioral constructs influencing a tested case of appropriation deficiency (appropriation gap), namely the appropriation of cycling as a mode of transport. An explanation of the choice of exploring the behavior intention from the perspective of parents as the target respondent in the survey is explained.

Chapter Five: Research findings and analysis

The research findings and analysis are presented in this chapter, detailing the results of field observations and earlier exploratory qualitative research to detail the nature of mobility in Haggana and related aspects. Data on children's Independent Mobility (CIM) and trips to school is then presented and analyzed, followed by an analysis of the qualitative data on children and parents perceptions about mobility options and their appropriation. The case study of cycling and associated behavioral aspects (as a case-study of controversial mobility-related topic) is then presented with results of detailed analysis of behavioral constructs influencing the nature of the studied mode of mobility. Results are further collectively discussed from the lens of motility, detailing the identified elements of access, skills and cognitive appropriation identified and relevant influencing factors.

Chapter Six: Conclusions and discussion

The final chapter presents a summary of findings, discussion, and suggestions for future research, and also presents and discusses research limitations. First, the answers to each research question is provided in conclusion and discussed with reference to relevant literature to discuss consistencies, inconsistencies, or new contributions to the existing relevant body of knowledge. The conclusions encompass the findings about the nature of children's travel behavior and independent mobility that characterizes the informal settlement, the nature of mobility enablers and inhibitors experienced, and

the influence of affective and socio-psychological factors affecting appropriation in general and prospects for promoting cycling among children in specific. The constructed tailored theoretical framework for motility-based analysis of informal settlements of similar contexts is then re-visited to discuss its instrumentality in conducting the study. The findings are then discussed in relation to bigger questions about sustainable mobility to contemplate the various implications of the findings and their relation to the evolving understanding of mobility and travel behavior. Finally, policy implications and the value of the research for planners is elaborated, and recommendations for future research are suggested. Implications and relevance to the discussions about global trends of car dependence and the contribution of the present research is also discussed to put research findings into global perspective.

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

Research about children's mobility and travel behavior in the context of developing countries is scarce. In the meantime, the advent of progressive approaches in transport research, whereby knowledge of behavioral and social sciences are employed to address challenges in achieving sustainable transport and better accessibility for people has lent the interdisciplinary study of travel behavior much credibility over time. This scientific and practical value is evident in the work of leading authors observing long term global trends and discussing policy implication, yet notably most research is based on knowledge from developed countries (e.g. Jones 2016 and 2009; Metz, 2004; Pickup et al., 2015; Sheller, 2014; Kaufmann et al., 2004; Goodwin, 2012).

Similarly so, research on mobility of children in specific is mostly associated with concerns pertinent to developed countries, most prominently relating to children's physical activity among other concerns that apply to the contexts of advanced countries (e.g. Kittä et al., 2015; Mitra and Buliung, 2015; Curtis et al., 2015; Westman et al., 2013; Fyhri et al., 2011; Fyhri and Hjorthol, 2009; Christie et al., 2011). This research therefore aims to explore a different context and to investigate what the interdisciplinary field of study can offer to the study of an urban setting in a developing country that is also seen as 'disadvantaged' within the city, and specifically observing the nature of children's mobility in recognition of the role of early development in the socialization of travel behavior. This is done not only through the use of existing tools for the study of travel behavior research that are reviewed herein, but also with further development of a tailored theoretical framework to suit the specific research purpose.

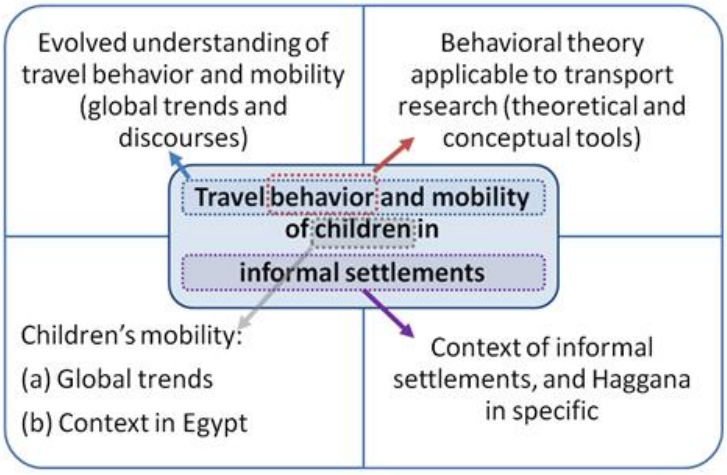

Figure 1: Components of the topic investigated in the literature survey

Accordingly, there are several associated sub-topics and fields of study that are associated with the topic of travel behavior and mobility of children in informal settlements that are reviewed in this literature review. Figure 1 illustrates and overview of the way in which the topic of children's travel behavior and

mobility in informal settlements was dissected. The literature review chapter therefore reviews each of these components. Firstly, background about travel behavior as a discipline and how it is associated with sustainable development and healthy lifestyles is reviewed. Secondly, advancements made in the interdisciplinary field of research of travel behavior, where theories and findings from behavioral and social sciences are employed in transport research are also reviewed. They helped expand understanding of mobility beyond the spatial movement of individuals, and into the understanding of mobility that recognizes lifestyles, cultures, aspirations and experiences, among other social constructions of reality.

Focus on children required a specific review of this demographic context, with recognition of influential factors that are specific to this understudied segment of society, especially with regards to parental influence on travel behavior, but also other factors associated with the nature of childhood. In this respect, research discourses related to children's mobility and the state-of-knowledge about the topic is reviewed, also including relevant research that was deemed informative about children's mobility in Egypt in specific. Research that explicitly addresses this topic in the context of Egypt has been found to be very scarce.

Furthermore, the literature review is presented in a manner that elaborates on aspects that relate to socio-cultural differences and issues that might be specific to developing countries and disadvantaged communities, investigating research that might be comparable or relevant to the context of informal settlements in Cairo. In the final section of the literature review, a specific focus on relevant background literature about the case study of Haggana in specific is reviewed as well as an assessment of the available relevant research on children's mobility in Egypt and poverty-related aspects for the purpose of informing the research methodology development, the development of the theoretical framework, and to provide background for the analysis and discussion of results.

2.2 MAPPING THE PROCESS

The literature review was conducted through review of scholarly literature, both online and through access to the journal databases and archive of the library of the American University in Cairo (AUC) and the library of Humboldt University in Berlin as well as correspondence with key authors upon need. The review was complimented with selected sources from grey literature where necessary, especially in consideration of the scarcity of background information about informal settlements in Egypt. Furthermore, consultation was made with relevant researchers and other stakeholders with regards to collection of background information about the case study area of Haggana in specific. The review process was structured as follows:

- **Theories and discourses:** A review of literature about relevant theories in sociology, cognitive psychology, and behavioral sciences (behavioral change, behavior prediction, habit formation, etc) and applications in transport research, as well as an extensive review of scholarly articles to recognize patterns and discourses in the field of study.
- **Related academic research:** A systematic review of related qualitative and quantitative research corresponding to a list of sub-topics that was developed based on the research questions and hypothesis, as well as a review of seminal work in the research area and correspondence with key authors upon need to ensure coverage of updated state-of-art knowledge.

- **Grey literature:** A need-based review of related literature on transportation, informal settlements, children's welfare, and other related topics available in policy papers, guidance documents, reports of development agencies, etc, to substantiate discussions about practical implications of state-of-art academic research in the field of study.
- **Geographical context and urban setting:** A review of existing literature about the specific settlement and settlements or communities of similar nature in proximity.
- **Counterarguments and gaps in knowledge:** A critical review of suspected flaws and counterarguments elucidated throughout the review process and through discussions with other researchers, and identification and confirmation of suspected gaps in knowledge.

Finally, a synthesis of the literature review is concluded in order to inform the subsequent development of theoretical framework and methodology, and to identify the gaps of knowledge that the present research shall contribute to.

2.3 TRAVEL BEHAVIOR

In simplified form, travel behavior research is the study of movement of persons outside reference locations for any activity. Pendyala (2012) explains that travel behavior research aims to develop in-depth understanding of the activity and travel choices that people make under a wide range of spacio-temporal and modal contexts. Behaviors commonly addressed in this context include mode choice, route choice, destination and trip purpose, preferences with regards to time and duration of travel and trade-offs between sets of attributes of various options, as well as vehicle purchase, trip planning, etc (Avineri, 2012).

Understanding the individual's activities, and not only movement, is fundamental to travel behavior research. This appreciation grew with the evolution of transportation research that came to consider a more holistic approach with time. Jones (2009) describes this development as an evolution or expansion of the transportation research paradigm. He recounts that the initial vehicle-based paradigm focused on catering to vehicles and meeting demand, followed by several subsequent perspective adopted by the research community; the *Person Trip-based Perspective*, the advent of the *Generalized Cost* concept, and with growing awareness about the importance of understanding the motivations behind travel behavior,the next expansion was the *activities based perspective*, and afterward, the*Attitude-Based* perspective, which made better use of marketing and social psychology sciences to take account of subjective aspects of decision-making. The latterwas much inspired from advancements in behavioral sciences and refinement of theories that are essential to understanding travel and activity behavior. In this respect, present day understanding of travel behavior draws on knowledge from a wide set of disciplines including psychology, sociology, and behavioral economics (Pickup et al., 2015). Among the valuable advancements in this field was the introduction of the Theory of Planned Behavior (TPB), as well as theories used in other domains that have later been applied to transport research such as the norm activation theory (Adjei and Behrens, 2012).

The attitude-based perspective offered better understanding of personal and peer factors affecting decision-making, and factoring in availability of information, among other subjective aspects that were previously often unaccounted for (Pickup et al., 2015).

Factors that influence travel behavior include demographic and socio-economic characteristics such as age, income, gender, stage in life, household size and role-distribution of household members and

household interactions, as well as socio-cultural characteristics such as cultural and social norms, and also individual characteristics such as personality traits, tastes, skills, capabilities, and lifestyle factors (Handy, 2012; Pickup et al., 2015). Research has maintained that travel demand is almost always derived from needs for activities, but there is also sometimes demand for travel for its intrinsic value, such as jogging or driving for leisure that should also be taken into consideration (Mokhtarian, 2001). On the other hand, supply-side factors influencing travel behavior include characteristics of land use and transportation systems, not only comprising the physical attributes but also related soft elements; service quality, pricing, marketing and information availability, as well as regulations and policies set to influence travel behavior such as the various Travel Demand Management (TDM) measures, or other policies and regulations that may influence travel behavior (Bamberg et al., 2011; Goodwin, 2007).

The question of how and why all the various factors influence travel behavior is the subject of much of recent themes in transport research and largely builds on the disciplines of behavioral economics, psychology, and sociology, among other related disciplines of humanities (Pickup et al., 2015). It is not only transport research that has progressively evolved, but other domains of science as well have been similarly evolving across disciplines to cater to transport research. Sheller (2014) explains how an evolution has occurred in the field of sociology, where the study of social mobility has evolved beyond the study of purely 'social' concerns toward a wider perspective of sociology that incorporates research on *spatial* mobility. Accordingly Sheller (2014), through observation of global trends in research describes this evolution as the 'mobilities turn' in sociology. The advent of such transdisciplinary field of so-called mobilities research is described as follows:

> …the new transdisciplinary field of mobilities research encompasses research on the spatial mobility of humans, non-humans, and objects; the circulation of information, images, and capital; as well as the study of the physical means for movement such as infrastructures, vehicles, and software systems that enable travel and communication to take place. Thus it brings together some of the more purely 'social' concerns of sociology (inequality, power, hierarchies) with the 'spatial' concerns of geography (territory, borders, scale) and the 'cultural' concerns of anthropology or communication research (discourses, representations, schemas), while inflecting each with a relational ontology of the co-constitution of subjects, spaces, and meanings (Sheller, 2014:791).

The broader understanding of mobilities notably also includes the *lack* of mobility, i.e. *immobility* as well (Büscher and Urry, 2009). Immobility is not only constrained to physical limits to mobility but also affective factors and skills that may be necessary to be mobile. From either perspective, the identified need for a broader understanding of mobility calls for new conceptualizations and philosophical approaches as noted in Sheller (2014). In this respect, a substantial contribution was developed by urban sociologist Vincent Kaufmann in his development of the notion of *motility*, which accounts for limitations in the mainstream discourses of transport research and understanding of mobility that is strictly spatial, focused on actual movement only, and is observed based on objective data. Kaufmann's notion of motility on the other hand comprises both actual and *potential* ability of an individual or group to be mobile. This is observed from the perspectives of skills and competences, access to means of mobility, and affective factors that may influence actual and potential appropriation of opportunities (Kaufmann et al. 2004, Kaufmann 2014). The concept of motility as 'capital' is therefore articulated, and motility as such is therefore subject to gains and losses or *exchanges* with other forms of capital, such as social, economic, and cultural capital (Kaufmann et al., 2004). This may therefore expand the domains

through which social inequality can be addressed. Unlike the conceptualizations of accessibility, motility stems from the agency of the individual (or group) who enjoys the various configurations of skills, access and appropriation, whereas appropriation refers to what the individual does with the available skills and features of access, and is governed by subjective factors. Accordingly, social and cultural factors, individual perceptions, representations of reality, competences, and other subjective factors are recognized in the discussion of actual and potential mobility, whereby such factors influence people's appropriation of available options and resources.

2.3.1 Departure from the paradigm of Homo-Economicus

People's behavior is seldom rational but rather subject to many biases and heuristics, whereby individuals often make 'satisficing' decisions rather than optimized decisions, they may also act habitually with little deliberation, or process information in a myriad of ways that are subject to a wide diversity of irrationalities (Kahneman, 2011; Thaler and Sunstein, 2008). This understanding of the human being departs from the earlier treatment of individual actors as the rational 'Homo-Economicus' in neoclassical economics, always thinking, having access to necessary information, and possessing necessary cognitive capacity to deal with the decision problems at hand and on time (Persky, 1995). In reality, none of such characteristics are found in real and imperfect human beings. The growing body of knowledge about such irrationalities have come to be the foundation of the line of study of behavioral economics, and have been instrumental in applications in travel behavior research where many forms of irrationality are observed (Adjei and Behrens, 2012; Pickup et al., 2015; Verplanken and Aarts, 1997).

In a theory-based account of irrational behavior, one economist, Joshoa Hall, labeled this embodiment of the irrational individual as a so-called *Homer Economicus,* in his book by the same name (Hall, 2014). The suggested name refers to Homer, the main protagonist of the popular animated satirical sitcom *The Simpsons* where reality-inspired irrationalities are central to the theme throughout all episodes and can be each linked to behavioral theories and known human biases. This 'irrational' individual is characterized by many biases that influence behavior and decision making, whether in transport or in other domains: He doesn't use all information available to make a decision (bounded in rationality) and rather uses rules of thumbs (heuristics) for satisficing decisions, he is loss averse, by which the perception of a loss is more felt than the perception of gain, he procrastinates to avoid decisions involving complexity or inconvenience, he prioritizes short term costs and benefits, he over-weighs small probabilities of dramatic outcomes, and his decisions are influenced by various emotions. The work of behavioral economist and Nobel prize winner Daniel Kahneman developed the foundations of this field as a distinct line of study, much of which was in collaboration with psychologist Amos Tversky, adding much vocabulary to enable diagnosis and discussion of such irrationalities (Kahneman, 2011).

One important issue for planners and policy makers is that such irrationalities might often not be to the favor of the individual or the society. Accordingly, the interdisciplinary research in travel behavior may prove to be valuable in addressing such irrationalities, such as in breaking modal choice habits to counter car dependence (Axhausen and Gärling, 2003), or understanding the influence of framing transport options in the way they are communicated, among many other examples (Avineri, 2012). Such knowledge has therefore been offering planners and policy makers tools to support (or influence) people to make decisions that are thought to benefit them as individuals or collectively. Practical implications are exemplified in applications of social marketing as advanced by Andreasen (1995) or in applications of passive influence as advocated by Thaler and Sunstein (2008) through the concept of 'nudging' as a tool for policy makers and planners to influence behavior.

2.4 TRAVEL BEHAVIOR PHENOMENA

Although the nature of travel behavior is highly contextual and requires the study of behavior at an individual level, there are also some trends that can be observed on a global, regional or national scale to provide general insight about the aggregate behavior of people. Such broader insight provides valuable information that may inform the planning for sustainable cities. Trends of car dependency and ownership are important in travel behavior research since they act as a proxy to inform about the negatively correlated trends of using sustainable modes of transport.

In this respect Jones (2016) maps out an observed common trajectory path of car dependency in many advanced cities, while Metz (2004 and 2008) observes how travel time across substantial populations seem to have remained stable for decades at around one hour per person per day and discusses implications. Pickup et al. (2015) indicate a reduction in overall car ownership and car use across many countries of Europe, especially among youth, and discuss how various features of modern day life develop new mobility trends and 'mobility lifestyles' among various generations. In the various attempts of retrospective analysis of aggregate scale phenomena associated with mobility and travel behavior, the debates over prospects for a more sustainable future can be put into perspective. Such background supports later discussions in this thesis to contemplate where the informal settlement studied would be positioned in such global trends.

2.4.1 Induced traffic

One of the early milestones in observing travel behavior at a macro level was the extensive research conducted in the early 1990's in the UK by the Standing Advisory Committee on Trunk Road Assessment in highlighting macro-observations (SACTRA, 1994). The study aimed to investigate the prevalence and significance of induced traffic experienced when expanding road capacities. The committee produced a flagship study showing that more roads do invite more traffic, so called 'induced' traffic. It refuted the earlier mindset of addressing congestion by, e.g., widening streets, which is exemplified in the government's earlier *Roads for Prosperity* program announced in the white paper of the Department of Transport in 1989 (as cited in Grayling et al., 2004). Roads for Prosperity charted out massive increases in road capacity in congested roads to improve traffic conditions. The study of SACTRA (1994) therefore had a substantial influence on correcting this misinformed mindset at the policy-level with empirical evidence, and highlighted the importance of predicting behavioral response to interventions.

2.4.2 Traffic Evaporation

Conversely to the induced traffic phenomenon, the impact of road capacity reduction has also been studied later (Cairns et al., 1998; Litman, 2001; Cairns et al., 2002). Research presented in Cairns et al. (2002) reports extensive empirical evidence, from 70 case studies in eleven countries, that reduction in road capacity often leads to an overall reduction in vehicle traffic. The selected case studies covered cases of road capacity reduction due to maintenance or renewal of transport facilities and implementation of positively planned schemes (e.g. pedestrianization), as well as security measures (e.g. London's 'Ring of Steel' cordon after the IRA bombing), and disruption from natural disasters. Furthermore, building on consultation with 200 transport professionals worldwide, the study demonstrated that an observed 'traffic evaporation' was evident; a net reduction in vehicular traffic. Cairns et al. 2002 suggests that the phenomenon can be attributed to various behavioral responses depending on the context; rerouting and retiming trips or intensifying traffic flow, as well as behavior changes leading to reduction in vehicle use such as changing mode choice and trip frequency, altering

destinations, consolidating various trips in one journey, allocating tasks differently within households, car-sharing, and cancelling unnecessary trips (or fulfilling the same purpose from home). The 'evaporation' was therefore largely attributed to behavioral adaptations that emerged in the face of constraints in road space.

It is notable however that the case studies are all from developed countries, which might have been influenced by conditions that are supportive to the favored behavioral responses (e.g. quality of public transport, availability of sidewalks, etc). Some of these conditions might be deficient in developing countries, characterized by lack of sufficient coverage and quality of alternative modes of transport and lack of sufficient regulation and enforcement capacity to manage and monitor interventions, among other differences, but the findings are still a valuable advancement in understanding the counterintuitive impact of reducing road capacity in various contexts, and has gained recognition in the global discourse of addressing sustainability in cities (e.g. EC, 2004; UNHABITAT, 2013; EU, 2011).

2.4.3 Observed eventual stabilization in personal daily travel

The rapid increase in car ownership and use continue to increase globally and represent an environmental threat as well as a threat to the livability of cities (EC, 2004). A peak car phenomenon is however noted in advanced countries, attributed to demand saturation, improved accessibility catering to sustainable travel behavior, along with constraints on less sustainable modes (Metz, 2013).

Goodwin and Van Dender (2013) note that other than hard interventions and regulatory measures, the attention to the role of lifestyles and attitudinal factors are increasingly being recognized to be of key importance to mobility discussions, especially when questioning the continuity of this observed decline in car use in advanced countries and whether this low car-dependence of youth will be sustained as they grow older or not. One key challenge for policy makers and planners to tap into this insight, is that soft measures (which address lifestyle and attitudinal factors) are notably "less-spectacular" as noted by Gärling and Axhausen (2003, p.3), compared to massive infrastructure projects and are therefore often down-played. However, in a review of past reviews on effectiveness of transport policies on reducing car travel, Goodwin (2007) concludes that the impact of soft measures is often significantly larger than assumed, although more complex, and these findings were later used to explain the more recent observations of the 'peak car' phenomena. Research on the impact of soft interventions on travel behavior has therefore greatly informed planners, enabling them to better chart out means to improve the sector and the quality of people's lives, and this is elaborated in various policy-related guidebooks on the topic that are used today (see e.g. UNHABITAT, 2013; Despacio and ITDP, 2013; EC, 2004).

2.4.4 The evolved trends of mobility

An updated and extensive expansion of the discussion about lifestyles, attitudes, and their relevance to mobility, has been elaborated in a study by Pickup et al. (2015) defining a new holistic perspective on mobility in Europe. In the study, a suggested 'new perspective' on mobility is elaborated based on intelligence gathered from various disciplines including economics, psychology, sociology, and spatial analysis. The study offers an analysis of the promoted notion of *mobility lifestyles* and its variation between different generations in light of emerging technologies, increasing connectivity, and emerging lifestyle trends. Accordingly, the so-called generations of *digital aboriginals, millenials, prime-busters, babyboomers* and *master boomers* all make mobility decisions that can be attributed to their respective mobility lifestyles; a configuration of influencing factors that forms their identity and changes with time.

Jones (2016) later made a further attempt in illustrating a trajectory related to motorization trends in various cities that shared a common trajectory. The study was based on the assessment of several decades of urban transport policy development in various North-west European cities, advanced Asian cities, and some identified North American cities. The trajectory recognized was explained as a 3-stage process, whereby rapid motorization rises before leveling off and declining in what is illustrated as an inverted U-shaped graph. It is reminiscent of the environmental Kuznets' curve (Kuznets, 1955; Grossman and Krueger, 1991), that in simple words, posits that things will eventually get better, but they will get worse before they get better; not an optimal trajectory towards sustainability. In the cities observed in Jones (2016) negative externalities of motorization (air pollution, noise, loss of public space, etc) initially build up but are eventually met with the response of improving public transport and departure from car-centric planning, while in a final stage of development, solutions that revolve around livability of cities are gradually put in place while owning a car no longer becomes an important status symbol. Not all cities however are aligned with this entire trajectory, but there are rather several common factors that Jones (2016) notes to be prerequisite to enable this process:

- An enabling urban fabric (suitable land use density and accessibility to needs and services). This condition is frequently found in older cities that had been originally designed for walkability, before the advent of cars.
- Comparable door-to-door speeds by public transport, by car, or by walking or cycling for various needs.
- Restriction on car use in place discouraging use of private cars. This condition would be viable if the urban fabric and transport systems referred to in the previous two conditions are indeed suitable.

Further research is needed to explore how stage-1 countries can directly move to stage-3 and avoid the unnecessary nuances of a phase of peak car-dependence. This is a question being addressed in an ongoing EU-funded research project that started in 2015 (CREATE, 2015, December 15), where five selected stage-1 cities from Eastern Europe and the Euro-Mediterranean region are among the case studies explored as candidates for leapfrogging.

With growing recognition of the threats of rapid motorization on one hand and the opportunities found in people's adaptability to change on the other, the global discourse in transport planning has changed. Catering to people's mobility needs has been decoupled from growth in car ownership and use. More and better mass-transit systems, mode integration including walking and cycling, and Travel Demand Management (TDM), mixed land use, as well as social marketing of sustainable travel behavior, among other solutions have become at the center stage of planning mobility sustainably (UNHABITAT, 2013). Furthermore, the pursuit of compactness and mixed land use in cities has become central to the discourse of planning for sustainable cities and communities to enable sustainable travel behavior (UNHABITAT, 2015).

2.5 BEHAVIORAL THEORIES USED IN TRANSPORT RESEARCH

Several theories from behavioral sciences are employed by travel behavior researchers to explain how individuals make choices and carry out actions and how they change their behavior. In the review by Adjei and Behrens (2012) of various behavioral theories used in travel behavior research, several theories were presented with examples of travel behavior change experiments or interventions that are

based on the respective theoretical framework, either explicitly or implicitly, in a valuable attempt to explore more instances of application of behavioral theories in transport research. Further theories based on behavioral economics have also been identified in Pickup et al. (2015) synthesizing the state-of-art knowledge about mobility choices specifically made in uncertain situations where deliberation plays a key role.

The insight that behavioral theories brought to transport research over time have mostly revolved around the premise that human behavior and decision-making is based on imperfect and incomplete information and based on limited (and varying) cognitive processing ability along with various other constraints and influences of affective factors and biases that characterize the human mind.

Much of the research conducted reconciling the knowledge of social and behavioral sciences on one hand and transport research on the other, has often revolved around an ultimate goal of mathematically modeling and predicting travel behavior (e.g. Timmermans and Zhang, 2009; Abou-Zeid and Ben-Akiva, 2012). Features of the irrational nature of humans are therefore increasingly being recognized in transportation models with time. However, in practical applications many simplifications are done for the sake of simplifying models and reducing the necessary input parameters (Pickup et al., 2015). This implies reduction in the necessary data collection and the associated time and financial resources needed for that, as well as economizing on necessary computing power for modeling. This argumentation is most valid in the case of modeling of large scale transport networks, where assumptions of expected utility theory (see section 2.5.1) are found acceptable (De Moraes Ramos et al., 2014). Many insights about underlying processes and social, cultural and behavioral specificities of various contexts can be lost in the process.

In this respect, in-depth investigation of case studies of specific behaviors and contexts from the perspective of various behavioral theories may provide valuable contribution to knowledge that can validate model assumptions, explain flaws in current understanding, or help explain observed anomalies. They also serve in providing basis for qualitative discussion and analysis of travel behavior phenomena. The applicable theories and respective applications are elaborated in the following sections.

2.5.1 Rational Choice Theory (utility maximization) and Expected Utility Theory

This theory suggests that individuals choose the best rational choice, i.e. they calculate costs and benefits, rank alternatives, and choose those with the best outcomes (Simon, 1955). A moderated understanding of rationality is also proposed through the 'bounded rationality' principle that suggests people may select a choice that is satisfying enough since they wouldn't have sufficient cognitive capacity and information resources to make optimal choices (Simon, 1957). The idea of rationality remains in various behavioral models and theories while being challenged by the evolving understanding of complexities of human psychology and cognitive processes when making decisions (see e.g. Conlisk, 1996). From a practical viewpoint however, utility theory is recognized as a suitable basis for modeling of large scale transport networks (Pickup et al., 2015). Expected Utility Theory in specific is a prevalent version where choice under uncertainty (a gamble) is accommodated in the model to predict behavior by recognizing individuals' attitudes towards risk when evaluating choices under uncertainty. Expected Utility Theory has been highly instrumental in investigating travel behavior and found popular today as a practical basis for transport models (de Moraes Ramosa et al., 2014).

2.5.2 Prospect Theory

The prospect theory describes how individuals make decisions under risk where the probabilities of outcomes are known but are processed with bias. The theory explains how individuals exhibit cognitive biases when processing values and probabilities of gains and losses (Kahneman and Traversky, 1979; Kahneman, 2011). The earlier *Regret Theory* recognized the variation in subjective value placed on losses and gains of same objective value, where options with satisfying positive attributes can be preferred to other options including negative attributes despite being a better option on average (Loomes and Sugden, 1982). It did not however take into consideration the difference between decision making in the positive and negative domains and the heuristics involved as individuals evaluate probabilistic alternatives. In developing prospect theory, Kahneman and Traversky (1979) show how individuals would depart from rationality when making choices by being risk-averse (satisfied with safer choices) when offered alternatives of different *gains* (the positive domain), as well as being risk-seeking when offered alternatives that are of different *losses* (the negative domain). This means that people's choices are inconsistent with calculable optimal choices (expected utility) and they make choices according to common heuristics and cognitive simplifications that can be generalized. The theory is found useful in explaining choices in travel that involve choice between risky or uncertain alternatives, or choice under time pressure (Rasouli and Timmermans, 2004).

2.5.3 Habit Formation Theory

The theory of habit formation explains behavior carried out to achieve certain goals that occurs automatically without deliberation. In earliest treatments of the concept, James (1890) suggests means to induce habitual change, warning about the loss of 'plasticity' of the mind at older ages and the importance of inducing useful habits at earlier ages. James (1890) also notes how indispensable habitual behavior is for a pleasant life as compared to excessive deliberation or 'indecision' when pursuing any goal. Habit formation and change is of interest to travel behavior research since many travel patterns are regularly repeated (become habitual) such as route and mode choices for regular trips for work and education. In later research specifically related to transport, it has been observed that decision makers develop mental 'scripts' in the first trials to meet certain goals, and as the goal is pursued repeatedly in the future, the scripts are retrieved from memory, reducing the intentional component (deliberation) of the behavior (Gärling et al., 2001). Verplanken and Aarts (1997) show how 'strong-habit' individuals exhibit less interest in seeking and evaluating information about travel choices. However, Bamberg et al. (2003), in observing college students, show how habit, measured by past behavior, might be influential in travel mode choice only in cases where circumstances remain stable, but otherwise this travel choice is often deliberated. Such findings highlight the importance of differentiating between situations where habitual behavior is likely and others where no or little influence is expected. Such research is important to support the design of effective Travel Demand Management (TDM) measures that target habits. Gärling and Axhausen (2003) for example discuss how to measure and model habitual travel behavior for the purpose of improving strategies to break car-use habits, and Murtagh et al. (2012) explores how exploring habit strength helped explain children's active school travel.

2.5.4 Theory of Planned Behavior (TPB)

The theory of Planned Behavior (TPB) is among the widely used theories to model, explain, and predict *deliberated* travel behavior. TPB suggests that intentions to perform behavior are a function of three determinants: attitudes towards a behavior (positive or negative), subjective norms (opinions of significant referents such as family and friends), and perceived behavioral control (Ajzen, 1991). The

latter component, behavioral control is an addition to the former theory of reasoned action. In later developments of the theory, *actual* behavioral control has been added to determine whether the behavior is actually carried out after forming the intention (Ajzen and Fishbein, 2005). Background factors influencing these determinants are individual factors (personality, mood, experience, etc), social factors (education, age, religion, etc), and information factors such as information obtained through media (Ajzen and Fishbein, 2005). Jakobsson (2007), in her investigation on motives for car use refers to TPB as one of the most influential theories that considers both internal and external factors of behavior. Extended forms of TPB have been frequently used in research to include other constructs, mostly habit strength, to improve explanatory power (see e.g. Hashim et al. 2014, Nordfjærn et al., 2014, Brujin, 2011, 2010, Donald et al., 2014, Murtagh et al. 2012). The settings in which habit should be incorporated is very important however. Bamberg et al. (2003) demonstrated how in the introduction of a new intervention (introduction of a prepaid bus ticket for students), modal choice was mainly a reasoned action where habit failed to mediate effects of past behavior on later behavior.

2.5.5 Norm Activation Model (NAM)

The Norm Activation Model (NAM) is used to explain pro-social altruistic behavior such as donating or volunteering for causes, suggesting that personal norms are the determinants of such behavior (Schwartz 1977, as cited in Bamberg and Schmidt 2003). Steg and de Groot (2010) review the use of the NAM among scholars and test the causal relationships and definitions of the determinants of personal norms to confirm the most plausible conceptualization of the model. Accordingly, in NAM, four variables influence pro-social intentions: *Problem Awareness* (PA), *Ascription of Responsibility* (AR), and *Outcome Efficacy* (OE) (conceptualized as perceived control over the problem), generally operating sequentially. Accordingly, behavior activation starts with problem awareness, followed by ascription of responsibility or outcome efficacy (perceived control), and thereby influencing personal norms to activate the prosocial behavior intention. Problem awareness may in rare occasions *directly* influence personal norms (without mediation of AR and OE) mainly in cases where problem awareness brings to attention issues that significantly threat core human values such child labor for example (Steg and de Groot, 2010). Outcome efficacy and its definition as perceived control over outcomes is highlighted in Steg and de Groot (2010) for its importance in case of large-scale environmental problems when collective action is needed, where the individuals' perception of control is in that case dependent on their expectation of other individuals to also engage in the same pro-social action. Reducing the scale of social problems and prerequisite collective action is therefore among the effective strategies to motivate pro-social behavior. The theory can therefore explain pro-environmental behavior (in the altruistic sense) and has been used in explaining travel behavior from the environmental perspective, such as choice of sustainable modes of transport, or means to design strategies and soft policy measures to promote such voluntary behavior (e.g. Bamberg et al. 2011).

2.5.6 Theory of Interpersonal Behavior (TIB)

TIB is similar in many ways to TPB in its consideration of behavior under conscious control (intention) as a determinant of behavior, but it further proposes two other determinants: facilitating conditions, and habit, whereas habit overshadows intentional behavior as certain behavior becomes more habitual rather than intentional as it is repeated frequently (Triandis 1977, as cited in Bamberg and Schmidt, 2003). Although TPB received more attention from scholars to predict behavior, TIB may be applied to explain travel behavior and enhance the predictive power of Ajzen's TPB as demonstrated in the study by Bamberg and Schmidt (2003) for example, predicting car use among university students in Germany.

The study found that the variable of role-beliefs assessed in TIB improved prediction of intention, while the variable of car-use habit improved predictive prediction of behavior when used to compliment TPB model, demonstrating the applicability of both models in analysis. Inclusion of complimentary behavioral constructs in such models have however been labeled as forms of *augmented* or *extended* TPB models (e.g. Nordfjærn et al., 2014; Brujin, 2011, 2010; Donald et al., 2014) rendering the TIB model arguably redundant.

2.5.7 Cognitive Dissonance Theory (CDT) and the Self-Concept Model

Cognitive Dissonance Theory (CDT) posits that individuals having two dissonant cognitions (e.g. conflicting beliefs or perceptions) experience psychological discomfort and will in turn aim to relieve themselves by achieving *consonance* by changing the cognitions they can control such as changing attitude toward a behavior or perceived knowledge about it (Festinger 1957). This can explain many of the biases observed in choice and opinion making. In a retrospective review by Aronson (1997) on the use of Festinger's theory four decades later, Aronson proposes an understanding of CDT from the perspective of her proposed *self-concept model.*

The perspective of the self-concept model suggests that CDT is better described as an overarching theory to many subsequent theories of cognition and motivation. The self-concept model proposes that individuals aim to specifically preserve three aspects of one's self as a reference for consonance: firstly, to preserve consistent, stable, predictable sense of self, secondly, to preserve a competent sense of self, and thirdly, to preserve a morally good sense of self (Aronson 1968 and Aronson et al. 1974 as cited in Aronson 1997). The model clarifies that the dissonance that one strives to reduce is specifically between such cognition of one's self (sense of one's consistency, competence and morality) on one hand, and cognition about behavior that violates this self-concept on the other, or in simpler words, cases when one would feel "astonished", "stupid" or "guilty" (Aronson 1997, p.131:4). As an example, Van Vugt et al. (1996) demonstrated how solo drivers reacted when a priority carpool lane was implemented along their route; solo drivers exhibited altered preferences compared to prior implementation, such as downplaying the importance of cost-savings of carpooling and overvaluing flexibility of solo driving. They exhibited this change in opinion or attitude as if to justify their interest in continuing the habit that is dissonant to their own previous more competent rationale. Although CDT has not been used frequently in travel behavior, the theory has been helpful to refer to in the formulation of hypothesis and discussion and explanation of results of research (e.g. Schwanen and Mokhtarian, 2005).

2.5.8 Stages of Change Model (SCM)

The Stages of Change Model (SCM) or Transtheoretical Model (TTM) proposes that behavior is changed and becomes habitual through consecutive stages (Prochaska and DiClemente, 1986). The stages are: *pre-contemplation* (before problem awareness), *contemplation* (weighing costs and benefits of different behavioral changes), *preparation* (forming action plans), *action*, *maintenance* (avoiding relapse), and *termination* of the change process. The theory has been applied to travel behavior research to study stages of behavior change toward favored practices, such as willingness to cycle or willingness to use public transportation (e.g. Forward, 2014; Bamberg, 2007). The studies however face difficulty addressing the multitude and complexity of constructs that are difficult measure in limitedly sized questionnaires, where one complex construct might be measured by one or two general and possibly ambiguous questions.

Another theory also explaining the process of behavioral change is the Goal Setting Theory (GST) (Latham and Locke, 1991), which has been noted to be applicable in car-use reduction strategies as an example of application in transport research (Adjei and Behrens, 2012). GST suggests that individuals vary in their task performance based on the formulation of the goals that they set for themselves, where specific and clear moderately challenging goals lead to better task performance than goals that are too easy (or too hard and overwhelming) and vague.

2.5.9 Applications in qualitative research

Social and behavioral sciences, as well as other related disciplines of humanities, have lent transport research many instrumental theories and insights. In the applications to better understand travel behavior, it is notable that a qualitative approach is sometimes more suitable for the research question at hand, while researchers might be misled to viewing quantitative approaches as always better and more objective, which is a common misconception (Clifton and Handy, 2003). An informative example is presented by Guell et al. (2012), where they demonstrate the use of social theory to explore every day commuting in Cambridge, UK, through extensive interviews, showing how valuable insight related to context-specific reasoning, ambitions, and identities was produced. Guell et al. (2012) highlight the limitations of the more quantitative and static models and frameworks that are not suitable in many contexts of research, and note that travel behavior in developing countries in specific is not receiving the necessary attention from qualitative researchers.

Clifton and Handy (2003) elaborately advocate qualitative methods in travel behaviour research especially when research is targeting contexts that are not familiar to the researcher or might lack background literature. In such cases, quantitative research would be confining and may fail to provide necessary insights for proper understanding of the subject. Regarding quantitative analysis of qualitative data, to facilitate objective analysis of data, thematic analysis is one of the most common methods. This has been used in TPB-based research, and is common in fields other than in transport research, addressing topics such as obesity, breast cancer diagnosis, depression, contraception, physical activity, etc (e.g. Kahlor and Mackert, 2011; Robertson et al., 2014; Pilar, 2014).

2.5.10 Association with the study of mobility in disadvantaged communities

In conclusion, what has been reviewed thus far indicates that there is an abundance of behavioral theory that can be (and has been) applied to transport research for various purposes and contexts. What this offers to transport research is what can be seen as a 'toolbox' for travel-behavior research that facilitates the diagnosis and understanding the gap between what is expected of rational behavior and what is observed in reality. Such a gap may have a different nature when looking at different cultures and subcultures (or whatever social-behavioral segmentation there may be). In subcultures or contexts where such social-behavioral influences are *amplified*, more attention is needed to the 'human' factor in understanding observed phenomena of interest. In informal settlements, and in the context of informality and contexts of poverty in general, the human factor can indeed be seen as amplified since such context of informality and poverty is characterized by high socio-cultural embeddedness (Gutberlet et al., 2016; Rankin, 2004).

The theories reviewed therefore expand the vocabulary and conceptual tools available for a much needed exploration of the social and behavioral specifics of phenomenology of informal settlements. Utility maximization may facilitate understanding the baseline from which discrepancies in behavior

(departure from rationality) can be identified. Thereafter, of the various theories investigated, TPB is the more common tool in research being highly instrumental in investigating deliberate behavior while further allowing extended variants of the TPB model so as to control for factors such as habit. As such, it is notable that the theories are not mutually exclusive but rather offer means to facilitate discussion and analysis even if not being central to the theoretical framework chosen for the research questions at hand.

Behavioral change theory such as SCM and NAM may facilitate identifying the stage at which a certain behavior of interest is situated within a presumed process of change, and may also facilitate the translation of diagnosis into a plan for intervention. NAM would specifically serve in the cases were certain elements of behavior may be framed as pro-social or moral, such as association with good parenting. Prospect theory, and its underlying concepts, may serve in discussing the differences in choice-making under uncertainty and with different framing while acknowledging various decision heuristics. Furthermore, as with other insights from behavioral economics, such theories may also be instrumental in developing interventions that leverage the knowledge about people's common heuristics. Uncertainty is a distinct characteristic of everyday life in informal settlements where formal transport services are scarce (Thieme et al. 2017).

Cognitive dissonance, is widely used to discuss observed discrepancies or perceived 'illogic' of people's behavior and inconsistencies in the perceptions, opinion, and actions. This may serve to discuss discrepancies between different subconstructs of behavior that are articulated in other behavioral theory such as TIB or TPB, such as observed conflict between a perceived subjective norms and attitude and normative beliefs, which is implicit in the example of the inconsistent car drivers in Van Vugt et al. (1996) (see section 2.5.7). These interrelated tools available can therefore cater to a more holistic analysis of travel behavior that is necessary in the unique context of informal settlements, and also facilitate the discussion of practical implications for policy makers, planners, or other agents of intervention (e.g. schools, NGOs, etc).

2.6 CHILDREN'S TRAVEL BEHAVIOR

The mainstream discourse addressing children's travel behavior has mostly revolved around concerns over the increasingly sedentary lifestyles that characterize modern day lives of children in many cities (Shaw et al. 2015). Decline in children's independent and active mobility has become a recurring trend in the past years observed in many countries, and a source of concern over both the reduced physical activity enjoyed by children and their engagement in sustainable lifestyles (Verhoeven et al., 2016; Chillon et al., 2011). Earliest treatment of the issue observed the erosion of children's rights to a safe outdoor environment as rapid urbanization develops with little consideration of catering to children (Ward 1978, Hillman et al. 1990). The dominant discourse in public policies today continue to result in children being treated as 'second class citizens' (Shaw et al. 2015, p.2).

Research conducted to better understand children's mobility and travel behavior is important for two reasons: (1) Catering to children's need (and right) for safe, inclusive, and sustainable cities and human settlements, including sustainable transport systems, is an imperative for the global agenda for

sustainable development[2], and (2) Travel behavior, including travel socialization and habit development, are specifically important to study among young children to enable 'nudging' sustainable behavior, especially since formation of habit is more influential at earlier ages, and therefore, behavioral interventions may be more effective in this demographic (Baslington, 2008; Buliung et al., 2012; Broberg and Sarjala, 2015). In this respect, the independence of children in their mobility and ability to commute actively (walking and cycling), are features of travel behavior that is specifically praised and advocated by urban planners and transport geographers. Measures to cater to children's active and independent mobilities are also likely to benefit the elderly as well (Buliung et al., 2012). They are features of successful planning of cities, as once elucidated in a popular quote by the renowned former mayor of Bogotá, Enrique Peñalosa, "*...the great city is not the one that has highways, but one where a child on a tricycle or bicycle can go safely everywhere*." (Roth, 2009, July 9).

Children's mobility has accordingly been subject to much research in the recent years, but much of the research has notably been focusing on developed countries (see e.g. Kyttä et al., 2015; Mitra and Buliung, 2015; Curtis et al., 2015; Westman et al., 2013; Fyhri et al. 2011; Fyhri and Hjorthol, 2009; Christie et al., 2011). A key area of concern in developed countries that has driven this research, has been related to the observed decline in children's physical activity in daily life. Specifically, a common trend in many developed countries is a decline in active travel (cycling and walking), such as reduced Active Travel to School (ATS) among children, along with prevalence of sedentary lifestyles and obesity (Fyhri et al., 2011; Buliung et al., 2012). Another closely linked trend is the decline in Children Independent Mobility (CIM), where much of the CIM (travel without the accompaniment of an adult) is conducted through walking or cycling.

2.6.1 Independent Mobility Metrics

Although there is no universal metric for Child Independent Mobility (CIM) to date (Bhosale, 2017), the term has in its simplest form been understood as children's travel without the accompaniment or supervision of an adult or a care-giver (see e.g. Kyttä et al., 2015; Mitra, 2013; Freeman and Quig, 2009).

In an attempt to use a more informative metric, Fyhri and Hjortol (2009) suggested a *mobility index* to better describe the degree of independence in CIM. In their large-sample survey on children in Norway, Fyhri and Hjortol (2009) investigated children's mobility in terms of main modes used to school, sport activities, and friends. Based on these three trip purposes, an additive mobility index was developed; walking and cycling were given three points each, public transport was given two points, and car was given one point, so as to have a maximum possible points of 9 for the three trip purposes multiplied by the respective mode score.

Shaw et al. (2015) propose a more expanded understanding of CIM, where so called children's 'mobilities' can be measured and compared based on several factors reported by children and respective parents aiming to assess 'mobility permits' that are granted to children; going out after dark, going back home alone from school, crossing main roads, etc. Nine core yes-or-no questions were asked, of which three were directed to children and six to their parents to measure the licenses of independent

[2] In the list of UN Sustainable Development Goals (SDG), the second target of the 11th SDG regarding sustainable cities and communities specifically addresses sustainable transport with particular emphasis on children among the vulnerable groups (UN Resolution 70/1).

mobility and compare them across 16 countries (insights from the study are discussed in section 2.6.2). Shaw et al. (2015) note however the limitations of the methodology in terms of considering specificities of local contexts, but argue that considering the scarcity of information available on this topic, such studies may serve as a baseline for further in-depth exploration of independence in children's mobility, from global trends to local specifics.

Nansen et al. (2015) offers a different perspective by questioning the notion of *independence* per se, arguing that children's mobility is rather multidimensional and would be better defined by *interdependencies* rather than through a mere dichotomy of dependence-independence. In his research on school children in the city of Moreland in Australia, Nansen et al. (2015) identified three themes of interdependencies that may prove instrumental to the topic, especially in qualitative research or in interpreting quantitative results. The three themes were articulated as *compositions, collaborations, and compromises,* which offer a broader framework to explain how children's mobility is negotiated, mediated and experienced, summarized as follows:

- *Compositions* refers to various companions and resources that are involved in a child's mobility. Companionship here is inclusive of family, friends, phones (remote companionship) and strangers (ambient companionship), all describing various configurations by which mobility is constructed and how a travel journey is sequenced.
- *Collaborations* refers to cooperation and assistance from people, objects and environment, i.e. through interaction with parents, other children, mobile devices, and strangers.
- *Compromises* refers to how children's mobility is negotiated rather than being granted or dictated by an authority, and how children can accordingly pursue their mobility needs based on available resources, opportunities, and constraints. Accordingly children are not seen as passive subjects, but rather have an active role in developing the evolving and progressing nature of their mobility.

Features of interdependencies have indeed been noted in the analysis and discussion of studies of CIM, where parents play a major role, but also other context-related interdependencies such as cultural factors, elements of the urban setting and mobility resources, etc (e.g. Kyttä et al., 2015; Mitra, 2013; Fyhri and Hjorthol, 2009).

The thematic categorization of children's mobility as suggested by Nansen (2015) may facilitate the discussion and analysis of research on children's mobility, but has not been operationalized through development of respective metrics to facilitate quantitative research approaches. The study of interdependencies and children's agency has rather been addressed through qualitative research that may be better suited to appreciate the complexity and context-specificity of the topic of mobility of youngsters, which is substantially under-studied as pointed out in Skelton and Gough (2013).

2.6.2 Decline in Children's Independent and Active Mobility

In a study by Kyttä et al. (2015), the degree of CIM in Finland over two decades (1990-2011) has been found to be in a decreasing trend, in what was described as a loss of last 'free-range' children in Finland. The case of Finland in specific is distinctly informative of the reality of decline in children's mobility since Finland is even among the top ranking countries globally in terms of catering to children's independent mobility (Shaw et al., 2015). In earlier studies, Fyhri et al. (2011) compared trends in different countries, specifically Denmark, Finland, Great Britain, and Norway, confirming the common observation of

increase in car use and a decrease in walking and cycling that is not limited to Finland only. In analysis of the phenomenon, Fyhri et al. (2011) notes several observations: Distance to school has increased, either due to bigger units and increased private schooling, and traffic motivates parents to drive children to school by car, while convenience for parents also plays a role, furthermore, the availability of organized leisure activity has partly contributed to the reduction in the role of the 'coincidental exercise' of active commuting as means for physical activity. Facilitating factors for car-use also play a role such as increased ownership of mobile phones among children over the years, which facilitate the logistics of accessing parents as drivers (Fyhri et al., 2011). For such reasons, children might often not have freedom to choose their preferred mode and have limited ability to enjoy an active and independent outdoor life in their urban setting.

In a report on a major international study covering 16 countries, Shaw et al. (2015) map out the trends of CIM and investigate parental influence based on a survey of over 18,000 children and a subset of their parents[3]. The study was conducted between 2010 and 2013 along with compiled historical data. The countries were notably mostly from the developed world: Australia, Denmark, England, Finland, France, Germany, Ireland, Israel, Italy, Japan, Norway, Portugal, Sweden, Brazil, South Africa, and Sri Lanka. Comparisons between and within countries enabled understanding of the role of cultural factors as well. Factors studied consisted of several 'mobility rights' granted to children; to cross roads alone, travel to places within walking distance other than school, travel alone after dark, and to cycle or use local buses independently. Parents' attitudes and fears were also investigated, including relevant factors such as ownership of mobile phones and car ownership, socio-demographics, and other influential factors. Findings of this wide-scoped study reported in Shaw et al. (2015) have led to an insightful and updated understanding of CIM drawn from the target countries (predominantly of the developed world), which can be summarized as follows:

- Even at a later age in childhood (up to 15 in the study) there is low level of independent mobility and other related outdoor activity restrictions despite being close to an age when other rights of adulthood would soon be granted.
- Fear of traffic is generally the strongest factor influencing parents' concern.
- Six countries are identified as 'top performers' in terms of prevalence of CIM, with Finland in the leading position, and followed by Germany, Norway, Sweden, Japan and Denmark. Finland was ranked as a top performer in almost every independent mobility indicator, the only exception being self-reported freedom to travel on local buses alone, where Finland ranked second after Germany. Children in Finland, seen as a good example, are granted the following levels of freedoms throughout childhood:
    - Age 7: A majority of children can travel to places within walking distance alone, whether walking or cycling.
    - Age 8: A majority can independently cross main roads, travel back from home alone, and go out alone after dark.
    - Age 9: A majority can cycle alone on main roads.
    - Age 10: A majority can travel alone on local buses.
- Going alone after dark is the most withheld independent mobility.

[3] This study was implemented by the UK-based Policy Studies Institute (PSI), a not-for-profit institute dedicated to informing public policy related to sustainable development. It is based in the Faculty of Architecture and the Built Environment at the University of Westminster, London.

Conclusions of the research also advocate the discourse of "removing danger from the road environment, not the removal of children from danger" (Shaw et al. 2015, p.68:2). In all countries there is a drop in overall independent mobility of children.

2.6.3 Context of disadvantaged areas and developing countries

The mainstream discourse of research on CIM and active travel has predominantly revolved around the framing of these features as a praised virtue of human settlements, often seen to be associated with the 'child-friendly' image of an urban environment (e.g. Shaw et al. 2015; Mackett, 2013; Buliung et al., 2012; Hillman et al. 1990). The common themes praised from this predominantly-developed-countries perspective can be summarized as follows:

(a) CIM is seen as healthy exposure for children to develop life skills and maturity,

(b) It is strongly associated with active travel (walking and cycling), thus offering physical activity for children who are increasingly leading more sedentary lifestyles,

(c) It is indicative of safety and friendliness of the urban environment.

However, it is notable that since most research on CIM is in the context of developed countries, the main discourse often lacks reference to active and independent mobility under *captive* conditions (see e.g. Kyttä et al. 2015; Mitra and Buliung, 2015; Curtis et al., 2015; Westman et al., 2013), i.e. where a child has no other choice but to travel independently or actively. This can be the case for example for children accessing schools in disadvantaged communities, who may often be captive active travelers, with parents not affording school busses or other motorized modes (Stewart et al., 2012). Yet whether or not they should be labeled as captive can be subject to much discussion since many children in developing countries, especially in poorer areas, greatly depend on using formal and informal transport services and walking in which available resources and urban and social contexts are different (Salon and Gulyani, 2010; Porter et al. 2011). Accordingly, having such options as being allowed and normalized in their society can conversely be viewed as a feature of independence not afforded (socially) by children in certain affluent societies.

2.6.3.1 The case of Cycling

Children's mobility in many cases may be largely influenced by factors that are not necessarily related to economic rationality, such as factors of culture and values (Stewart et al., 2012). Many factors influencing travel behavior are highly subjective and depend on individual perceptions such as fear of traffic and crime, or varying attitudes towards different transport modes embedded since childhood during the earlier socialization process of transport options (Baslington, 2008; Westman et al., 2013; Flamm and Kaufmann, 2006). These influences are noted in studies that investigate travel behavior in the various unique cultural settings of disadvantaged areas. In the case of cycling in specific, it is found to be a uniquely controversial mode of transport where socio-cultural factors play a significant role in influencing its uptake as a mode of transport in different communities, age groups, and social classes, and it may therefore serve as a suitable proxy to learn more about the way by which socio-cultural factors may have varying influence on travel behavior in different socio-cultural contexts (e.g. Amoaki-Sakyi and Owusu, 2011; Porter et al., 2011, Porter, 2012; Puttrowait, 2014).

In the study by Christie et al. (2011) of more than 4,000 children in various disadvantaged areas in England, it was found that although 30% of children have a strong preference to travel to school by bicycle, only 2% of the children actually did cycle to school as most parents perceived cycling as too hazardous, noting that propensity to cycle is less than in the rest of the country. Implicit cultural influences have been suspected since a variation in propensity to cycle has been observed between various ethnicities (ethnicities studied included Indian, Pakistani, and Bangladeshi young people, among others). In other countries, similar observations of low rates of cycling have been associated with cultural aspects as well. Amoaki-Sakyi and Owusu (2011) noted that cycling is underused in most developing countries except in Asia, while in Ghanian communities the prevalence of gender disempowerment seemed to be among the inhibiting factors influencing cycling among females, and further notes examples of existing gender biases among some survey respondents, such as those who believe cycling would harm reproductive health (girls would not be able to give birth), and those who see that boys should be more outgoing while girls should be conditioned to be home-makers. It is notable in this respect that parents' differential socialization between genders is highly influential on children's behavior and perception (Bussey and Bandura, 1999; Lytton and Romney 1991).

Observations of strongly gendered views on children's bicycle use in cases of developing countries were also confirmed in Porter et al. (2011) in a study in Ghana, while other socio-cultural factors may be rather related to issues of stigmatization of cycling as a mode of transport (seen as not proper for girls or too childish for adults or not socially prestigious for the status-conscious), such as indicated by Puttrowait (2014) through interview surveys conducted in Cairo in 2013, a city that is predominantly consisting of informal areas. The aspect of gender differences has not however been solely attributed to socio-cultural distinction and not only a notable feature in developing countries and disadvantaged areas. Studies that have looked into the gender aspects even in developed countries have noted that more boys practice active travel than girls for various reasons (Christie et al., 2011; McMillan et al., 2006; McDonald, 2012; Cooper et al., 2003). The difference is more notable in cycling than in walking, and it has often been associated with observed higher independent mobility of boys in general (Cooper et al., 2003, Christie et al., 2011, Johansson 2006) and simply a variation in individual preference or interest (McMillan et al., 2006).

Another distinct feature of disadvantaged areas is that they are often inhabited by residents that are already subject to multiple features of disadvantage since they often cluster in the same area where the quality of the urban environment is poor and the community is more likely to have lower income, educational attainment, employability, and health condition (Owen, 1994). This highlights the complexity of analyzing any observed distinct behavior in disadvantaged communities when many correlations may confound the analysis of case studies.

Westman et al. (2013), note that from the perspective of children themselves and their own attitudes towards cycling, it is often positive, or as eloquently described by Tranter and Sharpe (2012) seen as a form of 'playful mobility' that requires little more than removing obstacles and restrictions to enable.

2.6.4 Travel to school

Trips to school are often the most common trip for children and may therefore provide substantial insight about their travel behavior. Children use the various modes available for public and private urban transport, including modes that are specific to trips to school; the common school bus and the less known Walking School Bus (WSB). The WSB involves children walking together in an organized bus-like

formation, escorted by two adults. Otherwise, children are also chauffeured to school, or use various modes of public transport either accompanied or independently, as well as cycle, or walk. Despite the wide variation of modes used to commute to school, it is notable however that the discourse of this topic has mainly been addressing Active School Travel (AST) in specific for the sake of physical activity, and less about use of an alternative transport service for other practical reasons (e.g. Lang et al., 2011; Kopnina, 2011; Curtis et al., 2015; Morency et al., 2011; Macket, 2013; Broberg and Sarjala, 2015).

The factor of distance is recurrently identified in the literature as the most important barrier to active school travel (Mitra and Buliung, 2015; Fyhri and Hjortol, 2009; Curtis et al., 2015; Kelly and Fu, 2015). In a survey of students' mobility in St. Paul city in USA, Wilson et al. (2007) found that students walking to schools within their neighborhood were 6 times the number walking to the more distant city-wide schools. This exemplifies the importance of smaller closer schools, as well as the relevance to disadvantaged communities that might not have access to nearby schools and would therefore need to exit their settlement to access schooling (Stewart et al., 2012; UNICEF 2013). Children would therefore have to interact with poorly planned streets and transport systems.

Even in developed countries, Fyrhi et al. (2011) notes that part of the global decline in children's independent mobility is associated with the observed increasing distance to school. However, in the case of developed countries, the increased distance to school is not due to scarcity of schools (as with disadvantaged areas) but rather due to increase in school sizes and increasing demand for private schooling (Fyhri et al., 2011). Fixation on the distance aspect however may in many cases be unproductive if it is an issue that cannot easily be altered. Furthermore, low or declining rates of active travel are found even within the range of walking distance from schools (Shaw et al., 2015; Darwish et al., 2016). To understand such a decline, much research addresses affective factors of active travel along with the commonly investigated aspects of the built environment (e.g. Zuniga, 2012; Murtagh et al., 2012; Kopnina, 2011; Robinson 2005). In one example, Henne et al. (2014) demonstrates the positive association of parents' active travel with children's active travel, hinting at parental influence on children.

Affective factors among parents play a substantial role in children's mobility. In a study of school children in Denver Colorado, Zuniga (2012) argues that mode choices of parents for their children can be changed by addressing perceptions about neighborhood and traffic safety, thereby influencing mode choice without any change in the physical conditions. Kopnina (2011) investigates children's attitudes towards cars and environmental attitudes in general demonstrating how the socio-cultural context greatly influences children's representations of car use and recommends developing a curriculum to address children's awareness of sustainable transportation. In a review of literature about AST, Stewart et al. (2012) identified 8 common factors that influence the choice of walking or cycling to school that represent the common themes across the literature: Distance to school, parental fear of traffic and crime, family schedule constraints, values, school characteristics, family and community resources, culture, and weather. Although distance is paramount an many cases, other socio-cultural and behavioral factors are highly influential.

It is important however to be context-specific and cautious about generalizations from various studies. It is notable for example that the aspect of distance and relevance of land use diversity and density can in some cases have counterintuitive influence due to other confounding factors. Broberg and Sarjala (2015) for example explain how in the Finnish context, an increasing residential density and land-use mix was rather associated with a decrease in likelihood of children to travel actively to school, not an increase.

This was partly attributed to the better public transport availability in the denser areas and to a suspected *reduced* sense of safety (Broberg and Sarjala 2015). Density was however praised in other research noting that a sense of safety is arguably gained in the presence of 'natural surveillance' provided by people in the streets, rather than stressing the impact of distance reduction (Foster et al., 2015; Shehayeb, 2009).

Most research on the topic of trips to school aims to contribute with practical value for design (or evaluation) of Safe Routes to Schools (SRTS) interventions for safe commuting to school and promotion of active travel (Stewart et al., 2012).

2.6.5 Agents of Socialization and Parental Influence

Since parents naturally play a key role in the development of their children's personality, emotional development and behavioral habits, they are often taken as the subjects of research when investigating aspects of children's travel behavior (e.g. Ghekiere et al., 2016a; Pojani and Boussaw, 2014; Porter et al. 2011).

Baslington (2008) articulates the process as travel 'socialization', whereby children learn about mobilities the same way they learn about other aspects of culture, through agents of socialization such as the family, school, media, and peer groups. The influence of travel socialization on development of people's travel behavior has also been stressed in Flamm and Kaufmann (2006) as a key determinant of people's constructed representations about mode choices and various features and options of mobility that become embedded since childhood. Amoako-Sakyi and Owusu (2011), in a study of bicycle behavior of children in Ghana highlighted the role of teachers in influencing the socialization of cycling as a mode choice, noting the varying attitudes among different teachers that were not necessarily aligned positively; some teachers feared that children would play too much or cycle too far once they have bicycles or even start renting out their bicycles, and thus framing the bicycle as a distraction from school or a threat to discipline and order.

Other research has also demonstrated the influence of media in socialization; Tranter and Sharpe (2012) for example, highlight and discuss the role of specific Disney-Pixar movies, namely Monsters Inc and WALL-E, in potentially influencing children's behavior and children's values to motivate active travel. Other agents of socialization have been noted in various research, asserting the role of external factors that influence the socialization process of travel options (e.g. Fyhri and Hjortol, 2009; Nansen et al., 2015; McMillan, 2006; Zuniga, 2012). A relatively substantial influence however is specifically from parents in specific, where influence can be indirect, such as through influencing affective factors (e.g. Ghekiere et al., 2016b; Van Kann et al., 2016), or directly by granting various forms and levels of 'mobility permits' as extensively discussed in Shaw et al. (2015).

Parents have in turn been an important subject of research addressing children's travel behavior. Ermagun and Samimi (2015), in analysis of survey results targeting 4,900 middle-school and high-school students throughout Tehran demonstrated how addressing safety concerns among parents results in a 60% increase in probability of children walking to school (the authors however do not define what they mean by 'addressing' concerns). Pojani and Boussaw (2014) note how parents have been adapting over time to the perceived norms of modern urban environments, where children's mobility is commonly restricted and where escorting children or chauffeuring them to school is seen as a practice of 'good parenting' by many. A moral motive is therefore associated here with chauffeuring as a praised choice.

In a study about multimodality and so-called 'altermobility' trends (mobility without a private car) in Vancouver, McLaren (2016) notes that mobility restrictions that parents associate with perceived good parenting norms where also attributed to the observed increase in car-dependence in modern cities. McLaren (2016) however suggests that observations of examples of parents in downtown areas in Vancouver who decidedly chose to be altermobile, highlight that parenting and car-dependence can be decoupled even in this context of a modern city.

In another context, Ghekiere et al. (2016b) investigates psychosocial factors associated with children's cycling for transport in the context of Belgium, indicating the positive influence of support from friends, favorable perceived parental modeling and norms, in addition to internal factors, most prominently self-efficacy. In other research, Ghekiere (2016a) investigates the influence of the accompaniment of parents to children when walking and cycling in Melbourne, Australia, indicating how such co-participation in active travel has proven to be positively correlated with children's overall active travel tendencies. Positive correlation's of parents' active travel and children's ATS has also been found in other contexts in USA (Henne et al., 2014).

Van Kann et al. (2016), in a deeper investigation of interaction effects between factors, further notes a moderation effect of parents' active transportation in the Netherlands, noting that parents' active transportation tendencies positively influence the association between child's use of active transportation and the two factors of parental facilitation of child activity and the perception of safety from strangers. Similarly, Mitra et al. (2014) noted negative association of parental perceptions related to neighborhood safety, so-called 'stranger-danger', and sociability with children's independent mobility in a case study in Toronto, Canada; research here focused on perceptions rather than objective measures of safety. Carver et al. (2010) demonstrate that parents' perceived risk may result in less active children as indicated in their study of children and adolescents in Melbourne, Australia. Notably, although some variation in results reported by Carver et al. (2010) was evident between genders and age groups, a general relation was however concluded that perception of risk among parents is a worthy area of research that may provide insight on means to improve children's active and independent mobility regardless of gender.

2.6.6 Interventions for Active School Travel (AST)

Active Travel to School have been receiving much attention globally, most prominently in developed countries realizing its association with children's health and to counteract observed sedentary lifestyles and obesity (Noonan et al., 2017; Buliung et al., 2012; Fyhri et al., 2011; McDonald, 2007). The trip to school in specific, often being the most frequent trip for most children, is seen as an opportunity to contribute children's daily Moderate-to-Vigorous Physical Activity (MVPA) (Coombes and Jones, 2016). According to the British Heart Foundation, MVPA for children is recommended to be 60 minutes per day (Townsend et al., 2015). An enabling built environment facilitates active travel to school, whereas dense urban built environments are associated with prevalence of active travel (Curtis et al., 2015). However, many other factors beyond the physical environment may enable or inhibit active travel and can be influenced through various interventions as discussed herein.

Due to the growing numbers of attempted interventions to encourage active travel to school, numerous case studies of interventions have been made available for researchers to gain insights on successes and failures based on objective assessment of results from real world trials of what is labeled as Active School Travel (AST) interventions. AST Interventions however vary largely in scope, ranging from an

extra two-hour lesson integrated to a relevant course in school (e.g. Verhoeven et al., 2016), to a more elaborate plan involving paid project staff and extensive monitoring and evaluation (e.g. Coombes and Jones, 2016; Mammen et al., 2014) or even infrastructure interventions as discussed in Stewart et al. (2012). This makes it difficult to generalize whether interventions (or intervention types) are effective or not, especially given the diversity in contexts. Buliung et al. (2011) however notes that a common feature in many interventions is that they tend to leverage community resources in implementation, mobilizing parents, children, teachers, municipalities, police, public health professionals, and school administrators to collaborate in developing an enabling environment for ATS.

Objective assessment of impact of interventions on actual increase in AST or overall physical activity among children has been found to give mixed results even in elaborate interventions such as gamification of AST, where elements of gaming are integrated into promotional programs, such activities involving points-based competitions (Coombes and Jones, 2016; Hunter et al., 2015). Chillon et al. (2011) present a systematic review of various programs that have been reported in peer-reviewed studies, including programs of Safe Routes to School (SRTS), Walking School Bus (WSB), and Walk To School (WTS) programs. The review of Chillon et al. (2011) indicated a wide variation in the impact on increases in active transportation, ranging from 3% to 64% among 14 identified intervention studies. The three main elements involved in most programs that were carried out were *schools, parents*, and *communitie*s, while involvement of infrastructure was very rare.

Buliung et al. (2011) also note the prevalence of non-infrastructure interventions. The study discusses impact of a pilot School Travel Plan (STP) conducted in 12 Canadian provinces, which were classified using 4 categories; (1) education, (2) activities and events, (3) capital improvement (modification in the physical environment), and (4) enforcement. The review indicated that education was the most widely used type of intervention as well as in-class school travel planning workshops, but the extent of impact is questionable since statistical analysis of evaluation results showed low impact on increasing AST. Much of the continued driving to school was largely attributed to parents' perceptions of safety as well as parents' perception of convenience, such as the convenience found in trip chaining. The overshadowing roles of parents' perception of safety and convenience was also highlighted in the literature review of Pojani and Boussauw (2014). Pojani and Boussauw (2014) summarize the main factors found in the literature that support active school travel in western settings noting two key factors related to parental influence, being (a) the parents' schedules and (b) supportive parental attitudes, while other factors were related to the physical environment as well as gender and socio-economic background.

A distinct observation in prevailing literature on active travel to school is notably that it is predominantly in the context of developed countries that tend to have better urban infrastructure and traffic safety standards, such as in the cases of interventions studied in USA, Ireland, Canada, and Australia among multiple other countries where the topic of children's active mobility is receiving growing attention from planners (e.g. Kelly and Fu, 2014; Murtagh et al., 2016; Mammen et al., 2014; Henne et al., 2014; Curtis et al., 2015; Carver et al., 2010).

2.6.7 Association with the study of children's mobility in informal settlements

There is evidently a growing body of knowledge about children's mobility and travel behavior, of which much is valuable even in the context of informal settlements. Much of the recurring themes highlight the role of social and affective factors among children and parents in influencing travel behavior, which have been repeatedly recognized alongside the often-overarching factor of distance. The role of parents in specific is paramount in both the socialization of travel behavior as well as in their authoritative role of granting 'permits', both of which are susceptible to socio-cultural and behavioral influences that may in turn facilitate or inhibit children's mobility.

Furthermore, a recurring theme that is informative for investigations in informal settlements is the articulation of 'resource' mobilization in various contexts to enable mobility as a core feature of children's mobility. This is implicit in the concepts of 'compositions and collaborations' in Nansen et al. (2015), in the factor of 'community resources' in Stewart et al. (2012), and also from the perspective of interventions, an *imposed* mobilization of community resources is used as highlighted in Buliung et al. (2011) as a common recognized feature in interventions enhancing children's mobility. Accordingly, community resources, or social and socio-cultural assets are an important feature to observe in such research, which in poor communities would imply possible compensation for material poverty, and may thus have a substantial role in this context. Similarly so, the prevalence of other affective factors among parents is a recurring theme that implies that the field of possibilities for enabling or inhibiting mobility extend beyond the constraints of the physical environment at varying degrees. Whether or not these channels of compensation are substantial in informal settlements is subject to further research.

The mainstream discourse associated with the study of children's mobility has most often been revolving around concerns over children's sedentary lifestyles, associated with motorization and car-dependence trends among other modern day cultural influences leading to declines in children's independent mobility. However, research that stems from poverty-related concerns on the other hand is scarce. Alternative discourses that pertain to the context of poverty and marginalization must therefore be additionally acknowledged in the discussion of children's mobility in informal settlements. Such acknowledgment would address various issues as to whether children have *less* options for mobility due to marginalization or alternatively viewed as having *more* options due to exposure and enabling norms that facilitate the use of more options for movement (or having a different *nature* of 'options' altogether). The treatment must also be context-specific as indicated in the wide diversity of findings about factors affecting children's mobility as noted in Stewart et al. (2012) and Broberg and Sarjala (2015) that vary with context. This warrants caution about normative statements about children's mobility and suggests treating each novel context without imposing preconceived generalizations.

2.7 CAIRO'S INFORMALITIES AND THE CASE OF HAGGANA

Most of Greater Cairo's inhabitants, more than two thirds, reside in informal settlements, making it highly representative of the city's reality (Sims and Séjourné, 2008). They however mostly differ than make-shift huts or shacks found in many other developing countries, and are rather mostly structurally sound multiple story buildings, yet built illegally in the absence of government planning processes (Sims 2010). Accordingly, they may often lack amenities and basic infrastructure at varying degrees, whether access to electricity, water, sewerage, town gas, road pavement etc, as well as other services that require government intervention such as schools, police stations, and hospitals. Bremer and Bhuiyan

(2014) note however that with growing numbers and negotiating power, along with community collaboration, the informal areas gradually find various ways of meeting their needs, such as through self-help initiatives in some cases and pressure on the government in others.

It is notable that Informal settlements in general have often been wrongfully portrayed by popular media in many countries as a breeding ground for criminals, whereas research shows that this image is rather no more than a myth (Nuissl and Heinrichs, 2013). This wrongful stigmatization is similarly prevalentamong mainstream Egyptian outsiders, not aware of the reality of the societies of informal settlements who have mostly squatted illegally only due to poverty and lack of alternatives (El-Mouelhi, 2014; Sims, 2010).

While much of such illegal squatting has been on agricultural land on the fringes, much expansion has also been in desert areas that surround the city as it grew over the years. Yet, in either case, what were only fringes a few decades ago have today become engulfed by the expanding metropolitan area and surrounded by formal development.

Among the policies practiced to address informal areas in Egypt is the so-called policy of 'containment', where various forms of physically containing the area are practiced (roads, walls, neighbouring real estate development, etc) along with upgrading efforts. Haggana is an example of an informal settlement on former desert land that has today come to be among the largest settlements in Egypt and is arguably continuing to expand (in density) despite practice of containment strategies by the government (El-Mouelhi, 2014).

Background literature about Haggana in specific is scarce despite the size of the settlement and its population. The available literature on the settlement is mostly either limited qualitative scholarly work (El-Mouelhi, 2014; Bremer and Bhuiyan, 2014; Wahby, 2013), or grey literature produced through studies involving local NGOs (e.g. Mansour and Khalil, 2008), or scarce information presented in work of international development organizations, mostly noted briefly within a wider scope covering informal settlements in Greater Cairo at large rather than the specific case of Haggana (e.g. Kipper and Fischer, 2009; Sims, 2010).

2.7.1 Advantages in Greater Cairo's informality

There are several general insights about informal settlements in Greater Cairo in the literature that are valid in the case of Haggana. Firstly, as with the rest of informal areas in Egypt's cities, the typical housing in Haggana is also mostly structurally sound multi-floor red-brick buildings with reinforced concrete foundations as in most informal settlements in Greater Cario as described in Sims (2010) and Shehayeb (2009). Nevertheless, within such settlements, there can be largely varying degrees of wealth, and in turn, some very poor pockets within the settlements can be found were indeed the most disadvantaged are living in poor-quality shacks and sometimes under various types of threats, whether due to proximity to high voltage cables or in proximity to geologically unstable locations such as by a an unstable cliff or abandoned quarry (El-Mouelhi, 2014; Piferro, 2009; Sims 2010).

Secondly, researchers investigating informal settlements in Cairo from various disciplines have consistently praised the many advantages that informal settlements enjoy as a product of community collaboration, entrepreneurial abilities and other social and cultural assets (e.g. Bremer and Bhuiyan,

2014; Wahby, 2013; El Mouelhi, 2014; Piferro, 2009; Shehayeb, 2009 and 2011). Such observations are often followed by policy advice to the government advocating the recognition of the self-help initiatives and highlighting the need for improved consultation and engagement of the local community in any formal intervention. This further implies contribution of such assets to the sense of safety characterizing such settlements, which is also praised as a virtue and an opportunity for planners to capitalize on (Shehayeb, 2011; El Mouelhi, 2014). In other literature, Foster et al. (2015) also observes a sense of safety characterizing certain low-income neighborhoods partly attributed to 'natural surveillance' and pedestrian friendliness.

Shehayeb (2009) specifically highlights the economic, social, and psychological needs of the residents that must be understood in order to better cater to (or to facilitate) the development process. This stands in contrast to the usual top-down approach of the government of providing modular interventions superimposed on existing informal settlements, or in relocation options provided in the formally constructed alternative settlements elsewhere. In the policy-focussed work of Shehayeb (2011), she provides suggestions to operationalize her advocated discourse, noting various ways to capitalize on the existing assets and virtues that characterize informal settlements while recognizing associated nuances as well, all in attempt to suggest optimal compromises. In this respect, Shehayeb (2011) notes how informal street vendors and informal markets cater to commuters and are conveniently nucleated at neighborhood entry points, how informal transport efficiently caters to commuters and develops inter-modal integration, how the slow flow of traffic and high pedestrianization of streets are associated with safety, mixed use, prevalence of independently moving children, and notes how communities seek alternative space for recreation for girls such as access to school playgrounds after school hours, among other observed virtues of the typical informal settlement. Bremer and Bhuiyan (2014) and Wahby (2013) also praise community collaboration in meeting needs through self-help initiatives, including the extension of water infrastructure.

It is notable however, that although many advantages to the highly demand-responsive self-help initiatives organically forming in informal settlements, there are nevertheless significant drawbacks to this model of urban development that are intrinsic to the process; mainly revolving around the roles that cannot be adequately fulfilled without the government intervention, such as garbage collection or such as enforcing quality and safety standards in construction, in public transport, etc (Shehayeb, 2009). In the case of Haggana in specific, it is notable that there is a lack of availability of local public schools (El-Mouelhi 2014), which is also an example of a domain where the intervention of the government is needed and were implications to children's mobility need to be studied.

2.7.2 Previous research on Haggana

Haggana is a large informal settlement that lies in an enclosed area in an east fringe of Cairo. Its representativeness of common issues of informal settlements has drawn attention from the research community as an interesting case study in the domains of culture, urban planning and public policy. In a PhD dissertation, El-Mouelhi (2014) investigated the cultural factors that shape the roles of residents of informal settlements in developing their urban space, dedicating a chapter in his dissertation to Haggana, specifically focusing on the older northern part of the settlement to delimit the research scope. In his research, El-Mouelhi identified key cultural factors that pertain to upper Egyptians (arguably constituting the majority of those who have migrated to the informal settlements) that shape the informal urban development; the key cultural factors are *origin, religion, relation to the urban economy* (e.g. profession and income), and *relation to urban society*. The research mapped out the

influence of culture and power relations on urban form in the settlement over the years on both the macro and micro scales. Aspects of mobility were only noted in a brief descriptive manner, noting the limited availability of formal public transport and the prevalence of informal modes as a norm. The collaborative culture in meeting daily needs was however highlighted in the context of ethnographic observation.

From a public policy perspective, Bremer and Bhuiyan (2014) studied an initiative in Haggana as a case study of community-led infrastructure development that is characteristic of informal settlements. In her study they demonstrated how local collaboration developed in a specific case of self-help water infrastructure development over the course of 40 years, noting the history of struggles faced in the process. They demonstrate how the process is aligned with the model of Dosh (2010) that suggests that self-built communities of such context often follow a typical 4-step process: *take* (e.g. occupy space or appropriate a resource), *make* (build and develop to cater to own needs), *march* (standing for one's acclaimed rights such as in demonstrations or lobbying in the media, etc), and *trade* (negotiate trade-offs and compromises); accordingly, the initiative in Haggana was aligned with the five-step process of *take-make-march-trade*.

Although the case study by Bremer and Bhuiyan (2014) was based on the history of self-help acquisition and development of water supply infrastructure, the process is relevant to other domains of developing needed infrastructure and services, including transport-related developments. In this respect, Bremer and Bhuiyan (2014) advocate integrating self-help initiatives in informal settlements with government-led intervention plans as well as fostering so-called *grassroots public-private partnerships* (G-PPP). The argument builds on previous work of Wahby (2013) that investigated the process of self-help initiatives in Haggana with regards to water installations as well as electricity and sewerage connections, indicating how the local self-help initiatives often succeed in compensating for non-functional formal systems and should in turn be recognized and appreciated by the government. The case studies demonstrate the role of community collaboration and the strong social fabric in compensating for the marginalization of the settlement in official development plans.

2.7.3 Uncertainty about basic information

Available information about the population and the area of Haggana is often followed by disclaimers of uncertainty (e.g. El Mouelhi, 2014; Bremer and Bhuiyan, 2014; Sabry, 2009). Haggana is amongst the largest informal settlements in Egypt, and has experienced fragmented phases of interventions to improve its basic infrastructure over the past years, which have been to a great extent carried out by the local community, mostly since the 1970s when the rapid growth started (Sims, 2010). Interventions are both external (e.g. governments, donors, etc), and internal through community self-help. They include provision of water supply, pavement of road segments, provision of public transport and improving access to main roads, among other interventions.

With regards to population estimates, they remain uncertain to date. Sabry (2009) uses the case of Haggana in specific as an elaborate example of the general scarcity of reliable data on informal settlements in Egypt. Sabry (2009) points out how the Central Agency for Public Mobilization and Statistics (CAPMAS) stated that the population was 39,433 in 2006, while in other sources the figures varied widely in ranges that suggest up to 1 million citizens. In 2007, a rough estimate based on analysis of satellite images and expert estimates of demographics conducted by GIZ suggested an estimate of 212,575 at that time, but the assumptions are notably highly uncertain (Sabry, 2009), and have not been

updated ever since. Furthermore, estimates in a study managed by a prominent local NGO in Haggana stated an expert estimate exceeding 1 million citizens in 2008 (Mansour and Khalil, 2008), yet without indicating the source of the estimation. Implications of this variance in estimates are of utmost importance for the estimation of budgets that need to be allocated to the settlement to cater to their basic needs of infrastructure and services. An accurate figure would also help position the settlement in the context of global discussion of informal settlements to confirm whether or not it is indeed the world's 14th largest informal settlement as stated in Davis (2006), positioning it high in the ranks of the paradigmatic cases of large settlements of modern day megacities.

Notably, the estimation of the spatial area of the settlement is also subject to discrepancies in the literature although it is easier to estimate it with satellite imagery. Bremer and Bhuiyan (2014) resorts to an expert estimate of Abdelbaky (2013, April 18) of 750 acres, which is the same figure stated in Mansour and Khalil (2008). The area based on satellite imagery however indicates an area of 625 acres (Google Earth Pro Version 7.1.2.2041), based on the boundaries stated by the General Organization of Physical Planning (GOPP 2007, as cited in El Mouelhi, 2014). If assuming an approximate conservative population size of 500,000 in consistency with Bremer and Bhuiyan (2014), and living in the 625 acres of land as per the delimitation of the GOPP, the resultant density implied would be 198,000 person/km^2. In global perspective, this is higher than overall density of the world's densest cities, and only comparable with the highest urban densities that have been recorded at the 'neighborhood-level' within cities in high-density pockets, such as an extreme case of Kamathipura district within Mumbai city in India, of a density of 121,300 person/km^2 as highlighted in UNHABITAT (2012).

2.7.4 Children's health and education in informal Cairo

Although information and statistics about children in the specific context of Haggana is scarce, insight can be extracted from relevant sources of information about similar informal settlements or other more general information about the city that is relevant to Haggana where more specific information is not available.

2.7.4.1 Obesity and physical activity

With respect to children's welfare, one of the common concerns in Egypt in general is the high incidence of over-weight and obese children as indicated in latest statistics by the Ministry of Health and Population of Egypt. It was found that 37% of girls and boys of ages 5-19 throughout Egypt were overweight or obese. Notably, the proportion of girls who are obese increases with age (beyond 19) while the opposite happens for boys, showing both the high rates of obesity and the acceleration in the trend for females in later stages of life (MOHP, 2015). This gender disparity is pronounced when observing the older demographics, where among the so-called 'ever-married' women of ages 15-49, almost half of the subpopulation (48%) were considered obese, and a further 37% were considered overweight, leaving out only 15% of this population segment to be either within a normal weight range or underweight (MOHP, 2015).

In a study by Fellinger (2015), the pronounced phenomenon of obesity in Cairo was investigated in relation to the 'obesogenic' environment of the city, arguing that physical inactivity and unhealthy diets are the main culprits, while features of the urban environment that do not facilitate recreational and physical activity (air pollution, traffic, loss of public space, etc) further contributes to the problem. Nevertheless, in her results, it was found that although residents surveyed in richer areas of the city spend less time walking than in less wealthy areas, they are found to enjoy lower Body Mass Index

(BMI), which are ratings used as a proxy for health and physical activity. This suggests that walking was not necessarily associated with adequate physical activity. Fellinger (2015) argues that the reason is that the richer areas tend to compensate for less walking by going to private sports facilities. In other research, Mowafi et al. (2011) demonstrated through a large survey in Cairo that people in neighborhoods with higher education levels were statistically significantly less likely to be obese. The study accordingly highlighted the positive association between the factor of education in specific and slimness. Mowafi et al. (2011) argue that reasons are likely to include the association of education with better knowledge about health and nutrition, accessibility to better food options, as well as different cultural perceptions of beauty (appealing to the respective men of similar education) which favor slimness in areas of better education rather than plumpness that is favored in lower education areas (mainly the informal settlements). In later research, Mowafi (2012) and Mowafi (2014) question whether BMI among Cairenes is also associated with access to neighborhood green areas and if it is associated with socio-economic status, showing that no statistically significant association was found in either case; accordingly, the correlation with education was further emphasized as the key correlation compared to other suspected factors.

While lack of sufficient physical activity among females has not necessarily been associated with lack of active travel, Shehayeb (2011) notes that sports facilities in informal settlements are dominated by young males (adolescent boys and young men), and therefore sports facilities are not practically available for women and neither are playgrounds for younger children, hinting at the comparative lack of space for females (and children) to practice sports. Other than the issue of availability of space, the association of the gender aspect and the low *acceptability* of publicly visible practice of sports for adult females has been noted in Fellinger (2015) as one of the suspected obstacles for healthy lifestyles for women, and mentioned in Puttrowait (2014) as one of the issues limiting female use of bicycles, especially in more conservative areas of the city.

2.7.4.2 Trips to school

In an early study of over 1,600 children surveyed in schools of Greater Cairo, Abbas et al. (1996) observed that even schools had lacked open space and thus children play in front of schools in the streets. Abbas et al. (1996) further noted that the incidence of independent mobility was high, where most of the surveyed children live far from school, they come and leave on their own, and the average age at which children come to and leave school at that time was seven years. In the study, only 9% of children were classified to be safe road-crossers, while the rest varied in exhibiting different levels of unsafe to dangerous behavior, highlighting the role of safe-crossing education and skill development. The study however only reported about the location of schools in two districts (richer and poorer respectively) and did not report on the origins of the children that traveled to the schools to indicate the percentages that are coming from informal settlements, and therefore, a comparison between children from formal and informal origins cannot be compared. However, the study provides insights about some aspects of children's mobility in the late 1990s.

In a more recent study, twenty years later, Darwish et al. (2016) investigated children's trips to four schools in multiple formal areas of Greater Cairo, and found that 22% of the 253 surveyed students lived within a 15-minute walking distance from their school, but nevertheless most of those (69%) still travelled by motorized modes, school buses and private cars, despite such proximity, whereas the rest (the more distant students) all travelled by motorized modes, and notably the entire sample lacked any single case of use of public transport altogether (N. Darwish, personal communication, June 19, 2016).

2.7.4.3 Streets as the only public space

In Haggana, streets represent all the public space available, lacking sidewalks, predominantly unpaved, and catering to all functions of public space for all segments of society (El-Mouelhi 2014). Such a characteristic is common to most informal settlements, and for that purpose UNHABITAT (2013) provides that the pavement and upgrade of streets in specific have been identified as an essential intervention for urban transformation and regeneration of informal settlements. Streets in impoverished areas promise better integration into the formal city and give space to multiple functions since they are often the only public space available. The various functions may include extensions of household space for certain activities, as well as celebrations, play, commercial activities, etc (El-Mouelhi, 2014; Shehayeb, 2009).

Impacts of upgraded streets however are not only positive impacts, but also adverse impacts may ensue, such as increases in through-traffic and traffic speed and noise. It has been established that building more roads often invites more motorized traffic; *induced* traffic (SACTRA, 1994, as reviewed in section 2.4.1). Nevertheless, the approach of upgrading existing unpaved streets remains seen as a fundamental tool for an overall positive urban transformation in informal settlements as many case studies globally have confirmed (UNHABITAT, 2013). These acknowledgements highlight the importance of the informal settlement's street, where all public space functions of the urban life are found. Shehayeb (2011) maintains the importance of providing paved sidewalks along main streets, but boldly advises to pave the entire width of other streets, from building line to building line, in the rest of the network, and additionally advises to use material other than asphalt in streets where car access needs to be restricted (as a traffic calming measure) so as to prioritize pedestrians and enable other uses in pursuit of a more equitable distribution of public space and as a practical solution suited to the local context.

2.8 DISCUSSION

Throughout the literature review, global trends in understanding travel behavior has been presented, noting the growing interdisciplinary nature of this line of study, requiring insights from various disciplines including sociology, psychology and behavioral sciences. The evolution in understanding led to a recognition of a 'new mobilities' paradigm or a shift in perspective described in social sciences as a 'mobility turn' as viewed by John Urry and others, or requiring new tools and conceptualizations as advanced by Vincent Kaufmann in his work on Motility. Although much of the discourse related to new mobilities and observations of evolving travel behavior has mostly addressed western societies, the study of developing countries and communities in disadvantaged areas likewise promise plentiful insight about socio-cultural and socio-psychological aspects associated with mobility, especially due to the inherent richness and vibrancy of the social and cultural environment. Furthermore, children in disadvantaged area, represent a specifically interesting demographic for research, not only for their own sake, but also as a proxy to gain some understanding about how travel behavior and travel socialization develops in such context.

The context of Haggana in specific, being a highly dense and mixed-use area in an early stage of motorization, is of relevance to the discussion of prospects for a sustainable-mobility future and questioning whether a foreseen high car-dependence stage of development can be leapfrogged or not. The case study of children's mobility in an informal settlement in Cairo therefore offers valuable insight about the travel socialization phase in life. Drawing on the wealth of behavioral theory that has been

found relevant to transport research elsewhere further facilitates the study of children's mobility at various different levels of analysis. A general gap in the body of knowledge in this respect is that discourses associated with children's mobility and transport research predominantly relate to developed countries, while the scarce relevant research on disadvantaged communities mostly maintains a discourse of victimization with little contemplation of alternative discourses that recognize community assets.

2.8.1 Children's travel behavior in context

It is yet difficult to conclude whether or not there are indeed features that characterize children's travel behavior in informal settlements as typologically different in terms of independent mobility or mode choice, or mobility 'style' in a broader sense, since there is an overall deficiency of information about children's mobility in Egypt from this perspective and lack of sufficient details (e.g. Abbas et al., 1996; Darwish et al., 2016, as discussed in section 2.7.4). Available information can only lead to certain deductions knowing that most of the city's population live in informal settlements and it is therefore likely that most generalizations about mobility in the city are more representative of the informal settlements. In this respect, the latest city-wide transportation and household survey points toward the prevalence of walking as the most common mode of transport (trips longer than 500m) and various modes of public transport accounting for the vast majority of motorized transport, whereas private cars only accounted for 16.4% of trips as revealed in the report of JICA (2002). But this hardly contributes to the description of mobility in informal settlements due to being highly aggregate data, whether geographically or demographically.

Abbas et al. (1996) however confirm that schools in poorer areas are more likely to be associated with higher independent mobility and longer exposure to traffic among its children, but they do not distinguish the children who are coming from informal settlements. Notably, a school in a poor or rich area can be receiving different percentages of children coming from formal or informal areas, especially given that public schools are formal establishments that will most often only be found in the formal parts of the city. Accordingly, knowing whether a school is in a rich or poor area as in Abbas et al. (1996) indicates little information about the origin of the children who go to that specific school. Therefore, research that is based on a residential area (a common origin) would be preferable, rather than research based on the destination (schools), and is likely to be more informative about the nature of children's mobility in informal settlements. Otherwise, in studies that are based on surveys conducted in schools, this limitation must be compensated with a record of the trip origin of children in order to gain similar insight, but this has not been part of the existing surveys to date.

A case study of a representative informal settlement would provide valuable insight on the characteristics that may distinguish the mobility and travel behavior in informal settlements compared to what is known about mobility and travel behavior in the rest of the city. Furthermore, reflecting on the mainstream research about travel behavior, noting that it is predominantly based on research in developed countries, the dominant discourse addresses active and independent mobility as an issue associated with the need to promote active travel among children for the sake of health and environmental sustainability. Little discussion however is situated in the paradigm of developing countries or impoverished areas where the discussion of active and independent mobility might be better situated in the context of poverty-related discussions, alternatively associating the phenomenon with possible captivity and lack of resources, or on the other hand leveraging existing social and cultural assets, etc. Bremer and Bhuiyan (2014) and Wahby (2013) demonstrate as an example, how in Haggana,

the discussion of the planning for and provision of water infrastructure can only be discussed in a completely different paradigm than that of the formal sector; a paradigm where the issues discussed predominantly relate to community engagement and enabling socio-cultural assets and resources mobilized to compensate for a gap in the provision of basic needs.

2.8.2 Influence of socio-psychological factors

One fundamental issue pertaining to the nature of children's mobility in informal settlements in Cairo is the issue of lack of public space and lack of formal transport systems and infrastructure, which have been recurring themes related to this context as reviewed in section 2.7.4.3. Notably however, the lack of public space is compensated with appropriation of street space, while the lack of formal transportation services is compensated with informal services. Other means of compensation are also observed and implicitly discussed in Shehayeb (2009 and 2011) advocating the idea of recognizing and leveraging existing solutions that have emerged in informal settlements as part of the planning process for any formal intervention. A similar discourse of appreciating existing non-material assets and resources has also been noted in El-Mouelhi (2014), Bremer and Bhuiyan (2014), and Wahby (2013) for the specific case of Haggana, as well as in other literature regarding the general case of informal settlements in Greater Cairo (e.g. Kipper et al., 2009; Sims, 2010). This is consistent with the themes of mobilizing non-material resources, such as social and cultural resources in determining children's mobility, observed in mainstream literature (see section 2.6.7), yet with further emphasis on the dependence on such resources.

In this sense, non-material assets and resources (or the various ways by which the similar broad meaning is described by different authors) is related to what theorists have struggled to express in various ways that imply the treatment of mobility at a higher level of abstraction as reviewed in Sheller (2014), and articulated as a new mobilities paradigm. Likewise, in Kaufmann's work on the notion of motility (e.g. Kaufmann et al. 2004 and 2014; Kaufmann 2010), he continues to refine the idea of incorporating skills, competences, cultural and social assets and resources, and internal factors among individuals such as cognitive abilities and attitudes, that may all be employed by individuals or groups to realize their transport projects or expand their 'realm of possibilities'.

With respect to children's mobility in specific, in other literature as summarized in Stewart et al. (2012) among other reviews, the key factors influencing children's mobility indeed include the fundamental aspects of culture and values and community and family resources among other affective factors that require a framework of analysis that accommodates their interaction with the rest of the elements of mobility. Various approaches and frameworks are therefore converging toward a common discourse and are instrumental for the study of children's mobility.

One challenge however, is in foreseeing how this progress in abstract conceptual development shall be linked to practical application. In this respect, the concept of motility and the progress in its articulation is offering a promising prospect; whether evident in the attempt in Flamm and Kaufmann (2006) to explicitly 'operationalize' motility so as to add structure to the discussion, or elsewhere in guidance found in UNHABITAT (2013:108) specifically accrediting the notion of motility for putting the mobility aspects of urban poverty into a broader-but-structured perspective for policy makers and planners. This is especially relevant in the context of developing countries and impoverished areas since the role of socio-cultural and affective factors are indeed often very salient as discussed in section 2.6.3. Such acknowledgement in a policy guidance document of UNHABITAT is an early indicator that the concept is

being mainstreamed into the global discourse about urban poverty and sustainable mobility in disadvantaged areas. It is yet however work in progress due to much room for improvement in exploring the dynamics of the concept and the way in which it shall be used as a tool, such as refining its definition at different levels of abstraction, addressing unresolved ambiguities and delineation of its constructs, etc.

In retrospect, looking at several specific case studies that contemplate the resourceful nature of informal settlements, the recurring theme of *virtues* of informality, or 'strengths' and opportunities therein, can be looked upon through the lens of motility and in turn verify its applicability to the context. For example, when researchers (e.g. Shehayeb, 2011; El-Mouelhi, 2014; Sims 2010) describe the streets of the informal settlements from social, cultural, and physical environment perspectives, the various observations can be classified into different factors that enable (or disable) individuals to meet their mobility needs; the sense of 'safety in numbers', the local norms that govern the negotiated informal transport service provision, gender-related advantages and constraints, among other subjective factors, along with all the physical aspects of the transport system and available infrastructure, and more specifically the *perception* of it by the individuals and the community.

2.8.3 Motility and its dynamics

When discussing mobility in cases of informal settlements through the lens of motility, as a planner or policy maker, the concept of *motility maximization* becomes of relevance. This specific conceptual framing, discussed in Kaufmann et al. (2004), refers to motility as a form of capital, in which an individual arguably aims to maximize her motility capital. However, how does a planner or policy maker in turn support this welfare-seeking behavior? Is it always associated with an active pursuit for maximization or are there heuristics and habits playing a role? Is the maximization of skills and appropriation also irrational as with any other human behavior, implying room for improvement or opportunities for 'nudges'? Addressing such questions still demands the lens of motility, but rather than with an eye of a sociologist alone, it is now with the eye of a policy maker as well.

In this respect, gaps in the constructs of motility and room for improvement are of interest, and behavioral theory that has explained a lot about gaps between the rational and irrational human may become of use to explore affective factors that can explain these observations such as reviewed in sections 2.3 and 2.5 on travel behavior. This may support the construction of a suitable theoretical framework for the research questions at hand. The role of behavioral aspects in exploring potential for sustainable mobility is also fundamental, noting how the phenomena of induced and evaporated traffic explored in earlier research was attributed to a wide diversity of behavioral and attitudinal responses, indicating that at the disaggregate level there is much to explore about people's capability to adapt and change to meet similar needs in a more sustainable way.

Behavioral theories that allow the exploration of socio-psychological factors that play a role in people's deliberated or habitual travel-related behavior (or lack thereof) have often proven useful as discussed in section 2.5. In this respect, the Theory of Planned Behavior (TPB) in specific has been found instrumental by many transportation researchers to investigate choices related to travel behavior and mode choices, and to expose underlying constructs while further allowing expansion through augmented versions of the theory that may incorporate other constructs. Furthermore, the expanding 'toolkit' of behavioral theories provide additional support in explaining behaviors from different perspectives, ranging from theories associated with context of altruistic behavior such as norm-activation theory, to theories

associated with behavior under risk such as prospect theory or theories related to behavior -change and altering habits, all of which provide helpful basis for production of hypothesis or analyzing and explaining behavioral observations and analyzing related research results as well as planning soft interventions.

2.8.4 Policy relevance and implications

Through the literature review thus far, an expansion of the conceptual framework through which mobility in an informal settlement can be explored has been suggested. The policy relevance of such an approach relates to the acknowledgments of various advancements in the understanding of the new mobilities paradigm and relevant concepts such as mobility lifestyles and mobility cultures as well as motility and underlying constructs. More specifically, with the expansion of disciplines involved (sociology, psychology, behavioral sciences, etc) and the respective sets of factors introduced to the discussions, there are in turn new channels of intervention through which travel behavior can be influenced. The evolving vocabulary and conceptualizations facilitate more holistic description and diagnosis of travel behavior phenomena while the growing inter-disciplinary nature of the topic could likewise invite new inter-disciplinary means of intervention, which may be specifically interesting in contexts that lack financial resources as a primary tool for intervention. This is evident in a growing body of knowledge leveraging social sciences and relevant disciplines, to inform practitioners such as policy makers and planners about various options to promote sustainability, including sustainable travel behavior (e.g. Lunn, 2014; DfT, 2011; Axhausen, 2007), A notable reference for leveraging social sciences can be found in the 'nudge' theory as advocated and popularized by Richard Thaler and Cass Sunstein. It is rooted in behavioral theory and psychology and is employed in policy practices that were later institutionalized in the UK, USA, and other countries, with proven practical applications (Lunn, 2014; Thaler and Sunstein, 2008). However, although such prevailing discourses do leverage social sciences (often specifically behavioral economics), they are limited in the sense that they are associated with a discourse of *governing* rather than empowering. Conversely, in Kaufmann's concept of motility, a rather *subject-centric* approach is followed, where a discourse of *empowerment* is implied in the recognition of the individual's agency in enabling own possibilities. Notably, such various concepts are not mutually exclusive but can rather complement each other in practical applications (e.g. as implicitly observed in reviews of AST interventions discussed in section 2.6.6). A common theme here in either discourse, is the availability of opportunities for change through various channels other than those requiring financial resources, and therefore suitability for contexts of disadvantaged areas.

Accordingly, in the domain of transport research, where there is a special interest in the issues of impoverished areas like informal settlements, a more interdisciplinary approach may be of specific interest to reveal opportunities for effective and relevant interventions, and this requires the prerequisite research that explores and dissects behavioral phenomena, since proper *diagnosis* must precede prescription. It is notable in the observation of the various social science approaches and competing conceptualizations of mobility, that discussions are often in reference to observations in developed countries. This is possible due to the inclination of researchers to contemplate 'evolution' as something that is most observable in advanced societies, which might be seen as being the furthest ahead in the process. With such perspective, the discourse of literature about 'global' trends in travel behavior and in the evolving understanding of mobility revolves around examples from advanced urban areas. It is often associated with addressing already-prevalent car-dependence and pressing needs to reverse or mitigate unsustainable trends, or otherwise in some cases observing declines in car dependence among younger generations associated with evolving cultures of advanced societies as

discussed in Pickup et al. (2015). Such discourses are most often limited to a paradigm where planned supply of formal transport services and urban planning is the norm, income levels and educational attainment are high, and people's priorities and other subjective factors are associated with such different context.

The debate and discussion about the utility of this conceptual trans-disciplinary development in the study of travel behavior in developing countries and disadvantaged areas in specific is therefore scarce. This is despite the role that such early-stage settlements (in terms of car dependence trajectory) may have in the overall future of sustainable mobility. Jones (2016) does however contemplates this potential. He models the suspected progression of car dependence in a trend that is reminiscent of an environmental Kuznet's curve, where a problem escalates sharply before eventually climaxing to then shift to improvement. An implied open question is whether (and how) cities with adequate prerequisites for a direct transition to modern day models of livable cities (as envisioned in, e.g. EU, 2011; UNHABITAT, 2013), can actually achieve this transition. This highlights the relevance of this discourse to policy makers and planners. It also suggests an adequate discourse to choose for research in informal areas, which positions such urban settlements on a trajectory of evolving travel behavior.

2.9 CONCLUSION

In conclusion to the overall literature review, the study of disadvantaged communities in developing countries through the employment of state of art knowledge about travel behavior in an interdisciplinary manner as reviewed herein, is deemed an adequate basis to study children's mobility in an informal settlement.. Furthermore, the tools for such research, whether at higher level of abstraction through Kaufmann's concept of motility or through lower level of abstraction to investigate specific behaviors through suitable behavioral theories have both been found instrumental in describing and exploring mobility and travel behavior in a wide variety of social and cultural contexts. The tools for investigating travel behavior in disadvantaged communities that are abundant in social and cultural specifics are therefore available to facilitate addressing the disproportionate gap in knowledge about travel behavior in developing countries.

Notably however, from certain perspectives, the label of 'disadvantaged' is in itself ambiguous. Being described as such depends on the aspects taken into consideration from different points of view. Informal settlements in urban areas such as Haggana are often generally referred to as disadvantaged due to association with low income, low education, and other poverty-related constraints. However, researchers have repeatedly pointed out many advantages that characterize the nature and the community of the settlement, which may even have resulted in settlers preferring to stay within the informal settlements rather than resettle in the formal public housing provided by the government for resettlement. Such advantages, as detailed by Shehayeb (2009) and other researchers, not only include the better walkability and accessibility to employment and education opportunities among other needs and services, but also (and possibly more importantly) an accumulation of social and cultural assets and resources that enable the community to maintain safety, organization, entrepreneurship, and collaboration. Such a discourse however is notably often accompanied by clear acknowledgment of the many ailments that also characterize informal settlements due to different forms of poverty and various types of resource scarcity and other symptoms of social exclusion. However, a more holistic perspective that also recognizes other assets and resources may shed light on aspects that can be leveraged and supported to serve the welfare of certain informal settlements with similar characteristics. This is a core

argument for the subsequent conceptualization of a theoretical framework suitable for the specific context of the informal settlement.

Communities in more affluent urban areas, such as in developed countries and most advanced cities, are also experiencing symptoms of certain types of disadvantage that might not necessarily be prevalent in informal settlements. An example is the decline in children's active travel and natural means for 'play', or simply cases of highly mobile individuals that are found to suffer a state of low motility due to limited options and appropriation of possibilities, such as a case of a person frequently traveling by car to distant work as noted in Sheller (2014), while lacking time to do other activities or missing possibilities offered by a walkable environment. In other trends observed in advanced societies, Fyhri et al. (2011) note active travel among children might be increasingly replaced with *organized* leisure, implying a form of commoditization (privatization) of children's activity, and separation from more wholesome means of mobility that contributes to gaining life skills and enriching social and cultural experiences.

Within the same country, distinctions between formal and informal settlements are similarly apparent as an analogy to the global distinctions between the developed and developing countries. In this respect, another aspect that is subject to debate, is whether people in informal settlements, whether children or adults, are distinctly better suited to adapt to forms of sustainable mobility due to being accustomed to the (coincidentally) sustainable travel behavior. Providing some perspective, Darwish et al. (2016) shed light on the distinct unsustainable practices of parents and their children in schools of formal parts of Greater Cairo that are more affluent.

Indeed, as indicated by various researchers, global trends seem to indicate a common trajectory of increasing car-dependence in conjunction with continued income growth and development, which here is implied to occur at the local level in affluent parts of Greater Cairo. Yet the question remains open, as as to whether such a trajectory can be altered, so as to decouple economic growth and development from increased car-dependence. In this respect, what the new mobilities paradigm offers is an acknowledgment of deeper socio-cultural and psychological aspects of mobility that can dissect the wide range of subjective factors that are integral to this trajectory. In the meantime, among the key areas of interest for this discussion is the childhood phase, where travel socialization is found to be an influential factor in instilling the various mobility-related representations in early stages in life.

Little is known about children's mobility in Egypt however, but some insight can be gained from global trends. Research on children's mobility indicates a global trend in reduced child independent mobility (CIM) in general. Literature however predominantly focuses on the topic of CIM as a pursued feature of advanced cities with child-friendly urban environments in developed countries. This mainstream discourse advocates independent walking and cycling and views CIM as something that communities should 'return' to. On the other hand, there is seldom an acknowledgement of another discourse that suits marginalized communities, which rather views CIM as a symptom of poverty and time constraints of parents, which may also lead to independent mobility. Another perspective that is seldom acknowledged is the recognition of acquired skills and means of appropriation of existing resources that parents and children resort to for enabling mobility, which is a form of resourcefulness driven by poverty-related constraints. These alternative perspectives are suitable for contexts of poverty but are rarely used in mainstream research on children's mobility and travel behavior. Children's travel behavior is interesting for insight about the earlier stage of socializing mobility practices. Informal settlements in Egypt are still in an early phase of car-dependence while the urban form has developed over time in a manner that caters to walking; the predominant mode of transport. Studies discussing car-dependence

suggest these factors may qualify such early-stage settlements and communities to accommodate sustainable mobility lifestyles and avoid repeating mistakes of other advanced cities that have suffered adverse environmental and social impacts of a climax of car-dependence. The evident phenomena of traffic evaporation and of cities experiencing reduction in car-dependence both indicate that behavioral and social factors have played a central role in such adaptation.

The gap in knowledge about informal settlements and children's mobility and travel behavior within this global perspective is relevant, and it may offer valuable insight for the discussion of transitions to sustainable cities and communities. In this respect, a suitable tailoring of a theoretical framework for its study is also subject to much potential refinement and improvement in articulation and conceptualization.

CHAPTER 3: THEORETICAL FRAMEWORK

3.1 INTRODUCTION

In this section, the theoretical framework and applicability to the context of children's mobility in informal areas is presented and discussed with reference to relevant research and state-of-art knowledge about the topic. Firstly the current understanding and articulation of motility and its elements is presented along with a discussion of application of motility in transport and travel behavior research. This includes a discussion pointing out the different levels of abstraction that must be understood when dealing with concepts related to the new paradigms of mobility, such as motility, as advanced by Vincent Kaufmann. In this respect, research of different scopes can be looked upon from the same lens of motility, spanning from the exploration of an individual's potentiality for mobility to that of an entire community of interest or nation. This aims to resolve a likely source of confusion when reviewing the research related to motility that is often varying in scope and in levels of analysis.

Another clarification highlighted is the difference between the concept of motility and accessibility, highlighting the agency of the actor(s) as subject of analysis in the paradigm of motility and discussing implications of this framing and relevance to the study of informal settlements, association with social equality, and relevance of this conceptualization to planners and policy makers. This discussion is followed by an argument advocating the idea that motility is a result of an inherent dynamic between its constructs of skills, access, and appropriation, which are mutually supportive in the development of an actor's motility. The hypothetical argument is based on reflection on the knowledge about informal settlements in Egypt as discussed in the literature review, with specific insight from research that has previously explored means by which informal settlements creatively meet their various needs and compensate for deficiency in service provision in various domains (e.g. housing, water supply, transport, etc).

The theoretical framework is further refined through the identification of the implied 'gap' in appropriation which can be explored through the application of behavioral theory to understand the behavioral aspects which may enhance or inhibit potential mobility. This can in turn identify further channels for intervention or at least facilitate diagnosis of motility challenges to address, but it can also facilitate identification of virtues that can be enhanced or supported, such as the various enabling conditions and cultural assets mobilized in informal settlements in the form of self-help initiatives. For the in-depth exploration of the hypothesized 'appropriation gap', the Theory of Planned Behavior along with supportive behavioral theories and potential variants or augmentations is suggested as the basis for analysis, arguing that appropriation is a manifestation of a behavioral process. Consequently, an overall hypothetical theoretical framework is constructed, presented illustratively and discussed in terms of validity and suitability for the current research context and research questions of the case study of the informal settlement in Egypt and for exploration of children's travel behavior in that specific setting. Relevance and applicability for other settings are also noted.

There are therefore three elements of the thesis that are synthesized in this chapter: (a) A conceptualization of motility viewed as a product of dynamic and mutually compensating subconstructs

and specific to the observed agent (e.g. individual or group), (b) behavioral theory explaining appropriation, and (c) association of the theoretical framework with informal settlements as the context of the subjects of investigation.

3.2 APPLICATION OF MOTILITY

The concept of motility has been developed in response to several arguable limitations associated with the notion of mobility. Mobility refers to actual tangible movement without consideration of potential movement, and it is also strictly spatial in nature, void of intangible factors that may influence mobility, such as social, cultural, and other context-specific factors (Kaufmann et al. 2004). Motility on the other hand additionally incorporates potentiality of movement and considers social and cultural factors together with the structural aspects that collectively form a range of possibilities for movement (Kaufmann et al. 2004).

In an attempt to render the concept of motility operational, Flamm and Kaufmann (2006:168) further defined motility as "…how an individual or group takes possession of the realm of possibilities for mobility and builds on it to develop personal projects". Motility is accordingly described as a composition of factors related to three aspects or constructs enlisted below. Each construct is presented with a synthesis of description suggested in Kaufman (2004) and Flamm and Kaufmann (2006) with examples of factors involved:

(a) Access: Access refers to the availability of transport options and the conditions under which they can be used. It refers to prices and location-specific costs, schedules, and all attributes of transport-related services that can represent opportunities or constraints. It further includes other mobility-enablers in the individual's external environment, including the urban form and spatial distribution of infrastructure and services (which vary even within the same city for each individual), the options available through information and communication technologies, as well as access to social networks and socio-economic positioning of the actor that enable carrying out various projects.

(b) Competences or skills: Competence refers to the actor's know-how, physical ability, understanding of rules and regulations and ability to operate under their constraints, ability to gain and maintain awareness and understanding of available fields of possibilities, ability to plan (e.g. trip chaining, way-finding and reading maps, logistical planning, acquisition and management of information, ability to react to changes, etc), all of which can generally be categorized as aspects of physical ability, acquired skills, and organizational skills.

(c) Appropriation: Appropriation, refers to how real and perceived access and skills are used, influenced by affective factors. Appropriation is more specifically expressed as *cognitive appropriation* in discussions of motility at lower levels of abstraction addressing individual motility. It is a product of several subjective influences inherent to the actor, including needs, aspirations, understanding of fields of possibilities, evaluation, decision-making, and other means of cognitive processing that may enable or inhibit actual mobility and availability of potentials. It is therefore the cognitive employment of access and competences, and is also manifested in strategy-making by which the realm of possibilities for mobility can be expanded.

The concept of *access rights* is also suggested as a helpful term to account for all rights of access that an individual has acquired to allow mobility. Examples include vehicle ownership, reserved parking,

membership in transport services whether rental or car-sharing and ride-sharing, as well as public transport passes, etc, which together constitute an individual's access rights portfolio.

Kaufmann (2014) further discusses dimensions of analysis that contribute to this re-conceptualization of mobility: the *field of possibilities, aptitude for movement,* and *movement*. The field of possibilities is the wide context in which access is pursued, skills are employed, and opportunities are appropriated, which includes the available transportation systems, related services and infrastructures, etc, as well as all forms of space (urban layout, etc), governing institutions and laws, and the various social relationships and prerequisites for social success and meeting people's aspirations. The *aptitude for movement* consists of the elements of motility afforded by an individual or group: access, skills, and appropriation, which define the actor's aptitude for movement, not only in the physical space, but also in the economic and social space. In this sense, motility can be described as the aptitude to make use of the field of possibilities.

With this vocabulary, an example of the act of driving to work can be described as using the *skill* of driving to *appropriate* a car that can be *accessed* due to ownership in order to use the *fields of possibilities* offered by the available road network, related infrastructure, land uses and services to achieve *the project* of traveling to work in pursuit of the possibilities offered by available employment and thus enabling social mobility and forming lifestyles. Furthermore, the same individual with the same affordances, yet not driving to work, is still credited with a high level of motility due to the *potentiality* of mobility that she affords. This is at the level of an individual. The notion of motility likewise applies to higher levels of abstraction to address actual and potential mobility issues of businesses, nations, and other groups as discussed in Kaufmann et al. (2010, 2004) and Kaufmann (2014).

In Kaufmann et al. (2010), the concept of motility was operationalized through a motility-based statistical analysis of an extensive European survey, namely *Job mobilities and family lives in Europe*, whereby different typologies of motility were mapped out. The attributes chosen reflected the broader conceptualization of mobility, where laptop ownership and internet connectivity were among the attributes indicating access, and English proficiency and ability to use maps were among the attributes indicating skills and competences, among the other more common attributes describing mobility. The study identified 6 typologies and noted that they were strongly corresponding to gender, age and household makeup. Such testing of the concept in Kaufmann et al. (2010) validated the following important arguments: (a) socio-demographics and living arrangement strongly influence motility, (b) high levels of movement (highly mobile persons) are not necessarily resulting in high motility, such as in the case of the weak-motility type that was characterized by high probability of daily commuting, and (c) motility is not only associated with vertical social mobility, but also horizontal social mobility (in terms of lifestyles) as pronounced in the various typologies identified. The limitations of empirical research and quantitative analysis is apparent here, where despite the large sample, the in-depth investigation of the multitude of factors affecting motility is yet to be explored to further advance the understanding of the concept.

De Witte et al. (2013) in an extensive review of research on modal choice and its determinants, demonstrated how modal choice is strongly influenced by various socio-psychological factors, well suited for exploration through the lens of motility. The review argued that modal choice is among the most widely studied topics within travel behavior, yet is often conducted in a simplistic manner that disregards the complexities of the real travel experience, such as frequent disregard to trip-chaining, the experiences of using access and exit modes, and the overarching subjective factors that influence

choices throughout the process (De Witte et al. 2013). In this respect, the systematic review adds to the credibility of the concept of motility regarding it as a holistic framework to better discuss the determinants of modal choice as an example of one commonly studied aspect of mobility.

Literature on the concept varies between highly visionary and abstract discussions that give much space to interpretations and encouraging new ideas on one hand, to discussion of structured conceptualization on the other, depending on the respective level of abstraction.

3.2.1 Motility at different levels of abstraction

To resolve a possible confusion in understanding the ongoing development and discussion of the concept of motility, the variation in the levels of abstraction must be highlighted. Kaufmann et al. (2004) explore the conceptualization of motility as a form of capital and representative of a new form of social inequality. They build on the arguments of renowned thinkers such as Pierre Bourdieu, Amratya Sen, and Karl Marx, about the nature of capital, its role in addressing social inequality, and the dynamics between its different forms. In this respect Kaufmann et al. (2004) suggest that motility as 'capital' is interchangeable with other forms such as human, cultural, social, and financial capital. In applications in empirical research, Kaufmann et al. (2004) suggest treatment according to different levels of abstraction, ranging from the micro-level, addressing skills and competences of individuals, to a meso-level exploring associations between social and spatial mobility, and the macro-level addressing associations between national social and geopolitical policies.

Examples of using the concept of motility at various levels of abstraction range from the study of the urban implications of the mobility turn on Western cities as presented in Kaufmann (2011), down to the analysis of the determinants of modal choice of individuals (e.g. Flamm et al., 2014; De Witte et al., 2013). This in turn requires that researchers ensure clear definition of the scope of research and level of abstraction as well as definition of the actor studied (individual, group or institution, etc) in the introduction of any motility-based research and analysis.

3.2.2 Motility vs. Accessibility

Although the concept of accessibility addresses enabling or disabling conditions for mobility, it differs fundamentally from the concept of motility in that it is based on the actual field of possibilities and related attributes, whereas motility is based on the perspective of the commuter (or potential commuter). This implies a different discourse. As an example, two persons may have the same mobility possibilities, such as a train station two minutes away walking (adequate accessibility), yet one person is too physically weak due to age or cannot speak the language with which all the signage is written or believes that two minutes is too much time walking in cold weather. Accordingly, the identical spatial and temporal accessibility situation does not correspond to same motility of the two individuals. Motility therefore offers a different perspective for the discussion of mobility-related social exclusion revolving around the *agency* of the individual (or group) under study in achieving the pursued transport projects. Notably, it is true that for long there have been suggested treatments to the concept of accessibility where the *perception* of accessible options or attributes is taken into consideration as an attempt to incorporate subjective factors and articulate the concept more holistically (Pirie 1979; Handy and Niemeier, 1997), but nevertheless, the notion of motility presents the subjective factors at the core of its formulation rather than an augmentation of existing conceptualizations. It is thereby distinguished by framing the commuter as the subject of study rather than the transport services and infrastructure.

More specifically, as articulated in Flamm and Kaufmann (2006), "it concentrates more than accessibility on how an actor builds his/her relationship with space and less on the possibilities" (p.169:2). This in turn emphasizes the agency of the commuter in determining motility.

3.2.3 The commuter's agency in expanding motility

Flamm (2004) explores the determinants of mode choice in daily urban mobility based on the analysis of in-depth interviews, demonstrating the abundance of interdependencies between objective and subjective factors, while also stressing on the often over-shadowing influence of habit. Interdependent factors were conceptualized as revolving around four facets deemed essential for understanding an individual's choices:

- Actual travel behavior (trip chaining, mode choice, etc),
- Strategy of localization (how activity spaces are progressively set up),
- Capacity for movement (physical capacity, access to transport modes through ownership or membership, etc),
- Representations of modes of transport (affective impressions, appreciation of functional and symbolic value, etc).

The conceptualization of the interdependent factors was in essence aligned with the concept of motility, although with slightly different articulation to suit the specific research question. With regards to the individual's representation of means of transport, Flamm (2004) found that they are not only a product of individual affective factors, but also substantially influenced by 'dominant' social representations (Flamm 2004). This in turn highlights the role of the external social environment. Furthermore, the study indicated strategies by which a certain factor can be altered cognitively such as in the 're-appropriation' of travel time, whereby subjects were found to re-assess their view of travel time and opportunities that are afforded by travel time in order to conduct other valuable activities. Cuzzocrea and Mandich (2015), in similar ethnographic research have also discussed elaborately the alternative utilities of travel time, specifically in the context of parents traveling with children, showing how different narratives of mobility shed light on various 'mobility cultures', which were portrayed in the case study of Cagliary in Italy. In this respect, value found in the travel experience is not confined to achieving the optimal trip, but is instead enriched with 'micro-activities' such as social interactions, spending quality time with children, meeting other parents, relaxing, stopping briefly for play in urban spaces, or various forms of appropriation of 'interstitial' times and spaces (Cuzzocrea and Mandich, 2015).

In the various narratives of mobility experiences and choice making as indicated in Flamm (2004) and Cuzzocrea and Mandich (2015), there is much room for reframing the situation and the value seen in the mobility experience due to the abundance of factors involved in which alterations are possible, i.e. space for alteration is not only in the physical environment, but in the attitudes and framing of choices, the appropriation of options and resources, the perception of social influences, the ability to strategize to improve one's situation and the acquisition of helpful skills and competences, etc. This in turn emphasizes the agency of the commuter in developing and expanding own motility through improved appropriation or other expansions of the underlying elements of motility.

3.2.4 Motility for social equality

Building on the idea that motility may contribute to the welfare of an individual or group, researchers have gradually recognized its usefulness in investigating social inequality and social exclusion to identify

opportunities for improvement or intervention. They can either be motility-challenged due to aspects associated with poverty, but also for other reasons that may limit actual and potential mobility, even among the affluent segments of society. Shergold et al. (2011) sheds light on one important example, which is that of the rapidly aging population of the world today. Shergold et al. (2011), notes in a case study how the elderly in rural England and Wales are inclined to engage in community activity, which contributes to their social capital as well as the sustainability of the community, yet their declining physical capacity to use a car constrains them, thereby exemplifying the link between motility and social capital. Such research, if conducted several years later might have further included associations with the emerging technologies facilitating transport that require interaction with mobile applications, which might be difficult for the less technologically savvy elders.

Ureta (2008) builds on insights from in-depth interviews with 20 families in a low-income population in Santiago de Chile, revealing how the low motility of the residents is associated with their social exclusion, and where themes related to being 'on the move' to meet needs and aspirations were highly recurring and central to discussions about social integration. Here, the concept of motility was instrumentally used in a purely qualitative approach of ethnographic research. The research thereby met its objectives of investigating the mobility-related aspects of people's welfare and social integration in the context of a case study of social housing, shedding light on how the planning and location of the social housing has provided formal shelter but on the other hand depleted other forms of capital and resources, such as integration in former social networks and accessibility to proximate jobs, and other cultural assets and virtues that have been enjoyed at varying degrees by residents in their former locations.

Shareck et al. (2014), proposes a conceptualization of motility suited to the study of health inequality. They argue that health inequality is partly related to the nature of the individual's ability to access and appropriate means for accessing healthcare and adopting a healthy lifestyle. This includes (in)ability to tap into *contextual resources* that may encompass cultural and social assets and resources, such as in the case of refraining from accessing recreational facilities in an affluent neigborhood due to feeling "out of place", and a consequent loss of opportunity for physical activity (Shareck et al., 2014).Conversely, from this same perspective, there may also be cases where individuals appear to be more privileged (e.g. being financially wealthy or receiving high salaries) but are rather challenged in another way and in turn subject to a form of social inequality themselves, e.g. being time-starved due to longer commute to work, or experiencing an implied exclusion from the local neighborhood (Shareck et al., 2014). Cass et al. (2005) goes as far as to propose extending the conceptualization of *citizenship* altogether to further include 'mobility rights' as a modern day cornerstone of social integration. In this respect, Cass et al. (2005) refers to T.H. Marshall's description of civil, political and social rights associated with the definition of citizenship, and highlights the emerging realization among researchers that the facilitation of actual and potential mobilities can likewise be seen as a citizen's right and an enabler for social mobility and integration as with other basic rights.

In a study of two informal settlements in Medellin, Colombia, Heinrichs and Bernet (2014) investigate how an arguably transformational transport project, the MetroCable of Medellin, has affected accessibility of residents. Through in-depth interviews, multiple aspects were revealed that correspond to the elements of motility and expand the understanding of the context beyond what quantitative research might reveal. In terms of cognitive appropriation for example, Heinrichs and Bernet (2014) revealed how perceptions of safety, especially among females, highly influenced their mobility, noting the impact of both actual and 'felt' (perceived) safety, while other indirect impacts ensued due to the

reduced stigmatization of the settlement as the flow of safe commuting was enabled, integrating the residents with rest of the city. The role of skills and competences was also highlighted in the suboptimal use of the available payment options among some users, which might be attributed to limited awareness or understanding of the related disseminated information (Heinrichs and Bernet 2014). The research sheds light on how the agency of the *commuter* in achieving mobility plays a significant role and not only the supply-side factors of accessibility; they explicitly note how in terms of security aspects for example, "*different groups of people can experience the same place in a very different way*" (Heinrichs and Bernet 2014:59).

3.2.5 Implications for the discourse of planners and policy makers

In UNHABITAT (2013), in attempt to provide guidance for policy makers and planners, a simplified and structured definition of motility is articulated as a 'balance' between accessibility, individual skills, and user's appropriation of the mobility system. It further suggests that in the context of urban poverty, the aspect of access is seen as the "most important facet of motility" (UNHABITAT, 2013:108). This strong claim might be attributed to the expected typical discourse of the development community, where planners and policy makers are solely seen as *providers*, i.e. a paradigm where solutions are based on provision by the government to the citizens such as in provision of adequate transport systems and services in this context. This implies adapting to the citizen as a 'client'. The essence of motility however revolves around the agency of the individual, so I believe that a deeper understanding of motility should rather lead to a discourse that focuses on appropriation and on aspects of individual agency as the central purpose of using the concept of motility. Here the commuter is engaged and becomes part of the solution, and the interventionist does not provide in the traditional sense, but rather facilitates and supports. This is especially useful in the context of developing countries where economic constraints do not allow sufficient provision of transport services and infrastructure, so tapping into other areas of potential mobility enhancement can be another promising approach that accompanies the traditional provision of services. It would also expand the means of intervention and supportive measures available.

This discourse is aligned with the arguments of Shehayeb (2009 and 2011) and Bremer and Bhuiyan (2014) building on in-depth research on informal settlements in Egypt. Accordingly, I reason that cities suffering the impact of predominant poverty are likely to have a government that is likewise constrained by lack of resources. Rather than a provider (as in developed countries) the government may find itself better situated as a facilitator or collaborator with other actors that have emerged to fill the different types of gaps, a power gap, administrative gap, resource gap, etc. The agency of the community and the citizens are therefore more pronounced in this paradigm and allow a suitable description of the reality of actual and potential mobility, as indeed accommodated conceptually in the framework of motility.

3.2.6 Dynamics of Motility

Building on the literature about new mobility paradigms, mobility cultures, conceptualizations and applications of motility, I argue the concept of motility is specifically of substantial value to the study of mobility in the context of urban poverty and in relation to vulnerable groups for the following reasons:

1. Expanding the domain of intervention: In the context of scarcity of physical and economic resources, the notion of motility acknowledges various other types of assets and resources (e.g. cultural assets, individual skills, etc) that can be mobilized for the good of the individual's personal projects, or those of

the community. This approach therefore expands the set of factors that can be influenced to improve the state of individuals or communities.

2. Accommodating pronounced socio-cultural and socio-psychological factors: In informal settlements in Egypt, the role of tradition, culture, community collaboration, as well as the influence of social norms, are all factors that are highly pronounced in the daily life of people and is therefore likely to be significantly influential on their mobility or immobility. Investigating children's mobility and parental influence further expands the potential role of affective factors. Therefore, a framework that accommodates these factors would be highly suitable for this context in specific.

3. Acknowledging an inherent dynamic: In attempt to link the concept of motility with the discourse of asset-based community development that has been praised in the activity of informal settlements, it is suggested that motility is characterized by an inherent dynamic between its elements. Not only is an individual inclined to expand overall motility, but also tending to compensate deficiencies in one area with strengths in others. As with the varying ability to meet needs through different channels in other domains (education, housing, etc), likewise, cultural resources, skills, competences, perceptions, and other elements enabling motility are mobilized or manipulated in pursuit of an overall improvement of state in the domain of mobility as well.

Accordingly, a simple conceptualization of the dynamics of motility is suggested, as illustrated in Figure 2 where the sub-constructs of skills, access and appropriation are mutually supportive in pursuit of a satisficing level of motility.

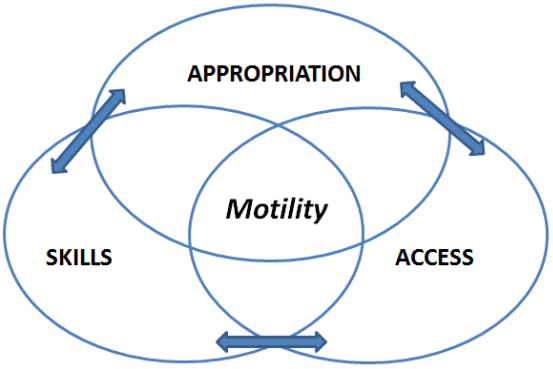

Figure 2: Suggested conceptualization of mutually compensating sub-constructs of motility

What this conceptualization hypothesizes, is that an individual (or group) lacking access, may be compelled to increase appropriation of the little access that she has or improve skills for the same purpose, and the same dynamic applies to all the interrelations between the three sub-constructs. A simple hypothetical example is a disabled person who cannot acquire the skills of cycling and driving (skill deficiency), but in turn increases her access portfolio by buying a special vehicle or membership in specialized transport services or relocating closer to work (access improvement), or otherwise builds on her relationship with neighbors to help in different ways or exchange favors in their daily life as a constructive strategy to better meet her mobility-related needs (appropriation improvement), whereas all three sub-constructs enable each other and are co-present in any motility development.

Notably, appropriation may also include change in perception, such as in the cases of resolving cognitive dissonance situations and reframing one's perceived reality in order to better one's state. The variation in appropriation is therefore an area that specifically requires leverage of behavioral theories to better understand and describe.

3.3 APPLICATION OF THEORY OF PLANNED BEHAVIOR

Theory of Planned Behavior and numerous variants or augmented versions of the model have been useful in research design, analysis and explanation of human behavior and dissecting its underlying constructs (Ajzen, 1991; Ajzen and Fishbein, 2005). It has been widely used to gain in-depth insight on causal relations and interaction effects between sub-constructs (e.g. Forward, 2014; Donald et al., 2014, Mayhew et al., 2009, Rhodes et al. 2006).

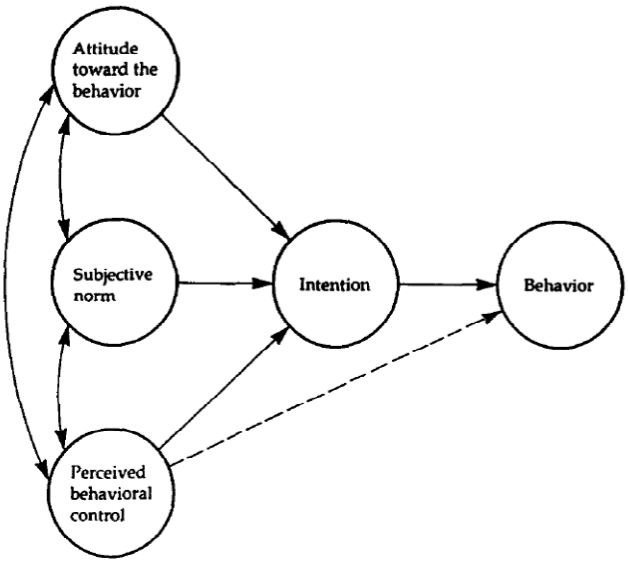

Figure 3: Basic illustration of the Theory of Planned Behavior (Ajzen, 1991)

Attitude towards the behavior refers to which the extent to which the individual sees the behavior as favorable or not. The subjective norm refers to the influence of social pressures as perceived by the individual to perform the behavior or not. The perceived behavioral control refers to the individual's perception of her own ability to carry out the behavior (self-efficacy) which involves the influence of past experience as well as perceived obstacles or enablers.

3.3.1 The Appropriation Gap

In the discussion of motility and its proposed conceptualization, the dynamics of its constructs were discussed. The variation of skills and access relate to acquisition and loss of identifiable elements of skills, competences and different forms of access that are more easily conceptualized than the construct of appropriation. Appropriation represents the individual's agency in mobilizing all available options and constructing various enabling or inhibiting representations of whatever is perceived to be at one's own disposal. Flamm and Kaufmann (2006) describe this facet of motility as "undoubtedly the most difficult to grasp"(p.178:2).

I interpret the facet of appropriation as where the cognitive process comes into play in order to carry out a behavior or not. Accordingly, I argue that enabling or inhibiting the expansion of appropriation is a manifestation of a cognitive process that can be described and analyzed using behavioral theory. I argue that where motility is an asset that can be expanded, its underlying construct of appropriation represents the role of the individual's behavior in this development process, where an appropriation expansion is a change in behavior. It is suggested in this research that TPB is a suitable framework to explain the nature of appropriation since TPB explains the precursors to deliberated behavior, and allows augmentation of its framework to incorporate other behavioral constructs, as well facilitating the exploration of the incidence of cognitive dissonance, which is revealed through the mapping out of behavioral sub-constructs that precede the resolved behavior intention.

In this respect, the difference between the baseline state and the improved state of appropriation can be articulated as an 'appropriation gap', and can be described through TPB and supportive behavioral theories and complimentary constructs as seen fit. This suggested concept is illustrated in Figure 4 in simplified form. The utility of this articulation is to diagnose the phenomenon and facilitate in-depth exploration of certain appropriation-related behavior. What defines the target 'improved' state and who defines it are both context-specific and should therefore be defined based on context in order to render it useful, whether by the subject himself/herself or by an intervening agent (e.g. a trainer, a government, a mother, an NGO or school, etc).

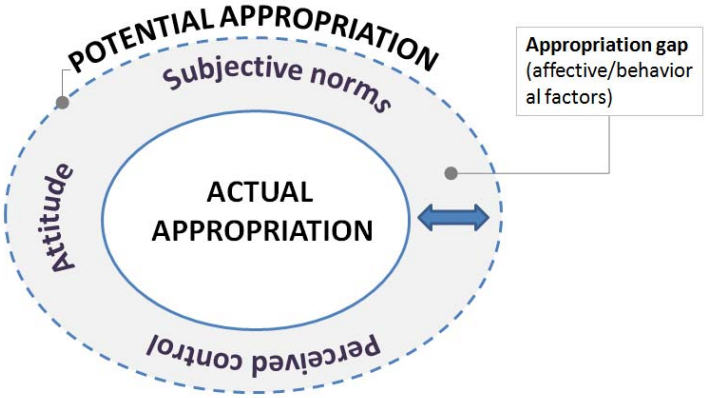

Figure 4: The appropriation gap

Furthermore, the behavior of an individual or a group (e.g. a family) is fundamentally associated with social context and various background factors. In the context of studying children's mobility, emphasizing the role of parents as a determining authoritative and socialization agent is a valid example.

Similarly skills and access can also be diminished or expanded and therefore could likewise be conceptualized in a similar manner where a skills gap or access gap can be discussed in research related to improving motility of individuals or groups.

3.3.2 Parents as a proxy

In the context of studying children-related behavior, the parental influence is central to the determining factors of behavior. In fact, much of the research that intends to study children's health, education and welfare, has targeted parents as the subject of the behavioral studies. Such TPB-based studies in various domains include exploring mother's decisions about children's sun-protective behavior (Thomson et al., 2011), parent's intention to instill healthy eating habits among their children (Andrews et al., 2010), and the involvement of fathers in the upbringing of children (Perry and Langley, 2013) among other health-related TPB-based research targeting parents as the subject (e.g. Finke et al., 2015; Hutchinson and Wood, 2007).

Similarly, in the domain of travel behavior research, the role of parent's in shaping children's travel behavior has also been highlighted, whether in their authoritative capacity, or their role as a key agent of socialization or through other means of subjective and objective influence (e.g. Kyttä et al., 2015; Henne et al., 2014; O'Sullivan, 2013; Baslington 2008; Flamm and Kaufmann 2006).

3.4 HYPOTHETICAL FRAMEWORK

For the present research, a hypothetical framework has been constructed in accordance with the theoretical discussion of the conceptualization of motility, the concept of the appropriation gap, and the suggested utility of the TPB-based analysis of this articulated appropriation gap. The framework has been constructed with specific suitability to the study of children's mobility and parental influence as illustrated in Figure 5.

Figure 5 illustrates the various theoretical propositions and framings that have been discussed in this chapter: the concept of the three aspects enabling mobility being mutually supportive and supplementary to each other as well as the possibility of the manifestation of the various enabling aspects to be further expanded or diminished.

With reference to the literature review and available information and research about informal settlements in Cairo as well as similar contexts elsewhere, the three facets of motility can be hypothetically associated with the context of the case study area and actors to confirm relevance of the framework.

Access is hypothetically exemplified in affordability and availability of transport services (microbus, bus, tuktuk, etc, and their attributes), the street network (high connectivity, human-scale, etc), proximity of needs and destinations due to the demand-responsive urban form, communication tools (mobile phones, internet access, etc), social resources (family members, friends, neighbors, other social networks and their attributes), security provided by 'natural surveillance', care-giver guidance and collective guidance from the surrounding community. Skills and competences are exemplified in awareness of station names and sign-language, social skills (e.g. for way-finding), cognitive mapping and spatial awareness, skills in mobile phone use and physical ability (walking, cycling, public transport, etc) as well as organizational skills enabling trip planning and adaptation to changes. Finally, appropriation is hypothetically exemplified in expected salience of various representations and attitudes towards transport modes, perceived social norms with regards to attributes of the transport services and with regards to strategies for planning, and association with social status and gender-related biases, as well as self-efficacy, referring to perceived ability to appropriate skills and resources. There are also

internalized background factors that would influence the nature of appropriation such as parental influence in terms of guidance, authority, and other forms of socialization provided for children, as well as social, cultural, and educational background, and influence of other past experiences.

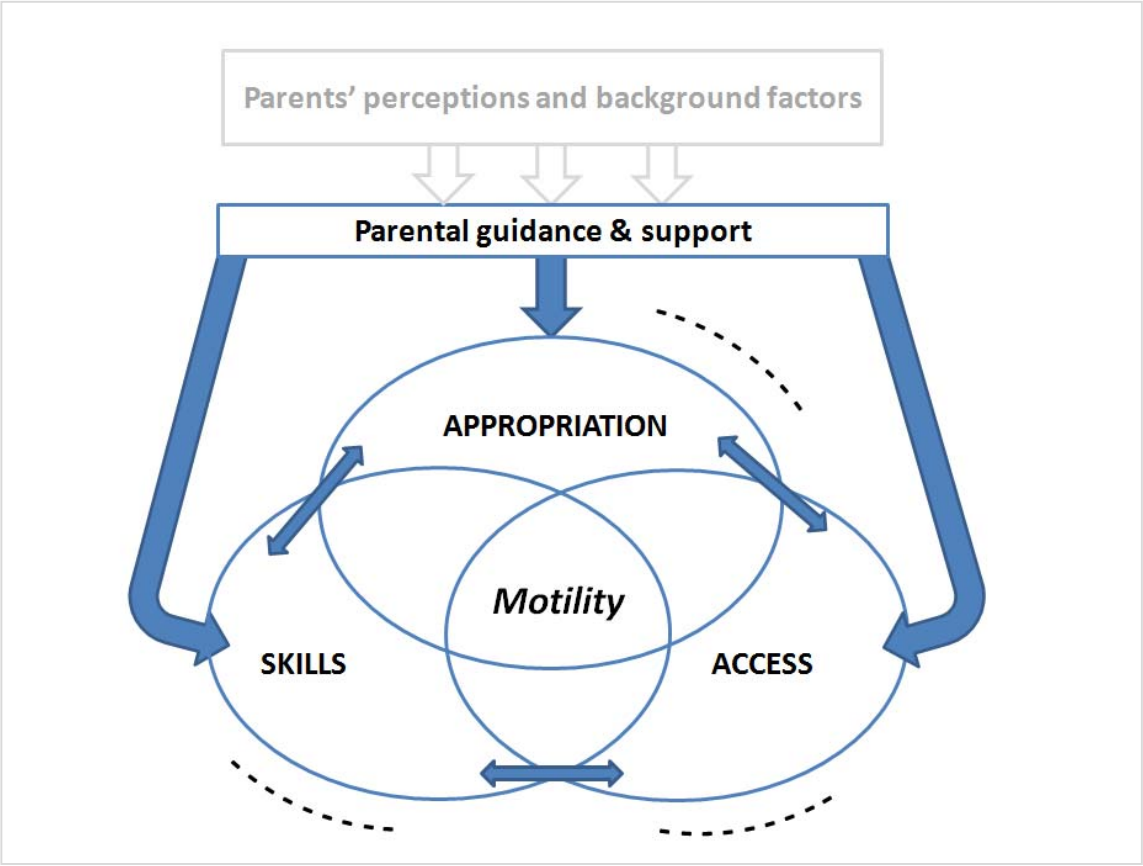

Figure 5: Suggested illustrative conceptualization of children's motility inherently associated with parents (dotted lines indicating variability in size)

3.5 DISCUSSION

Throughout this chapter, a theoretical framework was constructed based on a review of concepts and theories applied to travel behavior research and found suitable for research within the new mobilities paradigm. The concept of motility in specific is interesting because it not only highlights an aspect of social inequality, but it also offers a refreshing new perspective where the focus is on the actor, and therefore the role of the actor in improving own status is emphasized. This can be seen as a departure from the common patronizing discourse of service provision and toward an alternative discourse that recognizes mutual engagement between the providers (e.g. the government) and the actor (e.g. the citizen).

Furthermore, the accommodation of socio-cultural and socio-psychological factors in the framework allows a rich discussion of actual and potential mobility and facilitates the diagnosis of problems to address or virtues to capitalize on, whether looking through the lens of a policy maker or planner or through the lens of the subject of study, being an individual, a family or larger groups. The vocabulary involved further facilitates the diagnosis and discussion, with relevant articulation of the facets of motility of access, competence and skills, and appropriation, as well as the articulation of the 'field of possibilities' and 'access rights portfolios' and mobility 'projects' which actors pursue.

The theoretical framework based on elaborating the links between the concept of motility and behavioral theory highlighted a different perspective of social inequality. In the work of Icek Ajzen and other behavioral theorists, it was demonstrated how an individual may fail to conduct a behavior due to perceptions about norms and self-efficacy as well as personal attitudes and the underlying beliefs, which in turn may constitute constraints to any behavior, including travel behavior. Furthermore, as found in the work of Daniel Kahneman and Amos Tversky among other psychologists and behavioral economists, there is a rapidly expanding body of knowledge demonstrating how there are many biases that characterize human beings that lead them to act in ways that depart from rational paths that would favor them. Accordingly, if potential mobility is seen as a form of capital, as argued in the work of Vincent Kaufmann on the notion of motility, then such aforementioned behavioral and cognitive influences and constraints would influence an individual's relative status in society. They would enhance or inhibit the pursuit of motility as a form of capital exchangeable with other forms of capital; social, cultural, or economic capital.

The case study of an informal settlement in a developing country is likely to shed light on many behavioral and socio-cultural factors that have significant impact on travel behavior and on the enabling environment for children and their families. The concept of motility at the level of the individual or the family therefore offers a suitable framework to investigate such factors in specific, whereas supportive analysis through behavioral theory can be employed for in-depth investigation of specific behaviors that may contribute to a deficiency in appropriation. The exploration of the 'appropriation gap' is therefore of specific interest to explore means by which status improvement can be achieved through the diagnosis and treatment of specific non-material factors that enable or inhibit potentiality for mobility.

Further to the current research purpose, the hypothetical framework also inspires further future research into other implications related to the dynamics of the sub-constructs of motility. In future research, as with the conceptualization of the 'appropriation gap', there is also space for exploring the analogous 'skills gap' and 'access gap', and also the nature of compensations between them in various contexts. As indicated in the review of theory applications and discussions, the concept of motility is

interesting in the context of social inclusion among many other segments of society other than children in impoverished areas in developing countries. Examples can be elders, even in developed countries as implied by the research of Shergold et al. (2011), or people of diverse ethnicities in disadvantaged areas within developed countries (e.g. Christie et al. 2011). Even high-income individuals may have a questionable state of social inclusion and capabilities for potential spatial mobility and consequent social mobility, such as in the case of time-starved high-income individuals confined to a life of frequent long-distance travel and limited alternatives.

CHAPTER 4: METHODOLOGY

4.1 INTRODUCTION

There are various methods by which to explore the research questions about children's mobility in the case study area. However, determining the suitable methods does not only require method validity but also viability of implementation with respect to the time and resources required as well as the suitability for the specific context of the case study area and the local culture and educational level.

In principle the research investigates suspected phenomena in a unique setting. It is essentially a case study. Flyvberg (2006) strongly advocates the use of case studies as means of advancing knowledge, especially in the domains of social sciences and related fields of research arguing that phenomenological detail in itself and the 'force of example' can often be more valuable than insight from statistical inferences from large groups that would not expose the underlying phenomenology. He further criticizes the misconceptions about the sanctity given to either quantitative or qualitative methodologies among different researchers, stressing that proper research must rather be problem-driven not methodology-driven, and a suitable mix of both may often be optimal.

Clifton and Handy (2003) advocate qualitative methods in travel behaviour research, especially in settings that are unfamiliar to the researcher or lacking background information. In such cases, quantitative research would fail to provide detailed insights that would develop a proper understanding of the subject. Common qualitative methods include focus groups, personal interviews, and participant-observer methods. Attitudinal surveys are often used as well; they are not strictly qualitative but they measure qualitative factors (Clifton and Handy, 2003). Qualitative research can be used as a methodology for its own sake, or otherwise as a prerequisite to the design and implementation of quantitative research methods.

For the case of Haggana and research questions at hand, it is studied through the lens of a theoretical framework constructed on the foundations of the concept of motility and supportive behavioral theory. In this respect, and with acknowledgement of the scarcity of background information about the unique setting, the suitable research approach concluded was mixed quantitative and qualitative methods, where descriptive research and quantitative analysis of qualitative behavioral factors are used to support an overall ethnographic research approach that characterizes the methodology. In this respect, the methodology involves a journey of field observation visits, interviews, focus group discussions, and surveys.

4.1.1 Ethical Considerations

Throughout the implementation of all field surveys and FGDs, all participants were ensured of the anonymity of their input and that all results are used strictly for research purpose. In the case of interviews with children in the FGDs, they were all conducted in NGOs that have a track record of hosting workshops for children, and furthermore, the respective NGOs facilitated confirmation of parental consent prior to implementing the FGDs as per the local norms in their activity, and all activity plans have passed through the clearance of the respective NGO. All names used in reporting results are pseudonyms.

4.2 JUSTIFICATION OF METHODOLOGY

Building on the research question and the literature review, and the theoretical framework, the research at hand aims to explore people's constructions of meanings and perceptions that have not been previously explored in this setting. Due to the unfamiliar setting and the nature of the theoretical framework that requires rich phenomenological detail, qualitative approaches are necessary while supportive quantitative approaches are also used to enhance the reliability and confirm the validity of the research. Accordingly, interviews, FGDs, pilot surveys and full survey launch were implemented in a flexible manner that allowed tailoring to the local context and responded to insights from stakeholder consultations conducted throughout the process, resulting in a highly context-specific and culturally-sensitive research methodology as reported herein.

A key feature of the tailored approach was the manner in which the delivery of the survey was conducted in consideration of prevailing illiteracy in the settlements. The three main approaches characterizing the research methodology where field observations, Focus Group Discussion (FGDs) and a field survey that combined an attitudinal TPB-based survey with a semi-structured interview survey. The implementation was further supported with stakeholders consultations and desk research throughout the process.

Field observations throughout the case study area was conducted before starting the activities in order to gain orientation about the local context and to understand the urban setting. This included socializing with people in local cafes and with ground floor shop owners, etc. Clifton and Handy (2003) highlight the importance of immersing into the local community in order to gain important insight that would enable a relevant design of research methodology and to gain cultural sensitivity before conducting interviews and focus group discussions, and it can be implemented as an independent 'participant-observer' technique as well. Prerequisite interviews with key stakeholders were also conducted for both the purpose of interviewing influential stakeholders and also for consultation in the methodology design phase. El-Mouelhi (2014) highlights the role of NGOs in providing leadership in Haggana and serving as an interface with the 'outer' world, to communicate the challenges and needs of the community and the distinct features of the local culture.

4.2.1 Focus Group Discussions (FGDs)

For the focus group discussions, guidance in social analysis techniques by Krueger et al. (2001) was used in planning for and conducting the FGDs. Krueger at al. (2001) highlights that the level of analysis must be adjusted to suit the level of detail and level of abstraction required for the research questions at hand, where in some cases full verbatim transcription and coding of transcripts is necessary while in other cases analysis based on notes may be sufficient and instrumental in gaining insight and identifying common themes. The FGDs useful for investigating the salient beliefs and how people think and feel. Furthermore, in guidance for the preparation of TPB-based surveys, Ajzen (2006) and Francis et al. (2004) suggest conducting elicitation studies before the survey design to elicit salient beliefs and better understand the target population, which may be conducted through interviews or through small groups such as through focus group discussions (FGDs). The FGDs in the present study therefore served as both an elicitation process in preparation for a planned TPB-based survey as well as for exploratory research to map out elements of motility that emerge through discussions. Furthermore, prerequisite exploratory

interviews through a snowball technique enables orientation to the local context, the local culture, and facilitates preparation for the design of effective FGDs and surveys (Miles, 2010; Krueger et al., 2001).

FGDs have been used extensively in transport research as an independent methodology in its own right (e.g. Lucas, 2011; Kahlor and Mackert, 2011) or as part of a mixed methods approach (e.g. Hunter et al., 2015; Christie et al. 2011; Sakyi and Owusu, 2011; Anand and Tiwari, 2006). Lucas (2011) conducted 11 FGDs in a disadvantaged region in South Africa to investigate the links between transport disadvantage and social exclusion through purely qualitative thematic analysis without a preset framework for analysis. Kahlor and Mackert (2011) on the other hand also depended on FGD transcript analysis but used TPB as a framework for analysis in a study investigating parents perceptions with regards to ensuring that their children eat a healthy diet. Kahlor and Mackert (2011) coded transcripts into response units (text blocks) and subsequently tagged the blocks with respective TPB factors to quantitatively map out the presence of the TPB sub-constructs throughout all response units, noting that most units contained more than one factor, indicating the complexity of people's verbal expression that often reflects multiple underlying behavioral factors.

Analysis of FGD results can be conducted at various levels, whereas the analyst must determine the suitable level of analysis for the problem at hand (Krueger et al., 2001). In whichever way the analysis is conducted, the data (ranging from notes to full verbatim transcription) should be broken down into manageable 'chunks' to facilitate analysis, identifying major themes between participants and groups and facilitating a systematic process of analysis (Miles et al., 2014).

4.2.2 TPB-Based Interview survey

Based on the conceptualization of motility, and building on the conceptualized 'appropriation gap', latent constructs of the TPB, the indicators of beliefs and perceptions can measured through a TPB-based questionnaire (Ajzen, 2006; Francis, et al., 2004), and the elements of motility and other unexplored qualitative factors can be elicited through interview techniques (Flamm and Kaufmann, 2006; Flamm, 2004; Guell et al., 2012). For validation of the hypothetical conceptualization, a case study (specific behavior) *within* the case study (community) is investigated; more specifically a case study of a specific mobility-related behavior, cycling, that is found to be controversial and eliciting diverse beliefs. Accordingly Ajzen's TPB is operationalized through guidance of Ajzen (2006) and Francis et al. (2004) for the formulation of the TPB-based survey that constitutes part of the overall research. Furthermore, measures of past behavior as an indicator of habit are included to allow incorporation of a possibly habitual influence on behavior as incorporated in previous TPB-based research (e.g. Donald et al., 2014; Nordfjærn, 2014; Bamberg et al., 2003). Ajzen (2006) further recommends the inclusion of any other factors that might be of interest for the behavior under investigation such as relevant socio-demographic factors (e.g. age, gender, level of education, rural vs. urban origin, etc). A pilot phase is recommended for refining the questionnaire before launching, both through qualitative methods and through statistical methods as seen necessary.

Francis et al. (2004) notes the difference in two approaches in measuring the predictor variables for each of the TPB's internal constructs; a direct approach is to question the overall attitude while the indirect (belief-based) approach measures the behavioral beliefs and the respective outcome evaluation, thereby dissecting the underlying cognitive structure. Indirect measures imply more questions related to the same measured predictor. Such an approach is acknowledged and tested in the pilot testing of the questionnaire survey herein, while stressing however the practical limitations field

surveys and people's engagement and attention span that consequently lead to further tailoring of the recommended approaches to enable practical feasibility within the confinements of theoretical validity.

Apart from the paper based TPB-based questionnaires (administered by the researcher), interviews were conducted in a semi-structured manner to allow a balance between a structured approach to address the research questions and eliciting beliefs related to the various sub-constructs of the theoretical framework and allowing for insights that may be unfamiliar or unknown to the researcher as advised in Krueger et al. (2001) and Clifton and Handy (2003).

4.2.3 Structural Equation Models (SEM)

In the case of exploring behavioral constructs such as in the case of applications of the Theory of Planned Behavior, various approaches are used for model construction and data analysis. Anable (2005) expanded the TPB model in exploration of the potential of different groups to switch modes (to use the car less) using cluster analysis for a psychographic segmentation. The TPB constructs were supplemented with additional ones related to moral norms, environmental beliefs, efficacy with regards to ecological behavior, behavioral norm (how the behavior of others is perceived) and habit. Jones (2012) studied the impact of the UK National Cycling Network (NCN) urban traffic-free path in promoting cycling amongst adjacent communities using TPB constructs supplemented with two additional constructs: past behavior and 'anticipated regret' in attempt to integrate habit formation theory and regret theory. Multinomial logistic regression (MLR) was used for analysis to provide estimates for the probability of categorical outcomes in Jones (2012), but such analysis does not allow investigation of causal relationships and influences of mediation and moderation. Forward (2014) explored people's willingness to cycle using a combination of TTB and the Transtheoretical Model (TTB) using Principle Component Factor Analysis (PCA). Using this methodology allowed the analysis of constructs at various stages of change, whereas in the *pre-contemplation* stage for example, most respondents perceive cycling as an uncommon behavior, indicating distinct behavior belief in that stage compared to later stages. Bamberg et al. (2003) in the study of the impact of the introduction of pre-paid semester tickets on students modal choice in Germany also augmented the TPB model to incorporate the construct of habit measured by frequency of past behavior (past choice of respective modes in question) and analyzed the results through Structural Equations Modeling (SEM) to explore the causality and mediation effects between constructs before and after the intervention.

For the purpose of the research questions at hand, which aim to understand the underlying constructs of a certain case of a mobility-related behavior, a method of analysis that informs about causality of constructs and mediation and moderation effects is necessary. For that purpose, the Structural Equations Models (SEM) method is specifically suitable compared to other means of analysis reviewed.

Structural equation modeling is a multivariate statistical analysis technique used to analyze structural relationship between measured variables and unobservable 'latent' constructs. SEM is therefore instrumental in the study of latent behavioral constructs and it enables investigation of causal relationships and their causal directions as well as investigation of moderation and mediation effects that may be active. SEM in the study of TPB and its variants or augmentations has been a powerful tool for in-depth analysis in past travel behavior research (e.g. Donald et al. 2014; Nordfjærn et al., 2014, Bamberg et al., 2003).

4.3 RESEARCH DESIGN AND PROCEDURES

Based on the justification of methodology, the research procedures accordingly followed a mixed methods approach of qualitative and quantitative techniques described in the following sections. The methodology is designed to enable response to the research questions, which aim to explore children's mobility in the context of Haggana and their independent mobility, the influence of affective and socio-cultural factors, the framing of children's mobility status, and implications of the case study for the discourse of sustainable mobility in informal settlements.

The research process was conducted through four phases:

- Exploratory and consultative phase,
- Full implementation of FGDs,
- Pilot TPB-based survey,
- Full implementation of extended TPB-based survey.

The entire process was conducted in first hand by the researcher and entirely in slang Arabic language tailored to the local community's slang language, both in the spoken and written communication. A broader overview of the overall research process is illustrated in

4.4 ASSUMPTIONS, LIMITATIONS, AND DELIMITATIONS

There are several assumptions, limitations, and delimitations considered in the methodology development and in the analysis of results as follows:

Sample representativeness: Due to the lack of registries of households or of telephones, the random sample selection of parents was conducted in the street at various times of day and night and over multiple months. Door-to-door sampling was avoided as per the advice of key informants from the local community due to the lack of formal security throughout the settlement and also due to the conservative preferences of women who would not welcome a male interviewer in a private or semi-private space. Such context imposed some limitations in the sampling process but it is assumed that the segment that would have been interviewed in the households rather than in the streets can be treated as similar.

Consistency of the context: It was assumed that the availability of the existing transport services and the features of the physical environment has been stable throughout the year preceding the interviews and surveys (i.e. the data has been collected throughout a business-as-usual period long after the various periods of turbulent times in the wake of the 2011 revolution). This has been discussed in the preliminary interviews, and was deemed to be a reasonable assumption.

Geographic delimitation: The choice of the informal settlement was based on a choice of a large informal settlement that is connected to the formal areas of the city and is subject to attempts to upgrade its transport services and improve its infrastructure. Another informal settlement of comparable size and features is Mansheyet Nasser in the south of Cairo, among many other

settlements in Greater Cairo. However, Haggana was chosen since Mansheyet Nasser has been receiving more interest and attention from researchers and development agencies as evident in the preliminary research conducted before planning the scope of this research. The choice of one settlement would enable in-depth investigation given the available time and resources planned for the research.

Demographic delimitation: The specific segment studied is children of ages 6 to 16 years old living in Haggana and their parents. Focus on children would allow deeper insight into the nature of habits forming at an early stage in life while also acting as a proxy to understand other social and cultural aspects of the community that would relate to mobility and accessibility of both children and adults. The wide age group pertains to the age range of school children that can participate in focus group discussions. Furthermore, during the preliminary interviews in the exploratory phase of the research, the focus on children as an entry point in any interview was found to create greater engagement from the local community and was more welcomed compared to inquiries about travel behavior among adults.

Assumptions about formal areas in Cairo: Throughout the research, findings shall be compared to the state of mobility in most of formal Cairo as the 'counterpart', which is assumed to be increasingly car dependent, more affluent, and have lower use of public transport services based on available literature. The assumptions are carefully based on the insights from previous research as indicated in the literature review and is not based on an additional parallel study on formal areas in Cairo within the scope of the present study. Background information available on formal areas in Cairo is seen as sufficient for the purpose of indicative comparisons. Furthermore, comparisons noted by interviewees and participants of focus group discussions are also taken into consideration as additional insight about the various contrasts between the formal and informal areas in Cairo. Field observations from formal parts of Cairo are also included throughout the research for indicative or illustrative purposes.

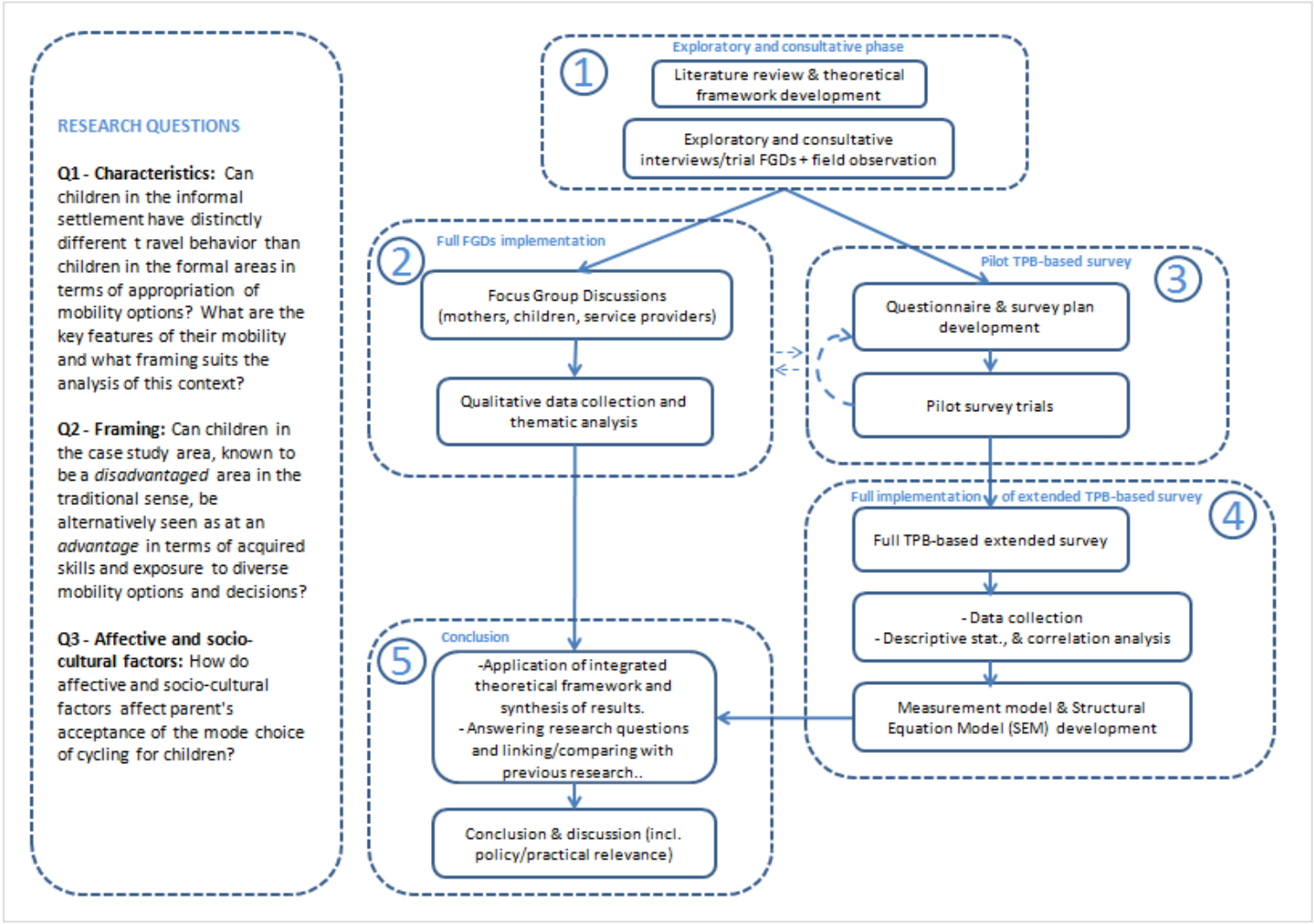

Figure 6: Research questions and overall research methodology

4.5 EXPLORATORY AND CONSULTATIVE PHASE

In the exploratory and consultative phase, consultations were conducted with informants in the settlement through a snowball technique whereby contacts are gathered sequentially through recommendations from each acquaintance. The Previous researchers that have conducted research in the settlement have been contacted as well for a meeting to exchange experience and contacts. The Minister of Urban Renewal and Informal Settlements (MURIS) at the time of this research phase was also interviewed for consultation on research purpose and approach and confirmation of policy relevance, and finally managers of three local NGOs were interviewed for consultation on research design and planning. Conducting the field work with support of local NGOs enabled gaining trust among the local community, and the prior exploratory and consultative activity enabled the researcher to understand the specifics of the local community to be able to better communicate and to better understand the spoken and unspoken communication during the FGDs and interview survey. Through the process it has been highlighted that there have not been any previous travel behavior research in Haggana whether targeting adults or children, nor has there been transport research conducted on the transport services in the settlement. In the case of children's mobility, the most common trip for children suggested by all informants was the trip to school.

Throughout this early phase, prerequisite to the detailed research design phase, field observations were also gathered by walking throughout the street network to gain an adequate orientation about the settlement and enable confident and well-informed management of FGDs and interviews in the subsequent steps of field research.

4.6 Focus Group Discussions (FGD) phase

Guidance in social analysis techniques by Krueger et al. (2001) was used in planning for and conducting the FGDs. The key research question was: How do children and parents interact with transport options to achieve the mobility needs of children in Haggana?

This was explored through focus groups with mothers, children, and a sample of service providers to substantiate the understanding of the context of service provision. Each focus group had a tailored set of questions to guide the researcher (the facilitator) in moderating the discussions and eliciting as much as possible from the participants.

The questions in the FGDs were structured around the constructs of the Theory of Planned Behavior (TPB) in order to ensure exploring the various constructs of behaviour: attitudes, subjective norms, perceived behavioral control, and behavioral intention towards specific mobility-related behaviors through recounting their typical and atypical daily travel behavior. Furthermore, questions related to frequent trips and decisions aimed at understanding habitual behaviour as well were posed, while the appropriation of cycling, as an apparently missing mode of commute in Haggana, was discussed in more depth.

The durations of FGDs ranged from 1.5-2 hours, and involved photo elicitation using a digital projector at the end of the session to elicit comments about hypothetical scenarios of transport service upgrades

as well as travel behaviour change, and also to explain basic concepts of sustainable travel behaviour to be discussed. In the case of FGDs with children, to enhance children's engagement, they were provided with art tools half way through the discussions and asked to map the settlement and present their results in teams, including explanation of their trips to school and use of transport services. This technique was used to enhance engagement and elicit mobility-related opinions and perceptions.

4.6.1 Sample Recruitment

In Haggana there are no registries of residents, no house numbers, and no presence of police security throughout settlement or any physical presence of governmental authority, so sampling techniques that depend on local data cannot be used due to the absence of relevant registries and databases. The common entry point for preceding researchers that have frequented Haggana has therefore been through local NGOs. A similar approach has been conducted in previous field research in the area (e.g. El-Mouelhi, 2014; Bremer and Bhuiyan, 2014; Wahby, 2013).

There are multiple NGOs that are interspersed throughout the settlement providing diverse charity and developmental services to residents and they have developed trust with the local community through their ongoing activities. Three NGOs were selected to support the FGD planning and implementation on a volunteering basis to support the researcher. They were at different depths into the settlement relative to the oldest public transport station at the settlement's entrance named 'kilometer-4.5'. The participant recruitment process was done through the respective NGO aiming to recruit 8-10 participants per FGD through word-of-mouth in the surrounding neighborhood to conduct snowball sampling. Krueger et al. (2001) enlists several sampling techniques to recruit FGD *candidates* (a pool from which to choose) among which snowball sampling is conducted as follows: the researcher finds people who fit the selection criteria and they in turn recommend others who also fit the criteria thereby developing a pool of candidates, and subsequently the researcher makes a random selection of a limited number from that pool. Krueger et al. (2001) also mentions the possibility to 'piggyback' on another event that attracts the people who fit the same criteria if the opportunity arises. This technique was used in one of the FGD cases in Haggana targeting children.

The three NGOs where the FGDs were implemented were Al-Shehab Institution for Promotion and Comprehensive Development, Emaret El-Ensan Foundation, and Caritas Egypt. The three NGOs have previous experience in helping the community as well as in providing space to host educational and awareness activities addressing diverse topics such as family planning, gender inclusion, facilitating access to education and vocational training, etc, among other community services.

The FGDs were eventually conducted with mothers (4 focus groups) and children (5 focus groups), and transport service providers (1 focus group). Three focus groups were conducted in December 2014, and six were conducted in October-September 2015.

In the case of transport service providers, a sample of ten drivers of microbuses (14-seater buses) who serve the residents of Haggana within their different routes have been recruited. The methodology for recruitment was based on a snowball sampling technique, and it was necessary to compensate participants with the equivalent pay of one working day. The FGD was conducted in a ground floor apartment in a building near Haggana for a duration of two hours. The FGD with service providers was exploratory in nature in order to gain insight on the nature of mobility in Haggana from the point of view of a service provider who highly interacts with the various stakeholders in the street, whether

commuters, formal and informal authorities, and other formal and informal modes of transport. Discussions where facilitated with photo elicitation.

All sessions started with ice-breaking introductions, a simplified explanation of the research purpose and duration of discussions, and confirmation of consent for photography, audio-recording, video-recording, and subsequent use of collected data for the research purposes.

4.6.2 FGDs with Mothers

The FGDs with mothers consisted of four sessions exploring the following respective topics: actual and potential mobility (motility) in general, exploring gaps and potential of mobility enhancement, and finally in-depth discussion of the case of cycling as a potential mode of commute for their children and for other demographics.

The following four sub-questions were explored:

1. What are the typical daily activities and travel behavior of parents and what are the common variations throughout the year?

2. What options for traveling to school and other destinations do the parents and children have in Haggana and how do they use them?

3. What are parents' and children's perceptions of the known transportation options and associated experiences? What are the perceptions and influences of the surrounding community?

4. How would reactions be (from children, parents and the community) with regards to interventions that promote cycling as either primary means or intermediate means of transport, and what are the perceptions about cycling in general?

Furthermore, parents were allowed to talk more about related topics of interest and issues that they see as a priority in terms of interventions to meet transport-related needs. The FGDs were conducted with a co-facilitator from the respective NGO.

Within the discussion of the final topic about perceptions about cycling, the parents' were also informed about the plans to conduct an opinion survey on the topic and were consulted about the questions in the survey in terms of appropriateness, wording, method of delivery, and completeness in terms of addressing salient beliefs.

4.6.3 FGDs with Children

The FGDs with children consisted of five sessions exploring similar topics to those discussed with the mothers: actual and potential mobility (motility) in general, exploring gaps and potential of mobility enhancement, and finally in-depth discussion of the case of cycling as a potential mode of commute. Photo elicitation was used, as well as an interactive exercise to stimulate discussions and maintain engagement and attention to the topic. The exercise was in the form of group work where groups of

two or three would illustratively map out Haggana as they know it, label the areas that they know and indicate their route to school, followed by an oral presentation of their illustrations.

The following three sub-questions were explored:

1. What are the perceptions about options for traveling to school and other destinations that the children have in Haggana from their own perspective and how do they use them?

2. What are the children's perceptions of the known transportation options and associated experiences?

3. How would reactions be (from children, parents and the community) with regards to interventions that promote cycling as either primary means or intermediate means of transport and what are the perceptions about cycling in general?

The FGDs were conducted with a co-facilitator from the respective NGO.

4.6.4 FGD with Service Providers

Stemming from the overall research questions, the following sub-questions were explored from the perspective of transport service providers that serve Haggana and surrounding neighborhoods:

1. What are the daily life experiences of transport service providers in terms of interaction with other transport services, authorities, and commuters, and what are the challenges faced in providing adequate services?

2. How do transport services cater to the residents of Haggana and similar settlements and what various options and alternatives exist?

3. How do commuters from different socio-demographic segments interact with the options? How do children in specific use transport services?

4. What are the opinions about future prospects for improvement of transport services, such as formalization and integration with other modes, etc, and what are the impacts on commuters?

The FGD was conducted with help of a co-facilitator and with support of photo elicitation to stimulate discussions.

4.6.5 Data Collection and Analysis

Data analysis followed guidance found in Miles (2014), detailing the various available techniques and numerous tips and advice building on accumulated experience of prominent qualitative researchers. Miles (2014) notes that analysis starts already in the field through a process of supplementary marginal notes taken by the researcher during data collection to keep log of own thoughts aside from the ongoing data collection. This is important since much of field observation and analysis *during* data collection may be related to context or other unspoken communication that would not be recorded in a transcript; different forms of such 'tacit knowledge' are therefore documented as well. The common outline of qualitative data analysis are as follows, as summarized in Miles (2014, p.325).

- Documentation of the data and the process of data collection
- Organization/categorization of the data into concepts
- Connection of the data to show how one concept may influence another
- Corroboration/legitimization, by evaluating alternative explanations, disconfirming evidence, and searching for negative cases
- Representing the account (reporting the findings)

Accordingly, all FGDs were translated and transcribed in English with accompanying annotation of observations. This was done based on the researchers notes and notes of assistants (in the cases where an assistant was used) during and immediately after the FGDs, as well as using available audio and video recordings as available to facilitate transcription.

4.6.6 Data coding and categorization

Data was then analyzed for emerging concepts through the development of a matrix of concepts. This matrix-analysis technique facilitates identification of themes that need further examination through an iterative process (Miles 2014). Transcript data is coded into various themes to identify recurrence. The units attributed to themes were mostly represented in the form of quotes, which are further supported with the researchers notes and analysis to evaluate the validity and importance of the themes.

As an exercise to reduce biases, conclusions were finally revised exhaustively to test for three criteria as advised by Becker (1958, as cited in Miles, 2014), which question the following aspects: the credibility of the informants and potential reasons for biases, whether the statements were made spontaneously or in response to the researcher, and whether the researcher's presence adversely influenced the discussion and the information shared (reactivity to the researcher).

4.7 PILOT TPB-BASED SURVEY PHASE

In the pilot phase, an initial survey form was constructed based on insights from the FGD results and fit within the framework of the TPB model. Additional questions were added to indicate socio-demographics and other proxies for background socio-cultural factors. The pilot aimed to test the following factors: the suitability of the method of delivery, the duration of the questionnaire process and related respondent fatigue, and the questionnaire design and understandability. During the process, the respondents were also asked for advice on how to improve the experience for others and to ensure reliable information.

Self-administered paper-based questionnaires were tested to understand the possibility of distributing questionnaires, and it proved to be unsuitable due to the prevalent illiteracy and semi-literacy, as well as inconvenience for parents who need reading glasses, or otherwise due to the burdensome experience of reading multiple pages of text, even if designed in a playful and illustrative manner. Next, the questionnaire was delivered personally by the researcher on another day in the form of Computer Assisted Personal Interviews (CAPI) using a smart tablet and an online questionnaire in order to allow direct data entry online for the researcher's convenience. It was also assumed that this novel approach would improve respondent engagement, but during testing, it was found inconvenient for two reasons: respondents respond faster to a familiar approach (pen and paper) rather than an unfamiliar approach

which instigates more suspicion and discomfort rather than engagement. Secondly, sunlight reflection makes it difficult for the interviewee to 'take a peek' every now and then throughout the interview as they prefer to do during the paper-based interviews. Furthermore, the questionnaire was exhaustive for two reasons: firstly, the duration of the questionnaire was too long, and secondly the types of questions and perceived redundancy was found exhaustive.

The type of questions that are perceived as exhaustive and confusing (or frustrating) where questions deliberately enlisted to abide by the detailed inquiry process recommended for TPB-based questionnaires as indicated in Ajzen (2006) and Francis et al. (2004), which distinguish between simple direct questions indicating a predictor variable and a more sophisticated indirect approach to indicate further underlying cognitive structures disaggregated by two indirect questions. The latter approach leads to a design of questions that may be viewed as very 'strange' to ask, and therefore leading to disengagement, or they can be cognitively substituted by another intuited question by the respondent, in which case the answer becomes invalid. This latter bias is a common 'substitution' heuristic that occurs when exhausting questions are asked, for which respondents give an answer to an alternative easier question that they have internally substituted (Kahneman, 2011).

Another difficulty faced by the respondents and elucidated through the questionnaire testing was in understanding bipolar scales (e.g. -3 to +3) due to the difficulty to understand the concept of the negative domain in scales. This is possibly associated with the modest levels of education prevalent in the settlement or lack of relevant past experience with such questionnaires. Scales were therefore all provided in the positive domain from 0 to 5. Although bi-polar scales are preferable in the case of prompting a response on a semantic differential scale (e.g. ranging from good to bad), it was rather compensated by verbal explanation of the semantic differential and depending on the visual layout of the question.

4.8 FULL TPB-BASED SURVEY

In the implementation of the full TPB-based survey it was conducted directly by the researcher to ensure consistency in the interviewing process, using bias reduction techniques, and to have first-hand experience of the communicated verbal and non-verbal feedback. The method of delivery that was concluded after the pilot phase was in the form of personally delivered paper-based interviews using a prepared TPB-based questionnaire extended with optional open questions.

4.8.1 Behavior investigated

The behavior investigated was parents' intentions to encourage their children to cycle for short trips. The hypothetical scenario presented to parents was a hypothetical promotional intervention of providing bicycle racks in common destinations within the next three months, which is a minimal intervention presented to initiate the deliberation process needed to elicit their perceptions about cycling. In order to stimulate a deliberation process, a certain behavior stimulus must be proposed as a trigger. According to Francis et al. (2004), the target behavior should be defined in terms of its Target, Action, Context, and Time (TACT) as a principle of design. Furthermore, it was confirmed through the FGDs that such a hypothetical intervention is strictly *not* within the expressed interests or priorities of the participants, which is a necessary condition to avoid 'strategic bias'. Strategic bias would result in

respondents giving answers that are strategically answered with the intention to encourage a certain outcome, such as believing that a certain answer will result in paving their streets, lobby for their property rights, or mobilize a budget for housing development. Therefore, distancing the hypothetical scenario from priority issues (including political issues as well) was important in determining the simple hypothetical scenario. Furthermore, the scenario must be understandable and believable to ensure engagement. For example, suggesting bicycle lanes is not a believable proposition (as also confirmed in the focus group discussions and field observations) since there are no formal streets, and the roads are predominantly unpaved and there are no sidewalks. Furthermore, the concept of cycling lanes is altogether unknown to the local community. Several considerations and constraints therefore led to the articulation of the context setting for the questionnaire and the investigated behavior.

4.8.2 Questionnaire design

The questionnaire was designed in the form of three sections, firstly a section including questions related to background factors including socio-demographics and proxies indicating cultural background. The second section inquires about the details about the school trip of one child. To facilitate the flow of questions, the individual child to be inquired about is requested to be the oldest child in school; the 'target child'. This was done to avoid having the parent think about which child to choose. Questions inquired about accompaniment, duration, costs, mode choices, and the school name.

The third and longest section consisted of the TPB-based questionnaire which refers to the target child. It enlists all the questions measuring the predictor variables for the respective latent constructs of attitudes, subjective norms, and perceived behaviour control, as well as measures of behavior intention and past behavior. Furthermore, an additional question is presented as an optional question (i.e. after thanking the respondent), to inform them that if they would like to give extra time to discuss more, there is space to include their further insights. The respondent is given space to explain more about how their child's mobility is enabled and how it can be enhanced, as well as space for open feedback. In that case, additional time is given to the respondent if he/she wishes to continue. The additional question allows further feedback to ensure that the respondents do not feel that they have been constrained to a strict structured interview, in which case they can continue to communicate further information and provide further insight. Such insight would also supplement the qualitative data collected in the FGDs.

4.8.3 Variables investigated

Variables investigated are described in Tables 1 and 2, with respective questions that measure each variable translated into English here (the original Arabic questionnaire is provided in Annex-1). The likert scales and the wording used were redrafted twice in consultation with focus groups and through feedback in a pilot survey in order to better fit the ease of understanding of the local community before finalizing the questionnaire and to use the proper slang language were necessary.

Table 1: Description of latent variables used, all measured on a 5-point likert scale (1-5)

Variable name	Question
Behavior Intention	
BI_Encourage	If safe bike parking is provided at PT stops and common destinations, would you encourage your child to start cycling for short trips within 15 minutes distances? (1: disagree/ 5: agree)
BI_Buy	If safe bike parking is provided at PT stops and common destinations, would you buy a bicycle for your child (unlikely/likely)
Attitudes	
Att_safety	You generally find that riding a bicycle for short trips as safe/unsafe in your area? (unsafe/safe)
Att_good	For a children like your son/daughter, it is good to encourage them to ride a bicycle (bad/good)
Att_practical	Encouraging to ride a bicycle is good in informal settlements due to its practicality in narrow and crowded streets (1: disagree/ 5: agree)
Att_economical	Riding a bicycle is generally good for saving money in short trips (disagree/agree)
Subjective Norm	
SN_good	How much do you agree or disagree with the following statement: I feel that people in my life, I mean friends, family and neighbors, etc, that I care about, if they see me encouraging my child to ride a bicycle they will see it as good (disagree/agree)
SN_Decent	I feel that people in my life, I mean friends, family and neighbors, etc, that I care about, if they see me encouraging my child to ride a bicycle they will see it as indecent (1: agree/ 5: disagree)
SN_harrassment	I expect that other youth in the street will harass/tease my child if he/she starts cycling for short trips (agree/disagree)
Percieved Behavioral Control	
PBC_encourage	I am confident that I can encourage my child to ride a bicycle if I want to (disagree/agree)
PBC_afford	The costs of cycling would discourage me from encouraging my child to start cycling for short trips (agree/disagree)
PBC_role	When it comes to an issue like this one, I am not the one who makes the decision (agree/disagree)
PBC_comfort	Uncomfortable roads will make it difficult for me to encourage my child to ride a bicycle (unlikely/likely)

Furthermore, the moderating variables used are enlisted in Table 2, indicating origin of subjects, schooling, gender of the child and age group. According to prior FGDs during the earlier phases of the research, the age of 13 as a threshold for indicating school children's age groups was seen by most participants as the age where the child is said to have 'grown up' and looked upon differently by society, where boys start becoming too old to 'play' with bicycles and girls in a stage where they should act more 'decent' in the outdoor environment, both ideas being recurring themes in the FGDs and accordingly used in the survey for testing. Past practice of cycling was used as a proxy for habitualization of cycling, while consultations in FGDs indicated that there is often little clear demarcation between leisure and non-leisure cycling for children as it is seen as a form of play in either cases. It is notable that past research has in any case indicated positive associations between leisure and non-leisure cycling, suggesting that both practices are favored from a viewpoint of promoting sustainable mobility (e.g. Kroesen and Handy, 2014; Lee et al., 2012; Park et al. 2011).

Table 2: Moderating variables used

Variable name	Description
Origin_upper	Parent reported to be originally from a governorate of upper (south) Egypt.
No_edu	Parent has never gone to school.
Child_ female	Gender of the child discussed is female
Child_age	Age of the child discussed is above 13 (up to 16)
Cycl_freq	How often has your child cycled in the past year (never/almost-daily)

Analysis of data was conducted through full non-recursive Structural Equation Modeling (SEM) incorporating both the latent and observed variables. SEM is chosen as an instrumental method to investigate and confirm causal relationships as well as direct and indirect effects of different variables in TPB (Donald et al., 2014; Nordfjærn, 2014; Bamberg and Schmidt, 2003). Interrelations between variables were investigated including direct and indirect effects of the moderating variables which was tested using the bootstrapping method.

4.8.4 Sampling and data collection process

The implementation of the survey was conducted in the form of interception interviewing within the streets. Due to the lack of registries of households or telephones to facilitate the preparation for random sampling, the convenient alternative chosen was to identify random locations throughout the street network of Haggana at various times of day and night to intercept passerby. The process involved walking at predetermined random locations on a map of the street network and then sequentially intercepting every fifth adult (as an arbitrary number) that is seen passing by. The adult is then first greeted, introduced to the activity very briefly, and then asked screening questions if they express willingness to listen. The screening questions inquire if the person lives in Haggana and if he/she has at least one child of school age and enrolled. If so, then the process and purpose of the questionnaire is explained and then the questions are delivered in the form of an interview, and the respondent is informed about their default anonymity. For the convenience of the respondent, the interview can be conducted while walking together to their destination not to waste their time, or sitting somewhere if they wish, or simply standing in place. The process takes approximately 20-40 minutes. The preceding trial survey had confirmed that this approach and the duration are feasible without monetary or in-kind incentives. After that, the respondent is allowed to talk openly if he/she wishes to add more comments or provide more insight and then he/she is thanked for their time. After that the research continues the same process with the fifth adult passing by. Necessary social skills are employed by the researcher to ensure engagement, comfort, and a high response rate.

Data was collected by the researcher on the paper questionnaire sheets, and at the end of every day of surveying all data was entered into an excel sheet. At the end of the entire survey, all data was validated, cleaned, recoded, and exported to SPSS in preparation for data analysis.

4.8.5 Analysis of survey data

The analysis of the TPB-based structural model was conducted using IBM SPSS Analysis of Moment Structures (AMOS) software, version 20, through the following steps:

1. Confirmatory Factor Analysis (CFA) was conducted to confirm that the measures of each construct are as hypothesized in the model design using pilot survey data.

2. An overall measurement model was developed, detailing the relationships between exogenous and endogenous variables.

3. Tests for mediation effects were also conducted to examine indirect effects between variables.

4. The structural model validity was tested by testing the goodness-of-fit index (GFI) and adjusted goodness-of-fit index (AGFI) for which values of 0.90 were accepted as good fit. Furthermore, to limit Type-1 and Type-2 errors, comparative fit index (CFI) values >0.95 were accepted as good fit, and a Root Mean Square Error of Approximation (RMSEA) <0.06 (Hu and Bentler, 1999).

Furthermore, for the analysis of trips to school, descriptive statistics were conducted to support the FGD findings and to examine the common features of school travel in Haggana.

CHAPTER 5: RESEARCH FINDINGS AND ANALYSIS

5.1 INTRODUCTION

This chapter presents the results of both the focus group discussions (FGDs) and the interview survey. Results are presented along with discussion and analysis, addressing the three sub-topics of the research; children's travel behavior and independent mobility in Haggana, the potentiality of mobility analyzed based on the conceptual framework presented in Chapter 3, and finally the results of the TPB-based survey exploring the socio-psychological factors associated with cycling.

Firstly the FGD samples are described, consisting of FGDs of service providers, mothers, and children, and the description of the 100 survey respondents is also presented. Secondly, for investigations of children's independent mobility (CIM), the case of trips to school in specific is investigated, being the most frequent trip among most children. It is informative about parents and children's appropriation of transport options and about associations with various background factors that can reveal distinct characteristics of children's travel behavior in an informal settlement such as Haggana. An analysis of the potentiality of mobility of parents and children is then presented and analyzed through the lens of motility. Finally, a case study of the specific mode of cycling is investigated based on the TPB-based survey, specifically investigating the intention of parents to encourage their children to cycle for short trips, and analyzed through structural equation modeling. The controversial case of cycling is informative about parent's attitudes and perceptions about social norms and expectations and how the various behavioral constructs can interact with each other and how background factors may be associated with the deliberation process of parents, all of which provide insight on a clear example of inhibited potential appropriation of a viable transport option. It also provides insight about the complexity of the underlying decision process in a way that dissects the problem of an identified appropriation gap using the theory of planned behavior.

5.2 FOCUS GROUPS SAMPLE DESCRIPTION

This section presents the description of the participants of the focus group discussions (FGDs) conducted with service providers, mothers, and children. The FGDs consisted of one with service providers (N=10), four with mothers (N=30), and five with children (N=48).

5.2.1 Service providers (microbus drivers)

The first FGD conducted was with the transport service providers for the sake of gaining background information about the context of transport service and options available for the residents of Haggana. The sample consisted of 10 drivers. They were all male (all drivers in transport services in Egypt are male except for very rare exceptions) and in the age range of 30-50 years old. Two of the drivers were also residents of Haggana and the rest came from other neighboring areas. All drivers operated in routes that serve at least one entrance to Haggana. The drivers were predominantly employees of vehicle owners; eight of them employees while two where both owners and drivers of their own vehicle. The

educational level of the drivers varied from those with basic education or mere literacy qualification to those with secondary education.

5.2.2 Mothers

The participants of the four FGDs with mothers were a total of N=30; groups of 10, 10, 6 and 4 respectively. The latter was of a smaller number due to unexpected logistical challenges during the day of implementation, however the session with a smaller number allowed for a deeper discussion. All participants reside in Haggana, had at least one child in school, and all fell within the age range of 25-40 years of age. Most mothers were unemployed except for two cases. The level of education was low, whereas 20% were illiterate, 30% were only literate but without school degrees, and the rest (50%) have at least attained primary school degrees or higher. A common notable feature was that all participants wore traditional full length dresses and headscarves known to be the traditional dress found in poor areas in Egypt and in rural areas in general, although changing in younger generations. Another observation that would be related to mobility is that the vast majority of participants were observably (and in self-reporting) overweight.

5.2.3 Children

The participants of the five FGDs with children were of a total of N=48, consisting of groups ranging between 5-12 participants each, whereas a total of 27 were girls and 21 were boys. All children attended schools at different grades and all resided in Haggana, the vast majority being born in the settlement. The five groups consisted of age ranges of 8-10 (one group), 11-14 (two groups) and 15-16 (one group) respectively. In the case of the groups of children within 11-14 years old, two FGDs were held in order to separate girls in one focus group and boys in one focus group since in a previous FGD the boys dominated the discussions so the researcher decided to discard the mixed FGD and repeat it with girls alone and then with boys in a separate group for that age range. This separation was deemed necessary to ensure that all voices are heard and that participants interact without intimidation from the social experience of the FGD.

5.3 FIELD SURVEY SAMPLE DESCRIPTION

This section presents the sample description of the parents that were interviewed (N=100) and their respective children that they have each reported on. As per the initial screening questions, all of the 100 parents were living in Haggana and have children who go to school. All respondents were individuals, i.e. either a father interviewed alone or a mother interviewed alone based on the sampling methodology of random interception interviewing. 61% were the father and 39% the mother due to the higher rejection rate from the females approached.

As each parent was questioned about one child (the oldest child in school) there were corresponding 100 children. They were 53% boys and 47% girls. The distribution of ages of parents and children are as illustrated in Figure 7.

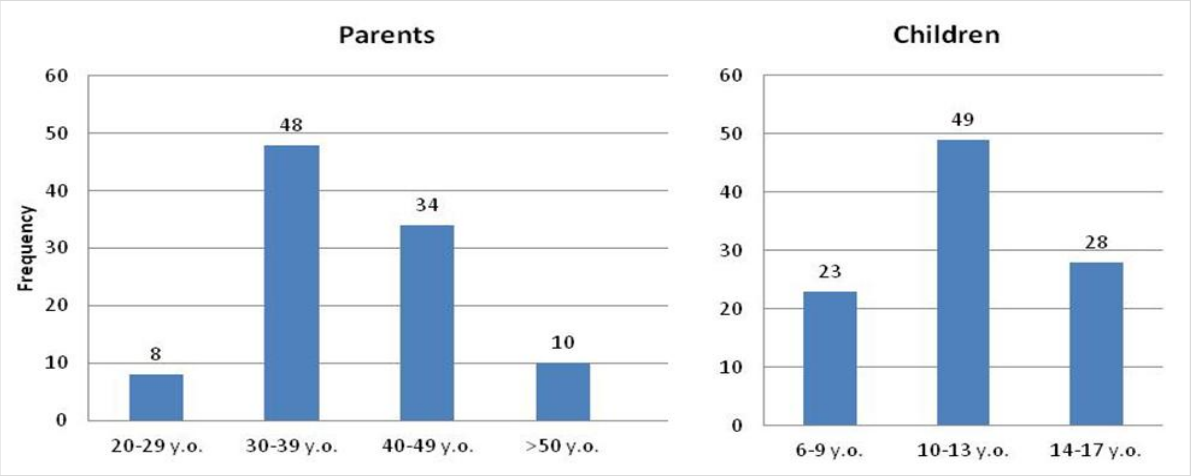

Figure 7: Age-group distribution of parents and respective children

5.3.1 Origins

Respondents were from diverse origins based on the governorates that they identify themselves as originating from; 15 different governorates summarized as follows: 39% within Greater Cairo, 43% within Upper Egypt (the South) and 18% within Lower Egypt (north to Greater Cairo). Furthermore, throughout the sample, 41% are originally from rural areas in specific. Some of the respondents as well attribute themselves to a larger family of immigrants from a certain governorate that dominate a certain neighborhood in Haggana and have a sense of kinship among themselves.

5.3.2 Education

With regards to levels of education, 28% had received no schooling at all, and only half have continued their education beyond preparatory school as detailed in Figure 8, illustrating the wide diversity in educational levels.

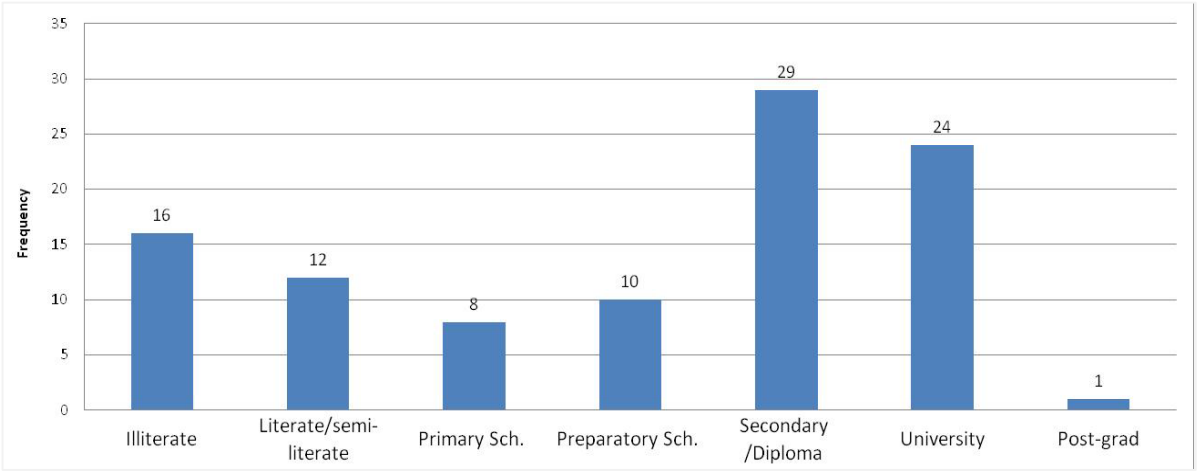

Figure 8: Levels of education of parents interviewed

5.3.3 Mobile ownership and connectivity

With regards to ownership of mobile phones as an indicator of connectivity, almost all parents (96%) owned a mobile phone, and about a third of them were smart phones. The respective children had lower ownership rates, where 59% owned a mobile phone, of which a substantial percentage were smart phones in specific as detailed in Table 3.

Table 3 Mobile ownership of surveyed parents and respective children

Sample	Mobile phone ownership			
	None	Normal	Smart	Total
Parent	4%	60%	36%	100%
Child	41%	34%	25%	100%

Furthermore, with regards to internet use, 59% of parents have never used the internet before, while only 12% use it regularly in their daily lives.

5.3.4 Vehicle Ownership

Vehicle ownership was defined as ownership per household. In this respect, 23% of households owned a private car. With regards to other vehicles, only 10% owned a bicycle in the household and 9% owned a motorized two-wheeler (motorcycle or scooter). Other vehicles and respective ownership where much less prevalent: Tuktuk (N=2), Taxi (N=1), Microbus (N=1), while no utility bikes or other types of motorized vehicles were found. The vehicle type most prevalent in households was therefore the car, which evidently even surpassed bicycle and motorcycle ownership.

5.3.5 Survey non-response

Conducting the survey through personal interviewing by the researcher ensured a high rate of survey completion. However, throughout the interception approach, there were numerous cases that were either not valid for interviewing due to the screening questions or have refused the interview for various reasons. The reasons and respective number of respondents are enlisted in Table 4.

Table 4: Reasons for rejection from the interviews and respective numbers.

Reason for rejection	Number of respondents
Does not live in Haggana	10
Children not in school	6
All children below or above school age	11
No children or not married	4
Refused interview	7
Total	**38**

5.4 CHILDREN'S TRAVEL BEHAVIOR AND INDEPENDENT MOBILITY

This section presents the insights from the FGDs about children's travel behavior and independent mobility, substantiated with quantitative data from the interview survey conducted with parents focused on the trips to school as the most frequent trip purpose.

5.4.1 Children's trip purposes and perceptions

FGDs about children's mobility (48 participants in 5 FGDs) indicated several recurring themes of trip purposes that are sought regularly (once a week or more): going to school, going to private tutoring ('the lesson' or 'the center'), going to the mosque or church for religious education and practice, and 'getting stuff' as commonly phrased to refer to miscellaneous errands being mostly for maintenance activities, and finally for play or sports practice.

Further clarification of the context may also explain the other trip purposes and wording chosen to describe them; in Egypt, it is a norm for school children to seek further tutoring outside of school, especially those who attend public schools, which are tuition-free but of modest quality. This phenomenon of widespread resort to complementary private tutoring is largely due to the deterioration of public education and overcrowding of classes. Public schools are therefore insufficient to enable students to pass the necessary exams. This deficiency has been compensated over time with private tutoring of various forms, both formal and informal, and at times in highly organized forms in what resembles compact schools yet in an informal setting. This trip purpose is therefore commonly known and referred to in the definite form as either 'the lesson' or the 'the center', being so prevalent and part of cultural norms. It is also a significant household expense for families, in addition to the associated transport costs if needed, and it is therefore an important aspect of children's mobility.

With regards to religious education, the community has been described as generally being conservative and religious as with most informal settlements, where both Muslims and Christian families care about their children's extra-curricular religious education during their upbringing. Several mosques and NGOs offer this service, in addition to two churches and other informal means. Furthermore, regarding access to space for play or exercise, most of the play is in the streets within the neighborhood with neighboring children or in school.

To a lesser extent, other common venues for play also include youth centers or sports clubs that provide space for popular sports for children, mostly for boys. These venues are all located outside of the settlement except for one sports club that is adjacent to Haggana. Despite proximity of the identified local sports club, many families do not know about it and other families may choose to associate their children with venues outside of Haggana in order to differentiate themselves socially and to access facilities of better quality and clientele, i.e. other children that go there are perceived to be of better education and upbringing and thus better influence on own children.

The trip to school is the most frequent trip (48/48 of the participants in the children's FGDs). Most children conduct all regular non-school trips within the settlement itself (36/48). Perceptions about the main modes of transport and transport services available and used are moderate, and noted below, with the respective predominant perception. Furthermore, non-motorized modes are also enlisted.

Table 5: Main modes of transport and respective perception (N=48)

Mode	Predominant perception	Predominant opinions elicited
Tuktuk	*Neutral* (37/48).	It is seen as 'OK', mostly praised for practicality and fun, but criticized for its undisciplined drivers.
Microbus	*Positive* (41/48).	It is mostly praised for its speed and availability.
Public Bus	*Neutral* (40/48).	It does not elicit distinct perceptions other than being 'OK', but is often compared to microbuses in terms of speed and availability, both being less.
Private vehicle (chauffeured by car or motorcycle)	*Positive* (44/48).	Being chauffeured is mostly praised for its comfort.
Pickup truck	*Negative* (45/48).	It is mainly criticized for being uncomfortable to 'climb' into and to sit.
Walking	*Neutral* (37/48).	It is seen as 'OK'. Walking is seen as normal and does not elicit distinct positive or negative responses.
Cycling	*Positive* (38/48).	Cycling is mainly praised for being fun, although not used as a mode for transport as a norm.

Table 5 reflects the prevalent perceptions about various modes of transport among the participant children, where notably the various modes known and available are seen as being 'OK', as in neutral or otherwise perceived positively, while the only mode associated with negative experience is the scarcely used (but well known) pickup truck service.

Throughout the FGDs, the most recurring theme associated with mobility and the quality of the urban environment was not directly related to the transport modes and services but was rather the specific complaint about excessive prevalence of waste piles throughout the street network of Haggana, and it was the most often mentioned issue by the children (39/48) as the first priority that should be addressed in the settlement.

With regards to attitudes towards the specific mode of cycling, children predominantly viewed this mode positively, but is associated with leisure rather than transport. Most children have cycled before (34/48) for leisure, typically renting bicycles on weekends and holidays, yet only a few (2/48) have ever used cycling for commuting. In all FGDs it was noted that the topic of cycling as a viable mode of transport was viewed positively, yet it was acknowledged that the social situation is different in Haggana and that cycling for commute is not normal, especially among adults and among females in general. Expectations about parents' perceptions about the acceptability and encouragement of cycling for children and for adults varied widely. However, most children (38/48) confirmed the positive impact of parent's support on their willingness to cycle for short trips.

5.4.2 Trips to school

The trip to school, being the most common trip, provided the most informative insights on the nature of children's frequent travel and allowed comparison between them. The main modes of transport to school and respective dependence on an adult care-giver is detailed in Table 6. The table is indicating the wide diversity of modes used and prevalence of independent mobility. The definition of independent mobility used here is the lack of supervision or accompaniment of an adult. The main modes are grouped based on consultations in the FGDs with regards to articulating the typologies of modes. Reference to all types of publicly available transport services, whether formal or informal are often referred to as '*mowasla*', simply meaning 'transport' but are however tabulated as separate

modes here. The formal and informal school bus services are seen as another type of mode, and finally the modes of walking and 'car' (being chauffeured) are each articulated separately. Figures 9-13 show examples of the most common forms of mode use noted through field observations.

A distinct initial finding was that 47% of all trips are conducted by children independently, whether walking or by motorized means and in all age groups. With regards to motorized modes in specific, out of all modes of formal and informal public transport services used, they are mostly (72%) used independently without accompaniment of an adult care-giver. The most common mode of collective transport is the bus, either the the 14-seat 'microbus' or the large public bus. However, the microbus is the predominant mode.

Some interviews indicated that in certain cases parents ensure that their child travels with other minor friends or siblings as a compromise. However, data showed that this was not the case for most of the independent travelers in the sample, where only a minority (13%) travelled to school with the accompaniment of other children; friends or siblings. Although in FGDs some children claimed to use bicycles for some errands, none in the field survey sample have used cycling in trips to school, whether as a main mode or a feeder mode. Another mode that was noted in FGDs as being used is the informal pickup truck service. This mode however was also not found to be used by any child in the surveyed sample despite being highlighted in the FGD discussions and noted through field observations. Within Haggana, as noted by FGD particpants, the pickup truck is seen as the transport of the 'poor'.

Table 6: Main modes of transport to school and dependence on an adult care-giver (N=100)

Main mode	Dependent	Independent	Total
Public collective transport			
Microbus (paratransit)	8	24	32
Tuktuk (paratransit)	2	5	7
Public bus (formal)	3	4	7
Non-motorized transport			
Walking	11	14	25
School buses			
Formal School bus	4	-	22
Dawra (informal)*	18	-	
Private motorized vehicles			
Private car	7	-	7
Total	**53**	**47**	**100**

*Dawra is an informal form of school buses, most often private 9-seat buses.

Furthermore, out of all instances of trips using public transport and paratransit, 22% of them involve modal interchange and are mostly conducted independently.

Table 7 further sheds light on the age distribution of independent commuters. Of the 33 children using transport services *independently* (public bus, microbus, and Tuktuk), most of them (72%) are doing so without accompaniment of adults. Overall, 45% of the independent commuters are of 13 years of age or younger across all modes, while in the case of walking as a main mode, 71% of them are of 13 years of age or younger.

Figure 9: Child boarding the informal 'Dawra' service, typically a 9-seat private bus

Figure 10: Unaccompanied children reach the public bus station outside the settlement, also served by microbuses

Figure 11: Tuktuks servicing multiple children to navigate the narrow 'shared-use' street network

Figure 12: A mother accompanying children and

Figure 13: A common view of unaccompanied children walking home

Table 7: Independent travel to school by age and by gender (N=47)

Main mode in independent travel	Age group			Gender		Total
	6-9	10-13	14-17	Males	Females	
Transport services (public bus, microbus and Tuktuk)	1	14	18	17	16	33
Walking	1	9	4	9	5	14

The results indicate the prevalence of independent commuting within the sample and high use of transport services other than school buses. The FGDs confirmed that the various transport services available other than formal or informal school buses are all considered as belonging to one category named 'mowasla', which means *transport service* in Arabic, and it refers to all formal and informal modes of transport that are available for public based on single-trip fares. Accordingly, to "*...take a mowasla...*" refers to either a public bus, a microbus, a Tuktuk, or a pick-up truck in the case of Haggana.

Part of the reason for the diversity in modes of transport is due to the large number of schools attended by children of the settlement and their widespread distribution. Within the sample of 100 children, there are 49 different schools the children attend although all the children live in the same settlement. The schools that were identifiable where 44 of 49 schools, marked in Figure 14.

The reason for the diversity of school choice is for various reasons clarified in the FGD discussions: Some nearby schools are either for boys or for girls only, many schools are for specific educational levels (e.g. primary school only or secondary school only, etc), the schools also vary in their costs from free public schools to various levels of private schools. The schools also vary in quality as perceived by the parents, and furthermore, access to public schools is associated with administrative processes that not all parents are able to carry out. As a result of such administrative prerequisites, despite having many schools in proximity around the settlement, the choice of public schools is highly specific to each family. All of these reasons explain the wide diversity of schools to which the children from the same settlement go.

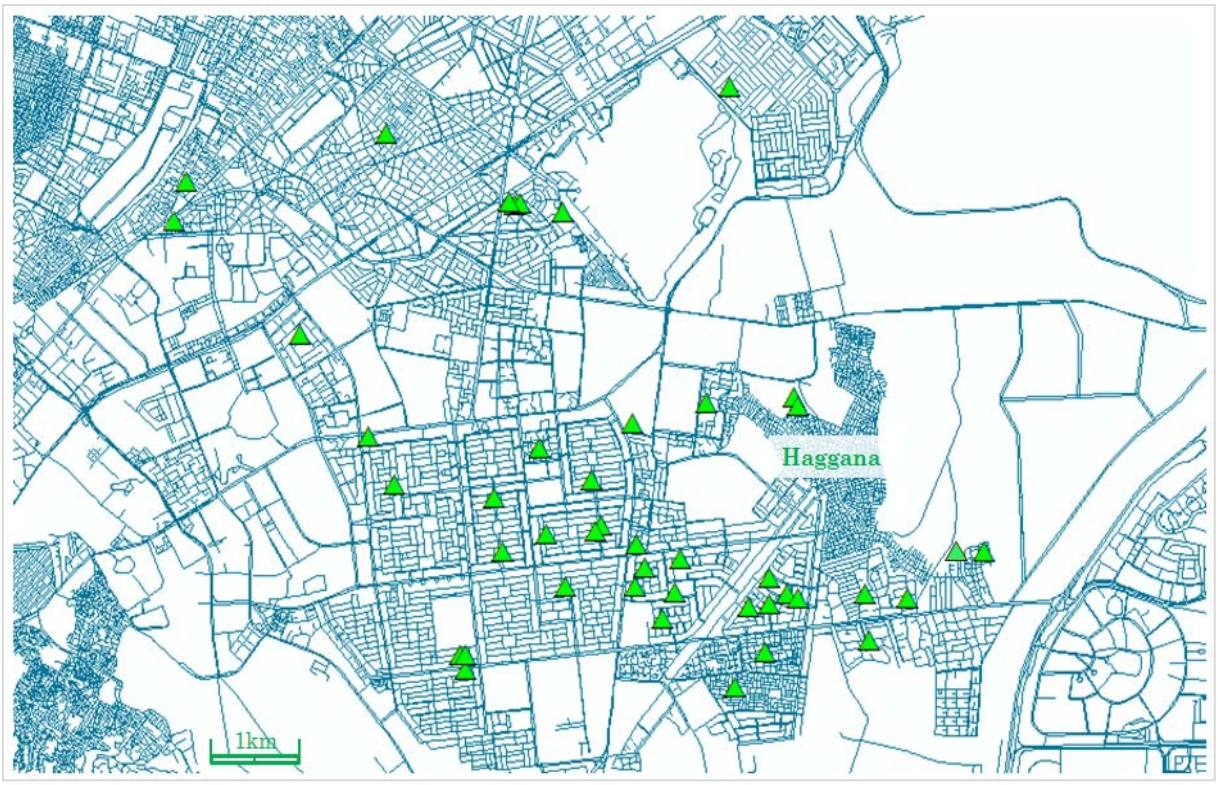

Figure 14: Locations of 44 schools that were identifiable out of the 49 reported

The average of the reported distances to school, including all modes of transport used was 3.6 km and the average time for the overall trip is 25 minutes. Costs and modes of payment varied widely from no costs for those walking only, to those using public transport and those using formal and informal school buses as presented in Table 8.

Table 8: Time, distance and costs for trips to school

Variable	Mean	STDEV
Time (minutes) (one way, from home to school)	25.1	19.1
Distance (km)	3.62	3.28
Daily cost (EGP) (using public transp. and paratransit for the round trip)*	4.91	2.19
Monthly cost (formal and informal school bus)	164	49.5

* For reference, 10 EGP is approximately 0.5 Euros.

5.4.3 Correlations of background factors with CIM

With regards to association of background factors with accompaniment of children, Table 9 presents the various background factors investigated through the survey. It shows the respective correlation with child accompaniment to the trip to school as well as correlation with car ownership as a proxy for relative affluence and transition to car-dependence.

Table 9: Correlation of independent variables with factors of accompaniment and car ownership

Independent Factors	Description	Child is accompanied	Household owns car
Parents socio-demographics			
PAge	Age of parent interviewed	-.210*	.020
YIH	Years living in Haggana	-.158	.045
ORIG_GC	Originally from Greater Cairo	.260**	.050
ORIG_Upper	Originally from Upper Egypt	-.315**	-.235*
ORIG_Lower	Originally from Lower Egypt	.076	.239*
Rural	Origin is rural	-.233*	-.069
Relatives	Has relatives in the settlement	-.155	-.199*
No_Edu	Attained no education	-.305**	-.288**
Basic_Edu	Attained primary or preparatory	-.132	-.009
Medium_Edu	Attained secondary education	.204*	-.035
Higher_Edu	Attained university education	.220*	.343**
Unemployed	Currently unemployed	.120	.143
Children_No	Number of own children	-.234*	-.133
Car	Owns a car	.086	1
Child demographics			
Child_Gender	Gender of the child discussed.	.044	.104
Child_Exact_Age	Age of the child	-.540**	.087
Main Mode to School			
Main_Walk	Walking	-.104	-.206*
Main_Chauffeured	Chauffeured	.258**	.316**
Main_Dedicated_Bus	Dedicated bus (formal or informal school	.500**	.054
Main_BBus	Public bus	-.056	-.057
Main_MBus	Microbus	-.385**	.084
Main_TT	Tuktuk	-.134	-.150
Dist	Distance to school	-.027	.058
Accomp_Adult	Child is accompanied by an adult	1	.086
Mode use habits of parent over the past three months			
MFr_W	Frequency of walking.	-.233*	-.165
MFr_TT	Frequency of using a tuktuk.	.095	-.270**
MFr_MB	Frequency of using a microbus	.033	-.289**
MFr_BB	Frequency of using a public bus	.080	-.195
MFr_Bc	Frequency of using a bicycle	-.150	-.095
MFr_MC_Dr	Frequency of using a motorcycle	-.136	.084
MFr_Car	Frequency of using a car	.117	.829**
MFr_PPckP	Frequency of using a pickup truck	-.326**	-.180
MFr_Taxi	Frequency of using a taxi	.011	.166
Connectivity			
Mob_Ch_bi	Child owns a normal mobile phone	.070	.359**
Mob_Ch_smart	Child owns a smart phone	-.012	.398**
Mob_P_bi	Parent owns a normal mobile phone	.115	.112
Mob_P_smart	Parent owns a smart phone	.205*	.283**
Internet	Frequency of internet use of parent	.158	.357**

*Correlation is significant at the 0.05 level (2-tailed)

**Correlation is significant at the 0.01 level (2-tailed)

Significant correlations with accompaniment indicated the following observations:

- Families originating from Greater Cairo are more likely to accompany children to school, and conversely, those originally from governorates of upper Egypt are less likely to do so. Originating from a rural area is also negatively associated with accompaniment.
- Lack of education among parents is negatively associated with accompaniment.
- Parents with more children are less likely to be accompanying their child.
- There is no significant relation between the child's gender and likelihood to be accompanied to school, but age is significantly correlated, where younger children are more likely to be accompanied.
- Children using microbuses are highly likely to be travelling independently, with no accompaniment by an adult.
- Parents that are more frequently walking for commute or using pick-up trucks service are less likely to be accompanying their child.
- Indicators of connectivity in terms of mobile phone ownership and internet use do not show overall strong correlations with accompaniment. Only the variable of parents owning smart phones in specific is positively correlated with accompaniment.
- Having relatives in the settlement, living for more years in the settlement, and being unemployed were all found to be not significantly correlated with accompaniment.

Furthermore, correlations indicated that those who own cars are significantly likely to be from Lower Egypt (the Northern governorates), having higher education, choosing to chauffeur their children and frequently using the car, and having higher connectivity in terms mobile phone ownership and internet use.

On the other hand, car ownership was found negatively associated with being originally from upper Egypt (the Southern governorates) and with having no education, as well as being negatively associated with having children walk to school. It was also negatively associated with parents' frequency of use of tuktuks and microbuses.

In conclusion, key features indicated by the correlations is that the origin of families have significant correlations with the accompaniment of children, with those from rural areas or upper Egypt less likely to accompany children to school. This might be attributed to the lack of education and lower economic status, which were both found to be associated with independent mobility among children in correlation analysis, and they were more likely to be the parents who walk frequently and use the cheapest transport service, the pickup truck. With regards to car ownership, as intuited, it was associated with less use of public transport and associated with other proxies of affluence and education, namely ownership and use of smart phones and frequent use of internet. In further correlation analysis, higher educational attainment was also found to be positively correlated with high significance ($p<0.01$) with car ownership and frequency of use. Results therefore indicate the association of relative affluence and education with car use and with less walking and less use of public transport, as well as less child independent mobility.

5.5 ANALYSIS OF THE POTENTIALITY OF MOBILITY

This section first presents a more detailed description of the context investigated; the modes of transport used, children's trip purposes, and the details of their most common trips, and parents' mode choices. This is followed by a presentation and discussion of the FGD and survey results addressed through the lens of motility as conceptualized in the theoretical framework constructed in Chapter 3.

5.5.1 Access to transport services in Haggana

The most commonly used mode of transport within the sample in Haggana is walking, either for internal trips or for accessing public transport at the fringes of the settlement (see Figure 15). All modes of transport and uses of public space are shared in the street, being the only available public space. The street network is dense and predominantly well-connected, but the streets are unpaved and entirely lack sidewalks, which is in consistence with the common characteristics of informal settlements in Egyptian cities.

In the settlement, diverse commercial activity is interspersed in the urban fabric, giving the settlement a characteristic liveliness that extends throughout the day and into late night. With regards to public transport service, the most common mode within the settlement is the motorized three-wheeler known as the 'tuktuk', an informal mode of transport commonly driven by children and often used to offer collective transport and in some cases used for transporting goods.

Although known in Egyptian media as the transport service of the poor, the tuktuk is actually relatively expensive in Haggana, having a fare rate that starts at more than double the fare of the public bus or microbus if ridden individually, and the rate further increases sharply with distance. This stands in contrast to the flat rate of formal public transport in Egypt, which is heavily subsidized; approximately 2 EGP (0.1 Euros) per trip for public busses and 1 EGP (0.05 Euros) for the metro (heavily subsidized flat rate for all distances, which may exceed 30km across the entire city) as per the rates at the time of the field survey. Tuktuks however provide the only transport service that can swiftly navigate through the narrow streets of the settlement and provide door-to-door service and can be used for multiple passengers.

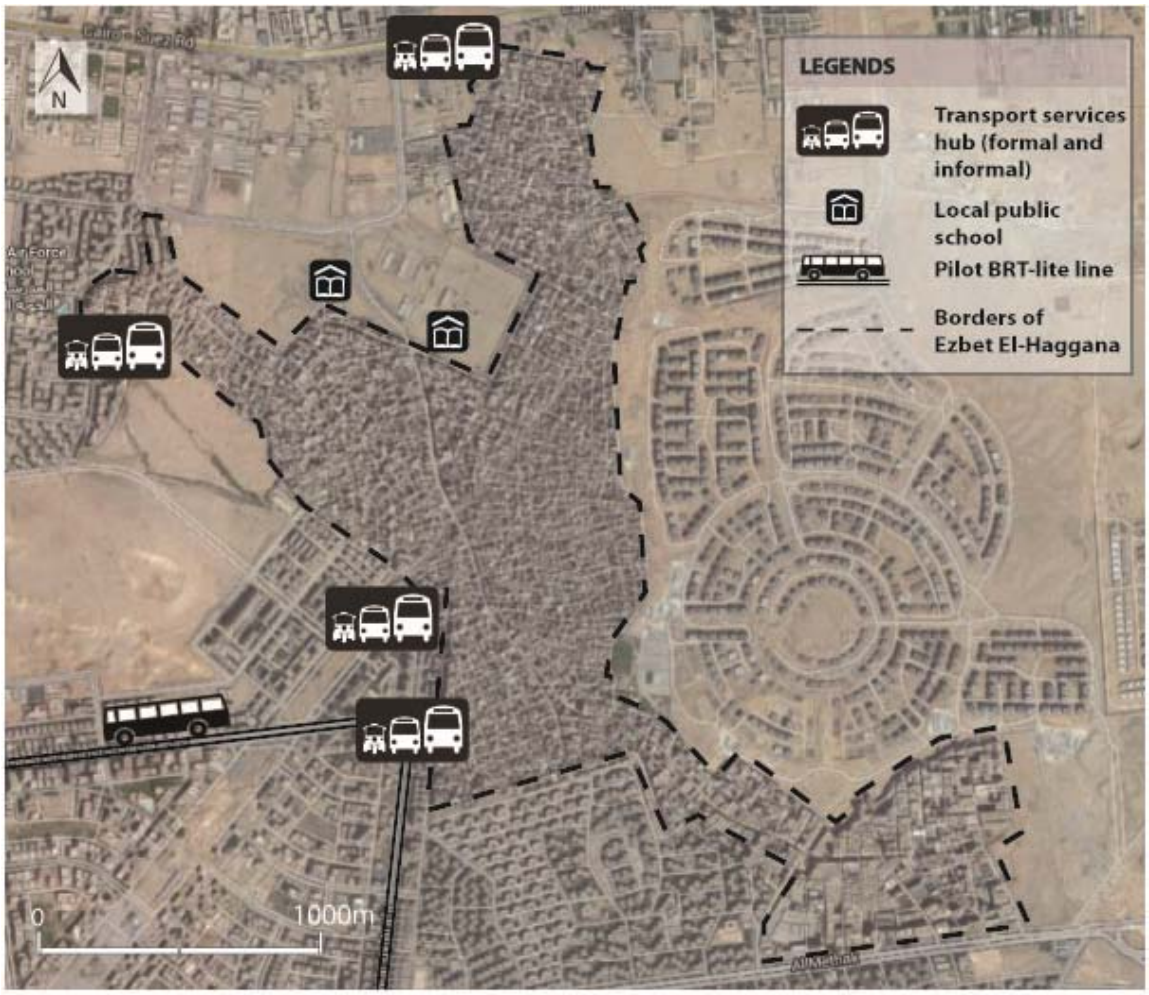

Figure 15: The dense and predominantly enclosed settlement of Ezbet El-Haggana.

Another mode of collective transport is the pick-up truck, which also operates informally, providing a transport service during rush hours and then attending to regular commercial activities throughout the rest of the day, thereby optimizing vehicle use. This mode however is associated with the poorest segments within Haggana being the cheapest and most uncomfortable. It only navigates the main (widest) streets (see Figures 16 and 17). The few main roads that cut across large areas of the settlement are where most of the motorized transport navigate, risking frequent occurrences of congestion and road blockages for diverse reasons. Common reasons include pedestrian congestions, civil works for infrastructure and new buildings, potholes and construction debris or other uncollected waste, uneven road width, and occasional sewage overflow, among other causes of congestion, or simply excessively narrow roads.

Figure 16: People casually helping each other's children board the paratransit pickup truck

Figure 17: Least comfortable but cheapest option for paratransit, only serving the very few wider streets that cut across Haggana

Research findings from the interviews and FGDs show that a distinct paradigm exists in Haggana, where accessibility to transport services is not seen by the residents as being only the formally provided service offered by the government but rather being all the options available including the abundant informal services; the Tuktuk, pickup truck, and in the cases of a few wider streets, the 14-seat and 9-seat buses, all acknowledged as the available mix of options and without attention paid to differentiating between what is formal, semi-formal, or informal.

Furthermore, by virtue of the origination of the settlement, being self-built by its earliest settlers who did not own cars (resembling a pre-motorization era settlement), it is highly walkable by design, and well-networked with narrow unpaved streets and pathways, and commercial activities accessible at street level. Figure 18 illustrates an example of the difference between part of Haggana and an adjacent formal residential area, which according to field observations has significantly less services at street level, less pedestrian traffic and much space available for car parking by design.

Figure 18: Part of Haggana (left) and an adjacent formal residential area (right).

This condition of suitable compact urban fabric resembles what was identified as one of the key factors necessary for the transition of a city from the pre-motorisation to the de-motorisation stage (as discussed in 2.4.4), noting that this highly walkable urban fabric is characteristic of old cities. In the observation of informal settlements in Greater Cairo, it is notable that this condition is evidently not only typical of old settlements but can also be found in more recently developed settlements that are also highly walkable, yet not because they are old, but rather due to the poverty-related low motorization prevalent during their formation, such as in the case of Haggana.

5.5.2 Parents mode choice and vehicle ownership

Throughout the FGDs, the majority of participants indicated that due to the central location of the settlement, it is serviced at the fringes with various options of modes of transport, and their mode of commute can therefore be seen more often as a 'choice' rather than forced in a manner implying captivity. In this respect, the parents interviewed indicated a high level of use of transport services in terms of the reported frequency of use in the past three months prior to the survey. This is illustrated in Table 10, where frequency is reported over a range from 1 (never) to 5 (very frequent, i.e. at least 5 times a week).

Table 10: Measures frequency of use of different modes by parents over the previous three months (N=100)

Mode of transport	Mean*	SD
Walking (>15 min)	4.37	1.09
Microbus	3.20	1.46
Public Bus	2.84	1.38
Tuktuk	2.60	1.31
Car	1.82	1.47
Taxi	1.35	0.86
Pickup truck	1.28	0.85
Motorcycle (driver)	1.22	0.84
Motorcycle (passenger)	1.11	0.60
Bicycle	1.10	0.58

*Frequency ranges from 1 (never) to 5 (almost every day, i.e. at least 5 times a week).

With respect to vehicle ownership, almost half of the households (51%) do not own any type of motorized or non-motorized vehicle. 23% of the households own a private car, 10% own an adult bicycle and 9% own a motorcycle. Other less common vehicle types included the tuk-tuk, taxi, and microbus, which are collectively attributed to 4% of households, and mainly used as a source of income. The most commonly used mode of transport amongst the parents is walking (defined as 15 minutes or more of walking).

Parents tend to coach children in their earlier years in navigating streets and using transport services, and they can alternatively be coached by older siblings or other older care-givers.

5.5.3 Skills and appropriation of transport services

The 'access portfolio' of residents in Haggana is diverse as indicated in previous sections, and in some cases more so than their formal counterpart in the city who may not have the same level of access to informal transport services. However access to private cars or other motorized vehicles is low. This section details the results and findings associated with the two other components that describe potential mobility, aspects of 'skills' and 'cognitive appropriation'. Table 11 indicates the attribution of the different themes of the FGDs to the different facets of motility. All recurring themes are described in the form of the salient beliefs or expressed perceptions that are shared in all focus groups and are recurring (repeated and confirmed by a majority) in each focus group as well. Observations cover both adults and children, which together create the field of possibilities for mobility as related to the individual, the family and the community.

Table 11: Recurring themes associated with 'access', 'skills', and 'appropriation' from the perspective of FGD participants and interviewees

FACETS OF MOTILITY	SUMMARY OF RECURRING THEMES
ACCESS	**Services, infrastructure and communication:** - Microbuses are affordable and available at the entrances of the settlement, they are faster and operate more frequently than the public bus, and passengers are guaranteed to always be seated, unlike in the public bus. - Public buses are affordable and available at the entrances of the settlement, they can also stop anywhere along their routes. However, they have a more limited coverage of routes. They also have less flexibility in operation (cannot navigate through side streets and cannot alter their routes). - Tuktuks are highly available within the settlement and are very practical, however they are more expensive than any other passenger transport service except for the taxi, and the drivers are usually children and they drive erratically. Tuktuks can also be used as a collective mode of transport whether by adults or by children, and in some cases, for cargo as well. - Pickup trucks are the cheapest passenger transport, however they are only available during peak hours and in the wider roads within Haggana, and they are uncomfortable since they are not retrofitted for passenger transport since they are used for other commercial functions in most other times of the day. - Motorcycles and scooters are used only by men and boys and ownership is low but increasing. Multiple people can ride the motorcycle, sometimes even an entire young family of five. However, they are seen as a dangerous mode of transport. - Car ownership is low, and is more common in the newer parts of the settlement, they are however increasing in number and becoming a nuance. Taxis are found in the settlement because owners live there and they park the taxis there. Otherwise, taxis are most often too expensive for the residents to use. - Streets are often blocked with piles of waste. Waste piles in public spaces is by far the most frequently reported problem in the settlement. - Streets represent almost all the available public space, they are unpaved but predominantly flattened and are unregulated to allow for various negotiated uses of space. - Daily commercial and maintenance needs are mostly available within close distances in the settlement since there is a lot of commercial activity (shops and street vendors) in the streets and many craftsmen live and work in the settlement. However, there are no nearby hospitals and there are no sufficient nearby schools for different ages. - Mobile phones are abundant, and most children have them. Ownership of smart phones and access to the internet is however low. **Social resources:** - Family members, friends, and neighbors are nearby and in touch for potential mutual support. However, this community spirit in some parts of the settlement is in decline. - Continuous physical presence of residents and shop owners in the outdoor environment provide a form of security. People in the neighborhoods of the settlement generally know each other and keep an eye on each other's children. There is no presence of police authority throughout the entire settlement. - Some local NGOs, Mosques, and Churches act as a space where people can communicate and discuss their local needs.

FACET OF MOTILITY	SUMMARY OF RECURRING THEMES
SKILLS	**<u>Using transport services:</u>** - Children are able to use the various transport service available, including knowing station names and locations as well as the associated sign language to signal the requested station or direction when hailing a public bus or a microbus, and other skills for communicating and paying throughout the process. - Children are able to find their way in different trip situations and are able to ask around for assistance when needed. However, they need some brief coaching when they are younger from their parents or older siblings. - Married women have less physical ability (associated with weight) to easily commute throughout the transport services available such as younger females. **<u>Driving:</u>** - Most children can ride bicycles, and many old boys are able to drive motorcycles. However, such skills are only practiced for leisure, and boys are more skilled in this respect. - Some boys are also able to drive tuktuks as a transport service. - Adult females cannot drive any motorized vehicles like in the richer areas of Cairo (lacking the opportunity to acquire the skill). Furthermore, their physical ability to cycle is limited, both due to limited physical capability and due to lack of practice and lack of the opportunity to acquire the skill. - Adult males are skilled drivers of various vehicles depending on ownership and practice, including cycling. **<u>Planning and organization:</u>** - Children above 13 years of age, and sometimes younger, are able to choose and navigate between different modes of transport and find different ways to reach their destinations independently or with their friends. - Many parents within the same neighborhoods coordinate with each other to plan informal private school buses for their children or car-pooling arrangements, as well as coordinating to meet other mobility needs of the family. Entrepreneurs within the community enable this process. - Trip chaining is often practiced by both parents and children. - Although almost all people, including illiterates, are able to use normal mobile phones, many adults are not skilled in using the diverse features of smart phones. Children are more skilled than parents in their uses of smart phones among those who own them.

FACETS OF MOTILITY	SUMMARY OF RECURRING THEMES
APPROPRIATION	**<u>Services, infrastructure and communication:</u>** - Public buses, microbuses and tuktuk services are seen as socially acceptable modes of transport for both adults and children. - Tuktuks are seen as dangerous, yet their benefits and practicality often outweigh their disadvantages and are seen as an acceptable and convenient transport service. - Pickup trucks as a transport service are stigmatized and seen as the mode of most disadvantaged classes of the settlement. - Bicycle use is seen as exclusively for leisure for children. For men, it is seen as an offense to prestige as it is seen as childish or associated with poverty, and it undermines social status. For women, it is strictly seen as indecent or not proper for an adult female to cycle in the street, and similarly so for adolescent girls, although to a lesser extent. - Motorcycle use is acceptable among men and is praised for its practicality and affordability compared to cars. Furthermore, it is sought by boys and young men as a likely attainable symbol of manhood as well as for leisure purposes. Females' use of motorcycles is only socially acceptable if they are passengers, and specifically with their male family members driving. Such perceptions are however diminishing with time. - Walking for various trip purposes is common. Parents fear for their children from the risk of being hit by a tuktuk in specific, and it is seen by both parents and children as the primary risk of road accidents when walking. However, it only results in constraints to the younger children. Fear of crossing main roads is also salient among parents but is viewed as a necessity of children's everyday lives that must (and can) be accepted. - Use of public space (streets) by entrepreneurs for various commercial purposes allows residents to easily access many of their needs locally. Use of public space for socializing and leisure allows access to both needs as well. - Mobile phone penetration in the settlement is high and it is used to coordinate between family members, They are used in coordinating activities and making sure that family members are okay. Internet however is mostly used by children, mainly for Facebook. Parents are increasingly using WhatsApp. Use of communication tools is evidently mainly associated with the specific predominant products. **<u>Social resources</u>** - Parents and children trust the acceptable level of safety in the streets since most people know each other and also due to the sense of safety in crowded areas. There is however high sensitivity towards perceived risks that girls are teased or harassed verbally or otherwise, which places constraints to their mobility and trip planning. - Parents arrange with each other and with local entrepreneurs to plan children's trips to school using the tuktuk collectively or using 9-seat buses as informal school buses, or otherwise planning car-pooling using private cars or taxis owned by local residents. - Children seek guidance and coaching from parents in their earlier years, and also resort to assistance and support from other adults when necessary. - Children are habitualized by parents to use formal and informal transport services available as well as walking as a common mode of commute.

Skills enabling actual and potential mobility are very context specific, including navigation skills gained through practice and training since an early age. Skills include relevant social skills, planning skills, decision making, spatial awareness and cognitive mapping. This is demonstrated in the high level of child independent mobility (CIM) and frequent use of various types of transport services early in life. Furthermore, with regards to 'cognitive appropriation' of available resources and of acquired skills, this is reflected in multiple observations, such as in the distinct acceptability of available services and mobility options, as well as in the use of the vacuum of formal regulation; the vacuum has been appropriated for more versatile and creative use of transport options, among other manifestations of cognitive appropriation whether by parents or children and the enabling community.

Regarding acceptability of services (a manifestation of cognitive appropriation), transport services that are stigmatized elsewhere in the formal parts of the city are rather viewed as suitable and practical in Haggana, and often even as pleasant. This perspective is exemplified in some of the typical comments on the various modes of transport:

> Samia: The microbus is great for my daughter, it is cheap and I know that she will always find a seat. The public bus is also good but the microbus is always faster and goes anywhere.
>
> …
>
> Hosneya: The Tuktuk? The problem is that children are driving them, and they drive quite erratically, and sometimes they play loud music. But it's ok, it's very practical for us here. For example, if I am carrying stuff back home, I won't walk, I will take a Tuktuk. I mean, what type of bus would be able to drive through these narrow and bumpy streets?
>
> (Mothers' Group)

This recurring neutral or positive attitude in interviews may be attributed to the fact that mobility was comparatively much less comfortable in the past when roads were even poorer in quality and the commute experiences were more stressful. As an example, women needed to buy and transport water buckets carried on their heads on a daily basis before the recent advent of water infrastructure and this was within the lifetime of the interviewed parents as they noted in the interviews:

> Ahlam: The world is better now. Yes we still complain about the garbage piles and bumpy streets, but I know in the old days we still didn't even have water or sewers in our homes. I used to walk long distances to get water until my neck would hurt.
>
> (Mothers' Group)

Conversely, in the formal or richer areas of the city, both formal and informal public transport services are available but might not be considered or not appropriated due to subjective factors related to stigmatization or other affective factors, or due to lack of necessary skills and awareness of the norms of use as explained in the FGD group of service providers. As an example, in the use of microbuses in Egypt, payment of fares on board is conducted collaboratively during the trip with little verbal cues necessary

(a manifestation of skills); passengers pass money to each other and pass the change back and forth, and sometimes grouping the payments and managing the change for each other, all to minimize the effort for the driver to find change, to calculate, to monitor, etc. There is also a sign language used between the driver and passerby on the street to remotely communicate the stations and landmarks that the microbus will pass by, for which various hand signals have been developed and widely used. These practices illustrate further manifestation of specific skills enabling mobility.

> Hamdy: The people in the formal parts of the city are well off, why would they use public transport? They have their cars [...] and you know, if you ask any of them to tell you the name of the stations in their own neighborhoods they wouldn't even know.
>
> (Drivers' Group)
>
> Shaimaa: Well, the people I work for, for example, they would never use public transport [giggling], they would be like tourists [other participants laughing and nodding in agreement], even using the metro.
>
> (Mothers' Group)

This indicates how in the formal and richer parts of the city, access to a certain service may be still available, but due to limited forms of appropriation and skills, the motility of the individual can even be more limited than an individual in an informal settlement such as Haggana in terms of potentiality of mobility. Furthermore, an acquired sense of acceptable safety amongst parents in Haggana enables children to enjoy more freedom in mobility.

> Sanaa: You know, during the [2011] revolution and in the absence of police forces, everybody was saying that places like Haggana are dangerous and they were afraid from men from Haggana spreading out into the city and attacking them. They think we are all thugs. But actually, at that time it was much safer to stay *inside* of Haggana than outside. And you know, we also have doctors, engineers, and lawyers here.
>
> ...
>
> Hala: People know each other here [...] outside of Haggana, the neighbors don't even know each other. Do you know that we don't even have one assigned policeman inside Haggana? And my children can still freely walk in the neighborhood streets at night. We just tell them to avoid some places, and that's all.
>
> (Mothers' Group)

With regards to the acquired sense of safety, this is attributed to two observations: In Haggana, the social ties and natural surveillance in the neighborhood streets reinforce the sense of security, and secondly, the slow movement of vehicles on bumpy shared-use roads, and their limited numbers, reinforce the sense of traffic safety. This may be described as 'coincidental' traffic calming. Either characteristic are recognized and appropriated for the benefit of children's mobility and freedom. For the sake of clarification, Figures 19 and 20 show examples of common scene that exemplify how the

limited street space available seves as an extension to home and play-space for many locals, whereby a sense of ownership and community can thereby be fostered, partly contributing to a sense of safety (yet also partly reinforcing the role of imposed social norms as explained in the FGDs).

Figure 19: Elders seated outside and children 'hanging out' is a common scene in Haggana

Figure 20: A young child left outdoors unaccompanied to play on a bicycle

Nevertheless, nuisances from increased motorization over recent years is still noted and is a recurring theme in FGDs and interviews.

> Nevine (13): The problems are just outside (of Haggana) where there is fast traffic. Here in Haggana the world is calm. But with more Tuktuks and more car traffic with time, I don't know what we will do. We won't find space to even walk in.
>
> (Children's Group)

Furthermore, whether with regards to mobility inside or outside the settlement, the flexibility in options or strategies to improve the sense of safety (further manifestation of skills) also contributes to children's potential mobility.

> Mostafa (11): In the morning I walk with my older sister to the station and I take the microbus. She takes the public bus. On my way back I can take any 'mowasla' [transport service] I find there. I like playing games on my mobile phone on the ride back, and sometimes [after arriving at Haggana] I find friends when I'm walking back home. It's fun.
>
> (Children's Group)

Options in planning children's mobility, by both parents and children, include commuting with siblings, friends, or neighbors, whether for the entire trip or part of it, as well as improved coordination and monitoring of trips through the widespread ownership of mobile phones, or agreeing with children on some compromises, such as agreeing on certain parts of the settlement to avoid, etc. Accordingly, some

fears are partly addressed without excessively limiting children's freedom; a manifestation of appropriation of existing planning capabilities or skills and of available social resources.

Furthermore, the past positive experience of parents and habitual use of walking and public transport services may explain children's positive representations of their means of transport and their appropriation.

With regards to the second mode of appropriation, which is associated with lack of formal regulation, it is observed that the lack of formal regulation and law enforcement allows for flexibility and creativity in services, not only from the supply side as obesrved in the entrepreneurial provision and integration of various informal transport services, but also demand-side creativity and strategy-making to meet mobility needs. From this perspective, examples in Haggana include residents organizing within the community for the use of a tuktuk for collective transport or as a shuttle service, or arranging for the use of 9-seat buses for various informal functions. This usually involves an entrepreneur from within the community and is planned through negotiated verbal agreements, and often results in an efficient use of the limited assets (vehicles) available to meet more mobility needs, even including cargo as observed. In the context of informality (lack of regulation enforcement) such practices are made possible, while social norms and community collaboration govern and secure the practices.

Such means of appropriation are partly enabled due to the freedoms enjoyed in informality. Notably, it is inadequate to describe this as a state of 'lawlessness', since lawlessness is a misleading description of the context. Although formal law is not enforced, there is instead an abundance of norms and tradition in informal settlements that govern the community, as well as certain forms of planning and enforcement that suit the local needs. Parents therefore provide a substantial contribution to better appropriation of skills and resources in the mobilities of their children.

Parents indicated that they prefer a future for their children associated with ownership of motorized vehicles; mainly for their male children, eventual motorcycle ownership is desired or possibly a car later in life.

> Samir: Of course I want my child to have a car when he grows up. Motorcycles are dangerous… and you need a car anyway these days to get married and build a family. Do you think you can go propose to a girl now and they will not ask if you own a car?
>
> (Drivers Group)

Results also show that some elements of travel behavior and the enabling cultural and social environment in the informal settlement may provide inspiration for low-carbon mobility that can be incorporated into plans or awareness programs for the formal parts of the city, or even inspiration for business ideas. Such elements include the ways in which resources are mobilized and shared, which have been prevalent long before the advent of modern day concepts of shared consumption. Examples in Haggana include the reported (and observed) interchangeable use of a same vehicle for personal use, for passenger transport services, and for cargo, as well as flexible use of owned, borrowed and rented assets, etc.

Nevertheless, in attempt to avoid romanticizing the idea of efficiencies inherent in the case study area and similar settlements, there are also several context-specific limitations to mobility identified, which would need to be addressed. There were certain features of appropriation in the sampled population

that also had a negative impact on actual and potential mobility. These included gender restrictions enforced by inherited social norms and attitudes and other affective factors. It is perceived as against the norms for a woman to drive a vehicle, and even more so if a bicycle, which is often referred to as impossible or 'unthinkable', and is often ridiculed during interviews, although acknowledged as a norm in other more affluent parts of Cairo. This can be viewed as an appropriation gap, or an opportunity for enhancing motility.

> Safaa: Do you think it's imaginable that a woman from a popular district drives a motorcycle or a bicycle in the street? …Maybe only on a motorcycle as a passenger behind her husband or brother or something.
>
> …
>
> Amaal: When my daughter grows up I wouldn't let her ride a bicycle. In principle I think it is ok, but not in Haggana. People would look at her and boys will bother her. This is not a high-class area.
>
> (Mothers group)
>
> Hanaa (13): How can we (girls) ride a bike? The boys will not leave us in peace, and even if for example I ride a bike, in my case my parents will actually let me, but you have Sara here, her dad is from upper Egypt, and he will never let her.
>
> (Children group)

Further subtle social restrictions are imposed on adolescent girls and young women, the age range where families pay most attention to maintaining their daughter's reputation until marriage according to local tradition and a related sense of responsibility. This is reflected in the additional protective considerations made for girls in this age range when planning their commute, such as more attentive monitoring by mobile phone communication and by ensuring availability of accompaniment from a family member (e.g. siblings) or other female friends seen as trustworthy. A common theme however throughout discussions is that it seems that such perceptions and attitudes are changing to the better with time, especially among youth, which demands further research dedicated specifically to this rapidly evolving topic.

In conclusion, a synthesis of the observations of how children's transport projects are met and how their potential mobility is enabled (or inhibited) shows that there are different ways to compensate for a deficiency in any component of motility, such as lack of access in one aspect being compensated with greater ability for appropriation of other resources or acquired skills, suggesting a form of resilience of the studied community. Findings are accordingly in line with the conceptualization discussed in Chapter-3, which is illustrated in Figure 21 with added annotations based on research findings.

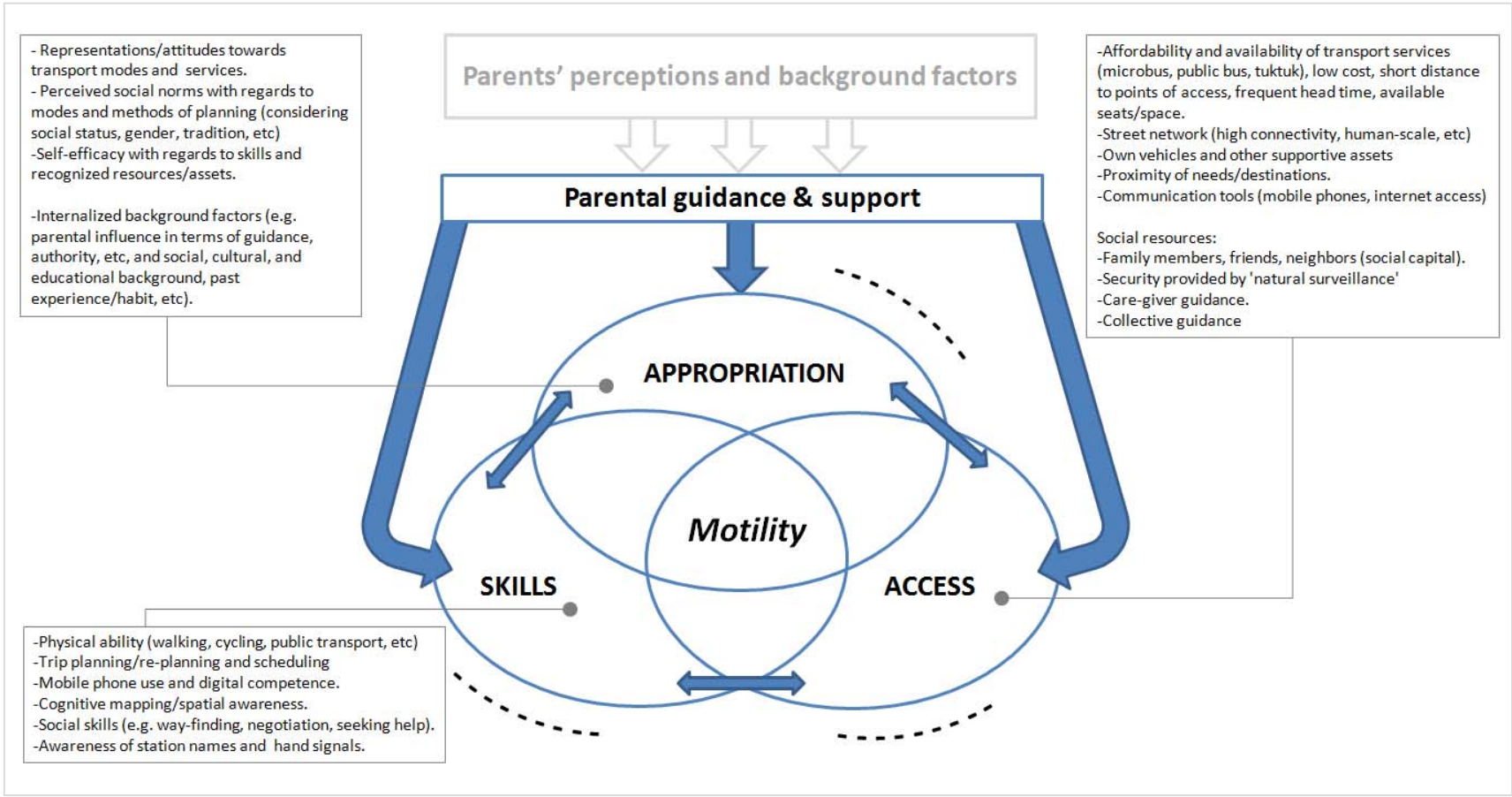

Figure 21: Annotated conceptualization of children's motility inherently associated with parents (dotted lines indicating variability in size)

While the factors associated with appropriation, skills and access were enlisted in Table 11 and exemplified in the annotations in Figure 21, the dynamics between and within the constructs can also be validated through several examples of factors that rather *inhibit* any of the constructs. If a sub-construct is found to be inhibited in some ways and enhanced in other ways, this indicates a possible variation in any of the sub-constructs and the possibility that one can compensate for the other in attempt to maintain one's overall motility. In the FGD findings, recurring themes of inhibiting factors have been noted to provide various validating examples. In terms of Access, cases of limited availability of owned vehicles and limited access to public busses within the settlement or frequently dumped waste blocking streets are examples of inhibited access. Cases of limited ability to cycle or limited ability to use a smart phone for navigation (which in turn are attributed to other reasons associated with access) are examples of inhibited skills. Fear of walking through certain stigmatized areas of the settlement or refraining (mostly in cases of girls) from cycling due to internalized social norms are examples of inhibited appropriation. Findings therefore reveal various means by which motility is enhanced through various characteristics of the informal settlement and its people, but also validates the possibility of various gaps in skills, access, and appropriation as well.

Within the scope of the present research, the area studied in more depth is the appropriation gap suspected in the case of using cycling as a mode of transport.

5.6 SOCIO-PSYCHOLOGICAL FACTORS ASSOCIATED WITH CYCLING

This section presents the results of the TPB-based survey and the structural equation model developed to analyze the underlying behavioral constructs behind the intention to encourage children to cycle from the perspective of the parent. Variables investigated are described in Table 12 and Table 13, with respective questions that measure each variable translated into English here.

Table 12: Description of latent variables used, all measured on a 5-point likert scale (1-5)

Variable name	Question	Median *(SD)*
Behavior Intention		
BI_Encourage	If safe bike parking is provided at PT stops and common destinations, would you encourage your child to start cycling for short trips within 15 minutes distances (1: disagree/ 5: agree)	2.53(*1.56*)
BI_Buy	If safe bike parking is provided at PT stops and common destinations, would you buy a bicycle for your child (unlikely/likely)	3.13(*1.57*)
Attitudes		
Att_safety	You generally find that riding a bicycle for short trips as safe/unsafe in your area? (unsafe/safe)	2.73(*1.53*)
Att_good	For a child like your son/daughter, it is good to encourage them to ride a bicycle (bad/good)	3.83(*1.46*)
Att_practical	Encouraging to ride a bicycle is good in informal settlements due to its practicality in narrow and crowded streets (1: disagree/ 5: agree)	4.2(*1.04*)
Att_economical	Riding a bicycle is generally good for saving money in short trips (disagree/agree)	4.36(*0.89*)
Subjective Norm		
SN_good	How much do you agree or disagree with the following statement: I feel that people in my life, I mean friends, family and neighbors, etc, that I care about, if they see me encouraging my child to ride a bicycle they will see it	3.11(*1.36*)

	as good (disagree/agree)	
SN_Decent	I feel that people in my life, I mean friends, family and neighbors, etc, that I care about, if they see me encouraging my child to ride a bicycle they will see it as indecent (1: agree/ 5: disagree)	3.57(*1.65*)
SN_harrassment	I expect that other youth in the street will harass/tease my child if he/she starts cycling for short trips (agree/disagree)	2.93(*1.75*)
Percieved Behavioral Control		
PBC_encourage	I am confident that I can encourage my child to ride a bicycle if I want to (disagree/agree)	4.3(*1.12*)
PBC_afford	The costs of cycling would discourage me from encouraging my child to start cycling for short trips (agree/disagree)	3.43(*1.34*)
PBC_role	When it comes to an issue like this one, I am not the one who makes the decision (agree/disagree)	3.52(*1.28*)
PBC_comfort	Uncomfortable roads will make it difficult for me to encourage my child to ride a bicycle (unlikely/likely)	2.51(1.28)

The moderating variables in Table 13 indicate the origin of subjects, schooling, gender of the child and age group. According to prior FGDs during the earlier phases of the research, the age of 13 as a threshold for indicating school children's age groups was seen by most participants as the age where the child is said to have 'grown up' and looked upon differently by society, where boys start becoming too old to 'play' with bicycles and girls in a stage where they should act more 'decent' in the outdoor environment, both ideas being recurring themes in the FGDs and accordingly used in the survey for testing.

Table 13: Moderating variables used

Variable name	Description	%
Origin_upper	Parent reported to be originally from a governorate of upper (south) Egypt.	43%
No_edu	Parent has never gone to school.	28%
Child_Gender	Gender of the child discussed is female	47%
Child_Age	Age of the child discussed is above 13*	28%

Variable name	Question	Median *(SD)*
Cycl_freq	How often has your child cycled in the past year (never/almost-daily)	2.07(*1.07*)

* A perceived common threshold concluded through discussions in FGDs.

Interrelations between variables were investigated including direct and indirect effects of the moderating variables which was tested.

5.6.1 Instrument Validity and data processing

With reference to Ajzen's guidance for constructing TPB questionnaires, direct measures where used to increase the TPB constructs reliability (Ajzen, 2006). The likert scales and the wording used were redrafted twice in consultation with focus groups and through feedback in a pilot survey in order to better fit the ease of understanding of the local community before finalizing the questionnaire and to use the proper slang language were necessary as detailed in the study methodology in Chapter 4. Data was entered into SPSS Version 20. Since the data collection was conducted in first hand by the researcher through interviews due to the prevalent illiteracy in the settlement, all of the 100 samples contained no missing items in the TPB-based section of the questionnaires.

5.6.2 Hypothetical Model

The hypothetical model developed is presented in Figure 22 indicating the direct relations between the observed variables and the latent variables, between the latent variables and each other, and the relations of the hypothesized moderating variables considered in the model. The relations are based on the theoretical structure of Ajzen's TPB and further hypothesized based on theoretical assumptions and based on feedback from the exploratory FGDs and stakeholder interviews investigating prevalent salient beliefs and elicited socio-cultural and behavioral characteristics and opinions.

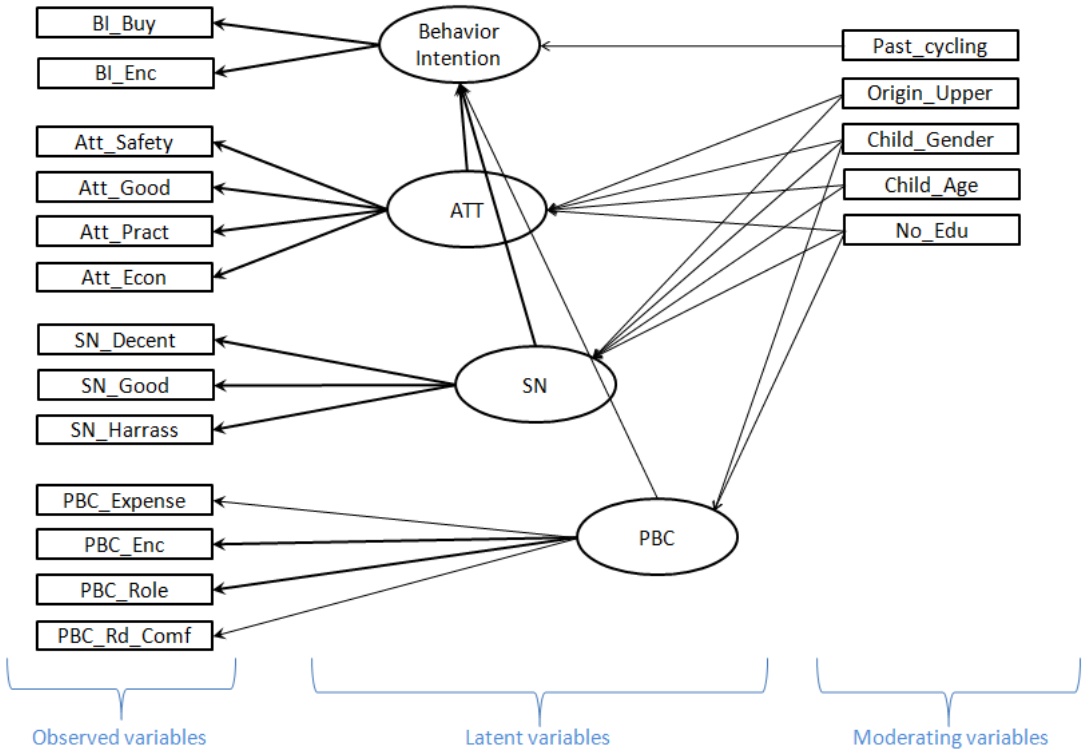

Figure 22: Hypothetical Model

5.6.2.1 Observed variables and relations to latent variables

The observed (measured) variables representing the latent behavioral constructs in the formulation of the hypothetical model are explained as follows:

- **Measuring Behavior Intention:** In the hypothesized model, the latent variable of Behavior Intention is inferred from two measured variables: BI_Buy (expressed intention to buy a bicycle for the child, triggered by a questioning cue and logical scenario) and BI_Encourage (intention to encourage cycling), these two measured variables are hypothesized to represent the latent construct of behavior intention. In the FGDs, a deliberation trigger (the scenario) was fine tuned in consultation with participants so that it contains a minimal cue that triggers deliberation while ensuring a logical scenario that is found realistic by respondents and understandable.

- **Measuring Attitudes:** The subconstruct of attitude (ATT) is inferred from context-specific attitudes towards safety, towards the overall evaluation of the act of encouraging cycling (good or bad), toward practicality, toward affordability. Practicality is an aspect that has been elicited in focus group discussions, although controversial, whereas views vary between praise for speed in traffic and narrow streets on one hand, and inconvenience due to limited functions and limited speed from other points of view on the other hand. With regards to affordability, it has been observed as a recurring theme in FGDs associated with attitudes. Notably, the affiliation of the good-bad semantic differential with persons attitude was used to accommodate answers that may be related to aspects that respondents will not explicitly express, and would therefore rather implicitly express. For example, if there is a belief (whether being a firm or an uncertain belief) that cycling for girls is unhealthy for their reproductive health (as noted in the literature review in reference to Amoaki-Sakyi and Owusu, 2011), this would in turn be among the implicit beliefs that might not be elicited explicitly during interviewing due to social-desirability bias or other relevant biases. It can however be implicated later in the analysis stage when controlling for gender, why further data from FGDs may facilitate explanation of results.
- **Measuring Subjective Norm:** The subconstruct of Subjective Norms (SN) is inferred from measures of three factors associated with the perceived social pressure or perceived opinion of *significant others* (family, friends and neighbours): Whether the action is perceived to be viewed by significant others as generally good or bad, decent or indecent, and whether social nuances, specifically harassment or teasing, is expected. Such factors were also suggested in qualitative research in Cairo by Fellinger (2015) and Puttrowait (2014), which further substantiated the feedback elicited in the FGDs of this research.
- **Measuring Perceived Behavior Control:** The subconstruct of Perceived Behavior Control (PBC) is inferred from measures of four factors associated with affordability (PBC_Expense), self-efficacy with regards to encouragement (PBC_Enc), with regards to role as a parent or authority in the household (PBC_Role) and also with the enabling physical environment, for which the most salient belief and understandable descriptor is reference to road comfort that was found best to encompass the meanings behind the key limitations of the built environment in the context of Haggana. Arabic wording in consultation with the FGDs ensured formulating questions that would ideally serve the purpose of indicating the latent construct.

5.6.2.2 Latent variables and relations in between

The structural relations between the latent variables of the model are in principle in accordance with Ajzen's theory of planned behavior as illustrated Figure 3 (p.56), with further hypothesized relations of interest. The basic relations in accordance to Ajzen's theory are the direct relations between Behavior Intention and Attitude, Subjective Norms, and Perceived Behavior Control respectively, and all latent constructs have been observed during the FGDs in attempts by the researcher to discuss underlying factors behind parents' endorsement and encouragement of the cycling.

Other distinct relations hypothesized are the direct relation between the subconstructs of Behavior Intention whereby Attitudes is hypothesized to mediate Subjective Norms and Perceived Behavior Control respectively (hence the direct relation illustrated between SN and ATT, and between PBC and ATT). Such indirect hypothesized effect on Behavior Intention, mediated through Attitudes, is in association with both observations in the FGDs and rooted in the theory of cognitive dissonance, whereby beliefs and convictions may be altered to reconcile differences with other conflicting perceptions, such as those imposed by sense of self-efficacy (represented in PBC) or social pressure or influence (represented in SN). In laymen terms, in the FGDs this was articulated as a form of

'adaptation', which FGD participants observed in themselves and in others in the community at the stage of elicitation and in consistency with the researchers hypothesis.

5.6.2.3 Moderating and control variables

The moderating variables, which were discussed during FGDs have been hypothesized to indicate the following relations:

Origin: The origin, defined as whether or not the family identifies themselves as originating from governorates of upper Egypt (the south) is suspected to influence the relation between subjective norms and behavior intention as well as between subjective norms and behavior intention since background factors of being distinctly conservative in opinions and having a distinctly different culture is often attributed to the explanation of differences in perceptions, opinions and behavior.

Child's gender: The gender of the child discussed is suspected to influence parents' attitudes and perceived subjective norms, whereas being a female is expected to have a negative effect on attitudes and on subjective norms and accordingly an indirect effect on behavior intention. Similarly so, with regards to perceived behavior control, it is suspected that with a child being female, it might inhibit the parent's sense of efficacy in encouraging the child to cycle and therefore a negative effect on perceived behavior control is also expected.

Child's age: The age of the child discussed is suspected to influence parents' attitudes and perceived subjective norms, whereas older children (defined in consultation with FGD participants as those above the approximate threshold of 13 years old) are expected to have a positive effect on attitudes and on subjective norms and accordingly an indirect positive effect on behavior intention.

Educational attainment: The educational attainment of the parent, which is defined in this context on whether the parent received schooling or not (i.e. no schooling altogether) is suspected to have a negative influence on all of the subconstructs of attitudes, perceived subjective norms, and percieved behavioral control.

Past cycling: Past cycling is included in order to consider its possible direct effect on behavior intention. It is hypothesized that given past experience of frequent cycling, there will be a positive effect on behavior intention, contributing to an automaticity of the respondent's response at the expense of deliberation in the cases where the behavior is not novel.

5.6.3 Measurement Model

The relations in the measurement model are reported in Table 14 below, comprising the relations between the observed variables and the respective latent variables they measure. The measurement model indicated satisfactory model fit indices, with a CFI > 0.95 (0.954), and RMSEA of 0.061, which was deemed acceptable for the subsequent steps of developing the structural equation model and analysis.

Table 14: Measurement model standardized regression weights

Relation	Standardized Regression Weight
Behavior Intention	
BI_1_Enc <--- BI	0.731*
BI_2_Buy <--- BI	0.85*
Attitude	
ATT_Schild <--- Att	0.658*
ATT_sf <--- Att	0.244*
BB_Pract <--- Att	0.616*
BB_Save <--- Att	0.515**
Subjective Norms	
SN_dec <--- SN	0.964*
SN_good <--- SN	0.684*
CBS_Harrass <--- SN	0.771*
Perceived Behavior Control	
PBC_enc <--- PBC	1.23*
PBC_role <--- PBC	0.449*
PCF_Cost <--- PBC	0.087
PCF_Rd_comf <--- PBC	0.024

* p<0.05

All observed explanatory variables are significantly related to the respective latent variable explained, with the exception of the two factors of perceived behavioral control associated with road comfort and associated with affordability. They are however maintained for further inclusion in the structural equation model due to their theoretical validity as a measure of perceived behavioral control.

5.6.4 Structural Equations Model Development and Results

The SEM model was tested for goodness of fit with the moderating variables tested to evaluate their contribution to the explanatory power of the model. The first results of the initial model as per the hypothetical model in Figure 22 showed an acceptable model fit (RMSEA=0.073, CFI=0.911). The final result was a final model excluding the factors of cycling frequency and child's age which were found to be of no significant effect ($p>0.05$ for all hypothesized relations) and also not contributing to the explanatory power of the model. The construct of cycling frequency was tested for its direct effect on Behavior Intention and additionally it was also tested for its indirect effects through the mediation of each latent variable. It showed a significant positive relation to Subjective Norms and Attitudes as intuited, however, it had no indirect effect on Behavior Intention through either constructs. Furthermore, the inclusion of the factor of past cycling frequency reduced the model's goodness of fit and had an insignificant effect on Behavior Intention and was in turn removed in the final SEM model. This may be attributed to the fact that the indicator of past behavior assessed in the survey was associated with cycling for leisure. Otherwise, none of the children used bicycles for commuting except for one case, and therefore the scenario of cycling specifically for commute is a new context that would in turn be mainly subject to deliberation rather than triggering a habitual response. This finding indicates the dissociation between leisure cycling and commute cycling in the minds of parents.

With regards to the child's age, it had no significant association with any of the behavioral constructs and no direct or indirect effects on intention where found. This may be attributed to earlier findings that

children's independent mobility is high in the informal settlement despite young ages. The factors of cycling frequency and child's age were therefore removed in the final model reported here as they did not contribute to the model's explanatory power. Table 15 shows the standardized regression weights of the model used in the final analysis described herein. This is further illustrated in Figure 23 demonstrating the final model and the significant relations (a full account of all direct and indirect effects are provided in Annex-2).

Table 15: Final model standardized regression weights

Relation	Standardized Regression Weight	Relation	Standardized Regression Weight
Behavior Intention		**Perceived Behavior Control**	
BI <--- Att	0.496**	PBC_enc <--- PBC	0.758**
BI <--- SN	0.403**	PBC_role <--- PBC	0.751**
BI <--- PBC	0.057	PCF_Cost <--- PBC	0.194*
BI_1_Enc <--- BI	0.766**	PCF_Rd_comf <--- PBC	-0.093
BI_2_Buy <--- BI	0.831**		
Attitudes		**Moderators**	
ATT_Schild <--- Att	0.712**	Att <--- No_Edu	-0.147
ATT_sf <--- Att	0.330**	SN <--- No_Edu	-0.134*
BB_Pract <--- Att	0.580**	PBC <--- No_Edu	-0.159
BB_Save <--- Att	0.511**	Att <--- Child_Gender	-0.168
Subjective Norms		PBC <--- Child_Gender	-0.344**
SN_dec <--- SN	1.000**	SN <--- Child_Gender	-0.797**
SN_good <--- SN	0.659**	Att <--- ORIG_Upper	-0.342**
CBS_Harrass <--- SN	0.753**	SN <--- ORIG_Upper	0.069

* p<0.05; ** p<0.01

5.6.5 Model Fit

The theory-based structural model was constructed through the introduction of the structural relations between the latent variables, as well as the introduction of the moderating variables that account for child age and gender, a cultural background proxy (indication of origin from upper Egypt), and educational attainment. Model validity was tested by testing the goodness-of-fit index (GFI) and adjusted goodness-of-fit index (AGFI) for which values of 0.95 were accepted as good fit as per recommendation by Hooper et al. (2008) suggesting 0.95 to be better for small samples. Furthermore, to limit Type-1 and Type-2 errors, comparative fit index (CFI) values >0.95 were accepted as good fit, and a Root Mean Square Error of Approximation (RMSEA) <0.06 (Hu and Bentler, 1999). In this respect, the model showed good goodness of fit (RMSEA=0.035, CFI=0.98).

5.6.5.1 Direct Effects

The results show that the latent variables of Subjective Norms and Attitudes were both positively related to Intention with high significance (p<0.001). Perceived Behavioral Control however, did not show a significant relation to Intention. This indicates that the perceived ability to encourage the child to cycle does not predict the intention in the studied sample and that attitudes and subjective norms overshadow the factors associated with perceived influence of practicalities such as the road quality and monetary costs. Such findings are in alignment with FGD insights. Results are illustrated in Figure 23.

The results for direct effects showed factor loadings of all the explanatory exogenous variables on the respective latent variables to be significant, except in the case of the latent variable of Perceived Behavior Control, where the two factors related to cost and road comfort did not have significant factor

loadings. It is notable that perception of safety showed the least effect on attitude among the four factors measured.

Among the feedback received in the focus group discussions that may help explain the limited influence of the perception of safety, is that in discussions about safety in the informal settlement, a recurring theme was that it is generally safe inside the settlement as "people know each other", as repeatedly phrased, and traffic is calm. Field observations further confirm frequent observation of children practicing leisure activities alone in the streets and independently running errands. The vibrant nature of the social environment and intense use of public space by residents has indeed been attributed in previous research to the sense of safety found in such places due to perceived natural surveillance and safety in numbers characterizing such informal settlements(see section2.7.1). This is further discussed in the discussion of research results in Chapter 4.

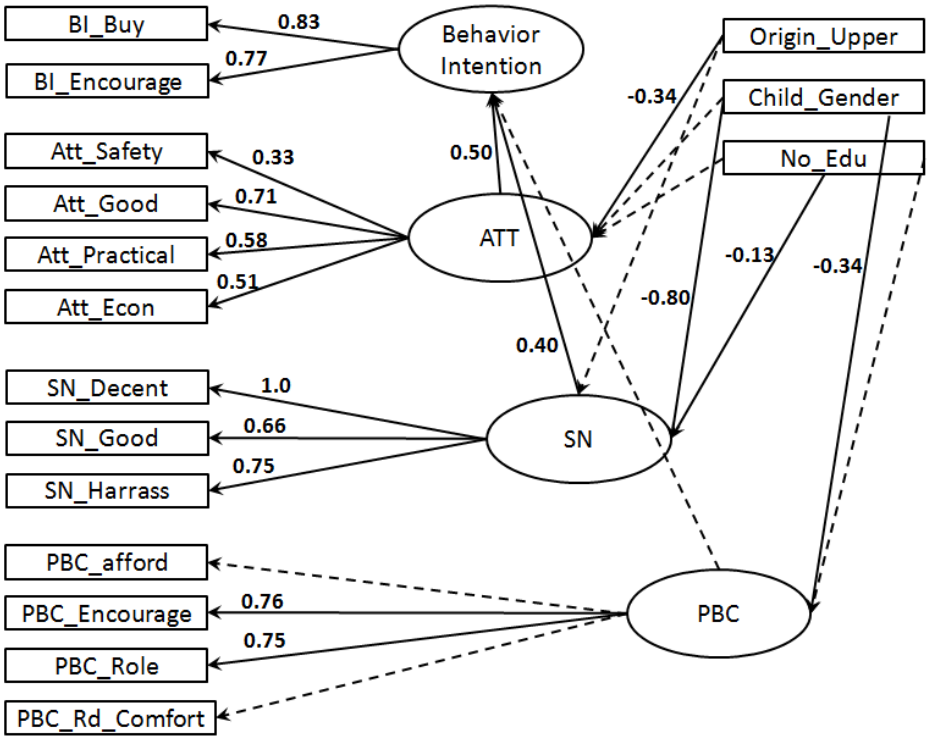

Figure 23: Model structure with significant standardized regression weights (95% confidence level)

In retrospect, throughout the FGDs, the topic of cycling was indeed found to be a controversial issue eliciting widely diverse opinions and contradictions through qualitative analysis. The results of the TPB-based SEM study however, not only indicated items that were elicited in the FGDs but further allowed mitigating groupthink biases and mitigating social desirability biases and therefore diagnosing the perceptions in better perspective, as well as indicating which of underlying factors are significant and what causal relations prevail, which cannot be concluded through FGDs.

5.6.5.2 *Indirect effects*

The moderating variables that contributed to the explanatory power of the model were of the gender, origin of parents, and the level of the parent's education as illustrated in the final model (Figure 23).

For each of the moderating variables, the direct and indirect effects on Behavior Intention through either of the three sub-constructs were tested to indicate the mediation effects at play.

Table 16: Results of mediation testing for direct and indirect effects (p-values indicated between brackets)

Relation investigated	Direct effect without mediator	Direct effect with mediator	Indirect effect (significance)	Conclusion
GENDER				
Gender->ATT->BI	0.560(<0.001)	0.199 (0.004)	(0.071)	No mediation
Gender->SN->BI	0.560(<0.001)	0.215(0.158)	(0.003)	Full mediation
Gender->PBC->BI	0.560(<0.001)	0.251(<0.001)	(0.078)	No mediation
ORIGIN				
UpperEgypt->ATT->BI	-0.008(0.919)	0.058(0.557)	(0.003)	Full mediation
UpperEgypt->SN->BI	-0.008(0.919)	0.01(0.898)	(0.118)	No mediation
UpperEgypt->PBC->BI	-0.008(0.919)	-.009(0.904)	(0.785)	No mediation
EDUCATIONAL ATTAINMENT				
NoEdu->ATT->BI	0.023(0.766)	0.032(0.694)	(0.083)	No mediation
NoEdu->SN->BI	0.023(0.766)	.009(0.991)	(0.054)	No mediation
NoEdu->PBC->BI	0.023(0.766)	.012(0.993)	(0.318)	No mediation

* Standardized regression weight and respective p-value.
** Bootstrap, two-tailed significance.

Gender

The moderating variables used in the model were highly informative about the influence of the background factors they represent. With regards to Gender, results show that it has a highly significant ($p<0.001$) effect on Subjective Norm, indicating a significant gender difference in what parents perceive as a social norm with regards to girls cycling in their community, as the association is negative. It was confirmed as well that gender has a significant indirect effect ($p<0.05$) on Intention through the mediation of Subjective Norms as indicated in Table 16. Although gender exhibited a significant relation to Perceived Behavior Control, it had no significant indirect effect on Behavior Intention. Gender also did not show a significant indirect effect on Intention through Attitudes.

Origin of Parents

With regards to the influence of the origin of parents, indicated by whether they are from the distinctly reserved culture characterizing upper Egypt or not (as discussed in , this moderating variable was shown to have a significant indirect negative effect ($p<0.05$) on intention, fully mediated through Attitude. It showed no direct effect on Intention and is not mediated by other constructs. This indicates the significance of the impact of a cultural difference on the individual attitudes inherent to that specific identity and its influence on the intention.

Parents' Education

Another moderating variable tested was the indicator of schooling, whether or not the respective parent had not attended any type of schooling at all. For that variable, lack of education was found significantly negatively associated with Subjective Norms ($p<.05$), and was also confirmed to have a significant indirect effect on Behavioral Intention through the mediation of Subjective Norms, whereas no similar effects were found to be of significance with regards to the other constructs.

5.7 SUMMARY OF RESULTS

The participants of the FGDs and the respondents to the questionnaire survey have indicated several features of the residents in Haggana that may characterize their community, the diversity in their origins, diversity in their travel behavior, and the wide variation in educative background ranging from those who are illiterate to those with university degrees. The sampled population indicated a high use of transport services, both formal and informal, while the most common mode of commute within the settlement was walking. Cycling however is absent among adults as well as it is among children, with the exception of use for leisure. Car ownership is low but is increasing and is seen by the residents as a common trend and a justifiable aspiration, yet a more common aspiration among male youth is the motorcycle, which is viewed as more attainable.

Within the sample, Child Independent Mobility (CIM) was found to be high, based on analysis of the most frequent trip as a proxy, and based on comparison with the best available information about trips to school in the formal areas of Cairo. About half of the sample use public transport and paratransit services, of which the majority of the users do so independently. Furthermore, the quantitative findings are substantiated with insights from the FGDs. CIM in principle is found to be associated with poverty, where inability to afford a school bus or a car often leads parents to resort to cheaper available transport services or walking for their children's trips to school. The most commonly used service is the microbus, which is also praised for its speed, reliability and relative comfort. For the youngest age group, the most common mode was walking, which is not only attributed to economic constraints but also to the proximity of primary schools relative to schools that cater to older ages, which are less and more distant.

Whether the children would be accompanied or not is associated with several factors. Independent mobility is positively associated with numerous factors other than older ages. Independent mobility was found likely among families with lower socio-economic status and those who are less educated, and those who frequently use the most popular transport service, the microbus. Positive association is also found with the origin of parents being from governorates of upper Egypt (the south) who are also characterized by having lower educational attainment and relative poverty. With regards to independent mobility, its virtues of either active mobility or gaining life skills are acknowledged by some parents but not seen as any motivation to encourage independent mobility. However, attitudes towards the modes used are positive among both parents and children with the exception of the cheapest and least comfortable mode; the pick-up truck. Interviews with frequent car users however indicated lower levels of acceptance and a negative attitude toward the experience of commuting using the available transport services. High car ownership and use is also significantly correlated with children's supervised mobility (accompaniment). Findings therefore suggest that attitudes are tempered by whatever mobility lifestyle the parents have afforded and have grown accustomed to. Yet, they are inclined to move towards stages of exclusive and accompanied mobility once affordable.

Furthermore, parents apply strategies to develop affordable solutions and they have the major the role in determining the mobility of their children and the appropriation of options enabling mobility, most well exemplified in the collaborative establishment of the informal bus transport services and the collective use of tuktuks, among other strategies, which are further supported with local entrepreneurial initiative. Both passive and active adaptation are therefore at play. In the meantime, both parents and children report that children who are more exposed to use of public transport and paratransit services gain more life skills and have more awareness about their urban environment, and such claims where validated by the insights from the FGDs.

All diverse characteristics of the prevalence of walking, the use of formal and informal collective transport services, and development of tailored mobility solutions by families with the community are all various developments of mobility that are aligned with notions of sustainable mobility that are not found in formal or more affluent areas of the city. Such state may also imply resilience to risks due to the diversity of approaches to mobility that are also rare in other parts of the city. Risk here refers to economic risks, loss of transport services, climatic risks, or other risks that might disrupt the field of possibilities for people's mobility. Furthermore, as a result of such motility capital in the context of low car-ownership and use, various policies that would restrict car use and promote public transport and walking may therefore be better accepted and accommodated in this setting as further discussed in the next chapter.

Through the FGDs, it was confirmed that the use of bicycles was indeed a mode that stirs much controversy and elicits diverse perceptions and opinions. The play of socio-psychological factors was less elaborate in the discussion of other modes of transport, which qualified the topic of cycling in specific as an informative case study of the role of socio-cultural, psychological, and cognitive influences on a mode choice that may be associated with the specific context of an informal settlement. In this respect, the results of the TPB-based survey results and analysis confirmed the major role of the various subjective factors involved in accepting and encouraging cycling. The TPB model and analysis using SEM proved to be instrumental in explaining influencing behavioral factors and the causal relations between them or lack thereof.

Results showed that parents' inclination to promoting cycling among their children is more of an issue of personal attitudes and perceived subjective norms rather than parent's perceived ability to encourage children or the associated practicalities such as cost and comfort or adequacy of infrastructure. The influence of perceived ability in terms of associated costs or ability to encourage or persuade the child is therefore overshadowed by the other affective factors.

Results also show that the frequency of children's past experience of cycling or lack thereof, is not a significantly influencing factor in the deliberation process of parents contemplating whether or not to encourage their children to use cycling as a mode for short commuting trips. This is possibly due to the views explained in the FGDs that cycling is viewed only as leisure activity, and therefore past experience in leisure cycling is not past experience in *commute* cycling. It was accordingly reported as an inadequate indicator and discarded in the final model.

The implications of the results with regards to gender aspects showed that the mediation of subjective norms in this respect overshadow the mediation of attitudes. This indicates underlying dynamics in parents deliberation process that are not revealed in FGDs, specifically indicating that gender bias is not because of their own attitude but rather mediated by what parents perceive of others' expectations and norms (in what in the field of social psychology is called *pluralistic ignorance*). This indicates that in the

case of gender issues in the studied sample, it is the subjective norm that has a greater influence on the intention rather than personal attitude, where parents show greater concern about social norms than about personal convictions.

Further to the distinct gender bias noted in the results, there were other socio-cultural influences at play as well. With regards to the influence of cultural difference, specifically with regards to migrants from upper Egypt, it was revealed in the analysis that their attitudes are disfavoring cycling in general, not related to social pressure, but rather the actual individual attitudes, which have a significant effect on their intention.

The analysis of the case of cycling reveals the complexity of behavioral aspects inhibiting a useful mode of transport, which is absent despite being in a densely populated urban setting with narrow streets and mixed land use. Results also indicate that the factor of poverty as well as aspects of safety and infrastructure (road comfort) are not necessarily key influencing factors, but may rather be overshadowed by other attitudinal and socio-cultural factors that would still inhibit the adoption of cycling in the community if not recognized and addressed.

The in-depth exploration of the case of cycling not only confirms significant influence of affective factors in transport-related decision, but also further highlights the importance of investigating the potentiality of mobility from the perspective of the commuter. Through this approach, the suspected 'appropriation gap' at the onset of the research was indeed confirmed through the behavioral survey results. Appropriation should accordingly be explored not only through the existing status (strategies, values, representations, motives, and habits that would enable more mobility possibilities), but also through exploring its *potential* that remains untapped due deficiencies or indifferences among these same descriptors.

CHAPTER 6: CONCLUSIONS AND DISCUSSION

6.1 INTRODUCTION

This chapter presents the overall conclusions for the research conducted and discusses its implications. Firstly, a summary of conclusions organized by research questions is presented, discussing the extent of support to the original hypothesis, relationship with previous research, and discussing the limitations to the study as well. This is followed by the interpretation of results and relevance to other similar contexts, discussing what value the research findings might present to the prevalent discourses related to development of informal settlements and the related policy implications. Finally, recommendations for future research and for practical applications are presented.

6.2 RESEARCH CONCLUSIONS

In this section, the three research questions of the study are each revisited. Each question is responded to based on the research findings, while remaining gaps of knowledge and limitations to the research results are also noted.

Q1 - Characteristics: *Can children in the informal settlement have distinctly different travel behavior than children in the formal areas in terms of appropriation of mobility options? What are the key features of their mobility and what framing suits the analysis of this context?*

Research findings showed that Child Independent Mobility (CIM) is prevalent in Haggana, as well as use of public transport services and paratransit in general, whether accompanied by an adult or not. Children of a wide range of ages and of both genders travel independently using public transport, and in many cases in trips involving more than one mode, while a substantial portion of commuting to school when accompanied is also through public transport and paratransit. In either case, accompanied or not, the exposure to different transport services and exposure to the experience of the necessary navigation is high. This stands in contrast with the case in the formal areas as revealed in the prior background research, most notably in the prior findings of Darwish et al. (2016), which reflects high dependence on both cars and school buses in the formal parts of Cairo.

Mode choices in trips to school are mostly associated with economic constraints, but transport options available are nevertheless seen as acceptable, or rather as the norm, for which any necessary improvement is rarely thought about as a priority. Within the context of economic constraints and schedule constraints of parents, a process of adaptation and creativity in providing alternatives in mobility and mobility planning comes into play, leveraging available assets and resources. Throughout the process, affective and socio-psychological factors may both enable or inhibit various possibilities of mobility.

Q2 - Framing: *Can children in the case study area, known to be a 'disadvantaged' area in the traditional sense, be alternatively seen as at an advantage in terms of acquired skills and exposure to diverse mobility options and decisions?*

From the traditional viewpoint of affluent societies, there are many ways by which enablers for mobility are deficient in the informal settlement under study, mostly for reasons associated with poverty, such as lack of vehicle ownership, difficulty to afford formal private school buses, and poor road infrastructure

to name a few. However, from another viewpoint that looks into the possibilities of diverse mobility options and mobility potentials that are inherent to such communities, another argument can be made whereby residents of the settlement can be seen to enjoy various advantages characterizing poor areas. Research findings have detailed the numerous examples of skills and resources as well as appropriation capacity and affective adaptation that are all mobilized to afford a diversity of mobility possibilities that might not be afforded by the more affluent and car-dependent counterparts in the formal areas of the city. This framing was well expressed through the theoretical framework based on the notion of motility. In this respect, findings show that children in the settlement become habitualized to walking and use of public transport and paratransit services as a normal part of everyday life, and the services available are generally seen as acceptable. Social resources at the community level also support the possibilities for mobility, whether through the distinct form of 'natural surveillance' enjoyed in the streets of the dense settlement or through the community collaborations and entrepreneurial initiative that enables creativity in finding mobility solutions for the children and economizing on existing assets and resources at both the family level and the community. The playing field is further expanded due to the lack of formal regulation, whereas local customs and norms are what rather govern the internal affairs, mostly tailored to the local needs.

Nevertheless, through the same lens of motility, there are also identifiable disadvantages such as limitations in mobility due to socio-cultural aspects in the community or stigmatization of certain modes or mobility practices. The use of pick-up trucks as a paratransit service for example is criticized both as a stigmatized mode associated with extreme poverty as well as a service of lowest quality and comfort *within* Haggana. The use of bicycles among adult men is associated with loss of prestige, while cycling for older girls and women is seen as improper, and cycling for young men is seen as a lack of competence associated with inability to buy a motorcycle. With regards to skills, the lack of education and limited literacy among parents confirmed through the survey limits ability to aspire to more sophisticated enablers of mobility such as use of applications on smart phones or using maps, or learning about new services or even obtaining a license for a motorized vehicle. Therefore, the potential to expand the realm of possibilities is apparent, not only in terms of appropriation and all the associated behavioral and socio-cultural aspects, but also in terms of skills and competences. However, the many advantages enjoyed, as seen through a more holistic observation of the actual and potential mobility of children and parents, is notable, and this demonstrates many ways in which children of the informal settlement can be seen to be at an advantage compared to counterparts in more affluent parts of the formal city.

Many of the mentioned disadvantages (related to subjective norms) are identified and acknowledged by the participants in the study as 'problems', i.e. personal convictions may contradict social norms that are seen as problematic. They often frame these inhibiting issues as unfortunate inconveniences of the social reality or imposed traditions, etc. The case of in-depth investigation of perceptions about cycling (section 5.6) further confirmed an example of such dissonance between underlying sub-constructs of behavior intention. This observation, that various disadvantages are framed as 'problems' is important; according to the Stages of Change Model (SCM) as reviewed in section 2.5, in the stages of behavioral change, the transition from the first phase of pre-contemplation to the subsequent phase of contemplation involves *problem awareness*, while in the framework of the Norm Activation Model (NAM) in the case of a pro-social motivation for intention, the *problem awareness* stage is also the prerequisite to the behavioral change process. In either case, the implication is that problem awareness, despite the lack of action, is in itself a stage of change, and it can be capitalized on.

Furthermore, other than the potential mobilities afforded by the residents of Haggana, the sustainability of their travel behavior or lifestyles in general is notable, and places them at an advantage compared to counterparts in the formal parts of Cairo from this sustainability perspective. This is evident in the high use of walking and collective transport, in addition to efficient use of assets and resources, such as through trip chaining or use of vehicles for multiple functions, along with affective support maintaining positive attitudes and acceptability towards such available options. This is all while enabling diversity and density in land use to satisfy diverse needs reachable within walkable proximity to residents thus reducing much of travel needs. Such mobility lifestyles may provide more fertile ground for effective implementation of car restriction policies and promotion of sustainable mobility compared to the rest of the city. Results therefore support a valid alternative discourse that recognizes the virtues found in informal settlements in terms of physical, social, cultural, and behavioral assets and resources mobilized to meet various mobility needs.

Within the same discourse, limitations to motility are also evident and can be framed as an *appropriation gap* as suggested in this study. Accordingly further improvement in motility is possible, and not necessarily through means that are limited to physical interventions but also through behavioral interventions in alignment with the notion of 'nudging' as advocated by Thaler and Sunstein (Sunstein, 2014; Thaler and Sunstein, 2008) and through developing guidance for operationalization of such planning approaches (e.g. DfT, 2011). However, whereas the discourse of Thaler and Sunstein revolves around the concept of so-called 'libertarian paternalism', the discourse of motility as conceptualized in the present study does not limit intervention to the limited scope of subtle nudges alone (which are a non-confrontational play on people's biases and heuristics), but also implies various confrontational means of capacity building, awareness, and conditioning that are actively provided to communities, families, and individuals, to support or guide favored behavior, including the engagement of the people in the process.

Q3 - Affective and socio-cultural factors: How do affective and socio-cultural factors affect parents' acceptance of the mode choice of cycling for children?

Through the in-depth investigation of cycling, which is a case of a missing mode of transport in this context, research findings confirmed the substantial role that affective and socio-cultural factors can play in inhibiting mobility potential. Factors associated with cultural background, past experiences, perceptions about social norms and expectations, personal attitudes, normative beliefs and perceived efficacies, among other socio-psychological and other background factors, all interact to produce a variety of influences on the acceptance of cycling. The variety of influences were not universal across the sample, but overall characteristics where clear, such as an overall association with the cultural background and education, and an overall inclination to refrain from the promotion of cycling among girls primarily due to perceptions of subjective norms. This is despite the more moderate and favoring attitudes at the personal level among the same respondents. The research questions targeting children as the subject therefore acted as an informative proxy about the attitudes towards cycling among adults as well. Issues associated with prestige of adult men and the respectful image of adult women were also revealed through the study of cycling for children. In the meantime, factors of poverty as well as aspects of safety and infrastructure (road comfort) were not necessarily key influencing factors in this case study, indicating that in the hypothetical scenario of a cycling promotional program, there are various behavioral factors that will limit the response of people that may precede infrastructure problems. The use of the framework of the theory of planned behavior further facilitated the revelation of underlying causes and motivators for an observed 'appropriation gap'.

A further unexpected insight gained through the research process was a specific context-specific deficiency in skills and aptitudes associated with mothers that was in turn projected onto their female children. There is a perception of limited physical abilities of women compared to males or to younger females, where women (especially married women) are commonly represented (by themselves and by others) as being overweight as a default. They equally expect this norm of being overweight for their female children as they grow up as noted in the FGDs with mothers. This observation is consistent with research indicating very high (85%) prevalence of overweight and obesity among adult females in Egypt (MoHP, 2015), which in turn was found significantly associated with areas of low-education in Egypt as per previous empirical studies (Mowafi et al., 2011). Notably, this is the case even though typical poorer neighborhoods are more 'walkable', yet obesity is still higher there as noted in a study of Cairo's so-called *Obesogenic Environment* by Fellinger (2015). These associations highlight the possible role of education as a key factor influencing physical activity and weight control, and accordingly affecting skills and aptitude that reduce the potentiality of mobility in areas characterized by low educational attainment. It also suggests the possibility that cycling for women is cognitively processed as something that *shouldn't* be done instead of *couldn't* be done in an attempt to resolve this occurrence of cognitive dissonance and avoid the sense of incompetence (see section 2.5.7 explaining cognitive dissonance and the Self-Concept Model).

Other distinct deficiencies in skills and competences are those associated with the literacy rates, especially among the older population, which is also consistent with national statistics indicating low (but improving) literacy in poorer areas of Egypt (MoHP, 2015). Although this is not yet causing significant perceived challenges by commuters in Haggana, it is expected to play an increasing role in the potentiality of mobility of the older and/or less educated segments of the settlement as more potential transport services will require both traditional and digital literacy. This might however be perceived as less of a concern to the younger generations.

6.3 DISCUSSION

In this discussion of research results, the focus is on the relevance of findings to the prevalent discourses and discussions about sustainable mobility, children's mobility, and mobility in disadvantaged areas. Firstly, a reflection on the current framing of children's independent mobility is discussed, noting its limitation to the limited scope of active travel and discussions about children's physical activity. Secondly, an important question is discussed, contemplating whether the claimed habits that are revealed in people's recurring travel patterns and choices can indicate expected behaviour further into the future, and whether choices are made in captive conditions. It is assumed that income levels will gradually rise and residents of disadvantaged areas would typically continue to strive for their aspirations based on their views of a model of growth and development inspired from their neighboring formal and more affluent communities in the city. Finally, the research findings and insights are also linked to the discussion of means to maintain elements of sustainable mobility in the future of communities that are yet in the earlier stages of a foreseeable car-dependence trajectory of development, and the role that research on children's mobility may play in that respect.

6.3.1 CIM beyond the discourse of active travel

As noted in the literature review (section 0), the predominant discourse in the treatment of children's mobility and independent mobility revolves around promotion of active travel. However, the topic of children's mobility should not be reserved to matters of physical activity only and how to enable more cycling and walking, but should encompass all aspects of their mobility as part of their life and of the

socialization of mobility lifestyles in their childhood. Even in most recent research on children's mobility in disadvantaged communities by Veitch et al. (2017), children's independent mobility is assumed to be entirely in instances of active travel (this issue was acknowledged in their discussion of research limitations). This can understandably be attributed to the priorities and concerns that are currently prevalent in many developed countries where much of the discourse on children's mobility originates; children are notably adopting more sedentary lifestyles. However, the case of Haggana indicating the prevalence of independent use of public transport and paratransit highlights the value of a wider perspective, where children's mobility is not only about promoting physical activity in daily life but also about gaining necessary life skills and ability for adaptation to available resources as well as ability to maintain resilience at the individual, family, and community levels. The value of this wider perspective is that focus here would be on the acquired skills and diversity in appropriation of mobility possibilities that children acquire at an early stage in life. Such a discourse, which can be described as a discourse of *resilience*, is therefore more suitable and relevant for the study of contexts such as Haggana.

6.3.2 The question of maintaining habits and norms over time

One challenge in analyzing the results is maintaining the assumption that the customary use of certain modes or the general mobility lifestyles is over time indeed developing a strong habit in consistence with evidence from empirical research elsewhere on habit formation (see section 2.5.3). The value from this argument, is that it implies that the certain elements of sustainable mobility found in poor areas such as Haggana are better positioning the subjects to continue behaving as such, and to therefore easily adapt to potential sustainable mobility interventions that reinforce much of this travel behavior (e.g. various methods of car use restrictions, travel demand management, and promotion of active travel, etc).

The results of FGDs (section 5.5.3) indicating a counterintuitive acceptance of available sub-standard transport services is notably consistent with similar observations in other developing countries. Similar studies in Indonesia have shown modest impact of negative attributes of paratransit services on users' attitudes, many of which view the services as 'OK' and satisficing (Joewono and Kubota, 2007 and 2008). This suggests that attitudes towards improvement and promotion of collective transport services would be positive (as a step forward). In contrast, a car-dependent community would be displeased and resistant when coupled with encouragement for a modal shift from cars. Such resistance is reviewed in Goodwin (2007 and 1977) described as a 'hysterises' phenomenon, in which changes tends to favor the *dominant* trend, i.e. if increasing car-dependence is the dominant trend (as it currently is), then it is easier to accelerate this phenomenon than to reverse it, such as in the observed asymmetrical income elasticity.

In consistence with the expressed views of the FGD participants about inhabitants of more affluent areas, stigmatization of public transport among certain societies has indeed also been noted in previous research in other countries (e.g. Chalak et al., 2016; Tran and Schlyter, 2010). This is also consistent with previous research indicating the limited use of public transport by residents of richer areas of Greater Cairo as noted in Darwish et al., 2016, or association of cycling with poverty in Egypt being among the inhibitors of propensity to cycle (Puttrowait 2014).In this respect, it is notable that there is much research on breaking or changing habits and norms as discussed in the literature review, but very little on *maintaining* them in the face of change. This is possibly due to the focus of most habit-related transport research on issues of reducing or reversing car dependence, and mostly in developed countries (e.g. Schwanen et al., 2012; Nordfjærn et al., 2014). This is a discourse associated with *shifting*

rather than maintaining or conserving favored behavior and perceptions in the face of changing circumstances.

In the case of Haggana, residents who are (or have become) more affluent indeed exhibited the earliest indicators of moving towards the car-dependence stage of development, suggesting the probability of alignment with the typical path of development if void of interventions.

A similar discussion applies to other aspects of sustainability in Haggana. In the history of access to water, the older inhabitants easily recall the days when they had to suffer a daily trip to distant water supplies to fill heavy buckets of water (and pay for it) and carry them back to their homes. Bremer and Bhuiyan (2014) and Wahby (2013) describe the case at length, but only from a service provision perspective. From a sustainability perspective, I would add the observation that the practice of efficient water use was of utmost importance to the residents and integral to their lifestyle as it was *scarce*. This was also confirmed in the focus group discussions. The situation changed today however. During the field surveys of the present study, several observations of excessive and unsustainable use of water was observed, now that water infrastructure has been established within the settlement and residents could further afford individual connections to each household. Observations of wastefulness included washing cars and tuktuks with gushing water hoses, washing shop entrances with excessive amounts of water, as well as frequently watering the roads to reduce dust (a common practice in Egypt). Excessive and inefficient water use *within* households can also be expected. In retrospect, this before-and-after contrast indicates an important example of the loss of favored habits (or norms) in the face of change, where no accompanying intervention took advantage of such habits or of the coincidentally sustainable *elements* of the lifestyles in the settlement and the enabling cognitive appropriation.

From the perspective of motility, results show that children in many aspects may be viewed as enjoying more advantage compared to their counterparts in the formal parts of Cairo indicated in the findings of Darwish et al. (2016) highlighting the strictly planned and supervised mobilities of children in formal areas of Cairo. Similar limitation of mobility in the formal urban settings is noted in much of the recent research on children's mobility in cities of developed countries (e.g. Kyttä et al. 2015; Kelly and Fu, 2014; Mackett, 2013; Fyhri et al., 2011; Mitra et al., 2014). In this respect, the observed relative independence and mobility of children in Haggana may better situate them to adapt to a future less dependent on cars if car-restraining measures are gradually introduced by planners or if well-designed awareness campaigns are launched to promote or maintain sustainable mobility.

There are notably however affective factors associated with car use that fulfill certain socio-psychological aspirations beyond the primary function of the car, which have been acknowledged in previous research and should therefore be considered (Jakobsson, 2007; Musselwhite and Haddad, 2010).

6.3.3 Preserving sustainable mobility in the face of change

Dwellers of informal settlements have the right to develop towards their aspirations; access to safe shelter, access to electricity and safe water supply, paved streets, and many further common aspirations depending on the stage of development, one of which eventually involves car ownership according to typical trends. In this respect, imposed car-restriction policies to limit car dependence might be viewed as unfair since the counterpart in the formal parts of the city had the chance to meet their aspirations in the past without restriction(and with the further incentive of heavily subsidized fuel over the past

decade in the case of Egypt). This bears asking an important question: Don't the informal settlements have the same right to experience the same fulfillment of their car-use aspirations if they wish?

The moral side of this question is controversial and reminiscent of the global debate on restrictions imposed on developing countries to curb their greenhouse gas emissions. Whether or not (and in what way) a developing country has the right to pollute for the sake of economic growth is at the core of such a debate. However, such a debate is not within the scope of the present study, which is limited to the epistemological assumption that the correct path for development must be aligned with environmental sustainability as the central discourse. Within this scope or world-view, constraints to unsustainable behavior are justifiable. The next question must address means to minimize and *mitigate* the adverse social impacts of such restrictions, such as constraints to car use and policies that might limit certain options and possibilities that were previously affordable and available to others.

More specifically, assuming that constraints shall indeed be put in place to inhibit growing car dependence, people will not only be deprived of the primary functions of the car, but also of the numerous secondary functions and affective factors associated with car ownership and use. Association with better chances of marriage, masculinity, perceived independence, social status, opportunity for quality time with loved ones or 'alone-time' for psychological restoration, are all various examples of such socio-psychological functions that the car may fulfill, and many of which have been noted in research in developed countries (e.g. Cuzzocrea and Mandich, 2015; Metz, 2013; Hartig, 2007), and noted in recurring themes in FGDs results as reported in section 5.5.

In this respect, the treatment of this mode of transport from the perspective of motility, with interchangeable and flexible underlying constructs, may therefore provide an adequate model through which compensations for such secondary services may also be incorporated as enablers or inhibitors of appropriation. Through such analysis, the loss of a primary function (movement by car) should not merely be compensated other means to provide the same primary function (e.g. shifting to movement by bus), but should also be compensated with other means that provide the secondary functions as well, even if provided in domains other than transport. Metz (2013) for example notes how one of the reasons that demand for obtaining car licenses is falling in many developed countries is that for more and more youth, especially young men, the car does not symbolize passage into adulthood anymore and its "implicit sexuality" is diminishing, while replacements for such needs is met through other products and icons. Such factors, among numerous others, had therefore facilitated the impact of rising costs and of imposed constraints on car ownership and use. Goodwin (2012) specifically highlights the major role of mobile phone ownership and use along with other status and connectivity-enhancing technology devices, while Pickup et al. (2015) discuss at length the changes in the mobility-related lifestyles of different generations and the social, psychological, and cultural implications observed in today's blending physical and virtual worlds, explaining much of the observed trend towards reduced car use in many European countries.

Reducing (or avoiding) car dependence can therefore be facilitated through leveraging the various alternative means by which socio-psychological needs and aspirations associated with the car (and other unsustainable travel behavior) can be met. Likewise, favored modes (or behaviors) can enjoy greater marketing impact if various associated socio-psychological factors, beyond the primary function, are understood, both in terms of their existing nature or their potential for change in order to induce or maintain favored behavior.

In other words, in the paradigm of motility, the subconstruct of appropriation involves the accompanying secondary functions and socio-psychological enablers or facilitators that may be *gained* with some introduced mode or behavior (e.g. side benefits of cycling or trip chaining), and also socio-psychological enablers or facilitators that may be *lost* with an abandoned mode or behaviour (e.g. losses associated with avoiding car use, or losses associated with sharing resources). Conversely, appropriation *inhibitors* may also either limit the appropriation of a new mode (or behavior) or reject an existing one. This was evident in the case study of cycling in Haggana, as well as in the insights from the FGDs about other modes and behaviors.

6.3.4 Motility Safety Net

Many restrictive policies require accompanying alternatives or impact mitigation measures. For example, parking restrictions tend to require provision of an alternative space for parking or require enhanced access to the same destinations by providing more public transport. An intervention of increasing fuel costs tends to require measures to ensure impact on vulnerable groups is mitigated, such as through targeted subsidies for public transport, or mitigating the indirect impact on the cost of bread which is expected to increase, etc. The point here is that in a similar manner, the behavioral and socio-psychological and socio-cultural impacts of interventions imposed may also necessitate alternatives and mitigation measures, or even *safety nets* in the language of macro-economists.

For example, car restrictions may lead to loss in a sense of assertion of masculinity among young men or mean loss of freedom for women, or have impact on perceived status, success, or social validation for others. From this perspective, for a community that does not yet highly depend on cars, the alternative of providing, e.g., improved public transport, is not enough as it is only an alternative to a primary function (commuting), but what is also needed here are also alternative channels for the secondary functions; gender assertion for men who partly lose this aspect, an alternative for the sense of freedom for women who partly lose this aspect, and the same for partial losses associated with social status, sense of success, etc. Another approach is to *alter* these needs rather than cater to them (i.e. facilitating a change in culture, in perceptions, representations, etc), which would facilitate intended impact of the overall intervention. Working toward facilitating the availability and use of such alternatives can be described as a psychological safety net, or alternatively a 'motility' safety net, whereby the concept of compensation is not only limited to material needs that are affected but also social and psychological needs that are impacted and might compromise the potentiality of people's mobility and compromise the success of efforts to promote sustainable mobility practices.

The implications of this trail of discussion is that in studying or addressing actual and potential mobility, the study of everything that constitutes appropriation is necessary in order to plan any effective intervention to promote sustainable mobility or to maintain existing favored mobility habits or avoid unsustainable behavior. Leveraging the expanded knowledge about associated socio-psychological factors associated with sustainable mobility may therefore offer answers to the question posed in recent work of Peter Jones (2016); he contemplates the typical historical trajectory of the car-dependence curve of many cities and asks whether those who are still in the pre-motorization stage of development can rather directly transition to a future of sustainable mobility. The agency of the people themselves, individuals, families, and communities, may well be an essential missing perspective in this discussion, and this highlights the potential that behavioral sciences, sociology, and social psychology have to offer to address this challenging question.

6.4 POLICY RELEVANCE

The policy implications of the study relate to two important aspects of the findings. Firstly, policy-makers and planners must acknowledge the independent child as a commuter and among the vulnerable groups addressed. Secondly, intervention designs must be based on an understanding of the various socio-cultural and affective factors that relate to the goals of the intervention. Such an approach requires a shift in mindset to extend the meaning of 'intervention' beyond the traditional measures of infrastructure and regulation enforcement to further incorporate measures of behavioral and social interventions where necessary, aiming to support, maintain and develop mobility related skills, and appropriation of assets and resources as well as addressing factors inhibiting potential mobility.

Early signs in the shift in such mindsets in addressing informal settlements had been briefly observed in 2014 when a dedicated ministry was established for informal settlements, the Ministry of Urban Renewal and Informal Settlements (MURIS) pioneered by a progressive minister. The ministry only ran for one year struggling to establish a paradigm shift in addressing informal settlements in the government as pioneered by the Minister herself. The title she chose for her work plan document translates to *Developing the human being*, which according to her (personal communication, March 20, 2015), aims to shift the discourse of development work in informal settlements from that of building houses and paving roads to a people-centered discourse of building sustainable, educated, and cultured communities as the central goal. At the time of the interview, she predicted a long struggle and confirmed that many tries will be needed to advance this approach. And indeed a year later the Ministry was dismantled and its mandates were transferred back to the Ministry of Housing under the pretext of the need to reduce the number of Ministries due to limited resources. She had further confirmed that the topic of mobility in informal settlements was of utmost importance, especially since there has been no in-depth research on this topic in Egypt to the knowledge of the ministry and therefore no knowledge stemming from the local contexts.

Furthermore, better understanding of mobility in informal settlements also enables policy makers to better plan resettlement sites. Resettlement of inhabitants of informal settlements is a challenging issue in Egypt. It is a policy applied to those living in dangerous zones in specific, such as being near high voltage cables, or near a geologically unstable location, etc, or in the way of an infrastructure development project that is seen as necessary for the common good of the city, such as a highway. There is gradual improvement in planning such settlements in Egypt. This is found in the contrast between earlier housing for resettlement and today. Earlier mistakes involved establishing settlements that are too far from the original informal settlement and far from the dense urban environments that enable vibrant economic activity. Resettled residents would therefore need to travel long distances to access their needs and would be unable to meet many of their needs locally. The resettlement housing projects had also often lacked consideration of the common practices found in informal settlements, which required a specific type of mixed development and flexibility in the use of public space, etc. Flaws in planning resettlement areas had therefore been receiving much criticism over the years for such reasons (e.g. Shehayeb, 2009, Sims, 2010). Today, many of such flaws are reportedly acknowledged in newer projects (Temraz, May 30, 2016). The considerations are however limited to the main ideas of proximity to the central business district and local availability of basic facilities such as schools, sports facilities, and hospitals, but little is understood about the subjective factors of mobility which need to be accommodated in the new context so that the efficiencies and options of people's mobility are maintained or enhanced.

6.4.1 Empowerment to enhance children's motility

In the study, the elaborate role of the agency of children themselves and their families in enabling children's mobility has profound implications to the discussion of children's mobility. Agency here refers to the ability to enhance one's own options of mobility in the context of economic constraints. Given the elaborate role of such agency, the plans for interventions to cater to children in transportation planning should not only be restricted to the features of services provided (for which much research and guidance is already available), but should also include capacity building and empowerment programs targeting the children, the families and their communities, recognizing their role in enabling own mobility through aspects of skills and competence, perceptions, beliefs, adaptation, community collaboration, etc.

This may be a more elaborate necessity in contexts where substantial infrastructure and service improvements are unlikely to take place in the near future due to budget constraints. This implied approach of empowerment does not need to replace the approach of service provision, but they may both rather complement each other and work in tandem. This can be done through educational institutions as well as local NGOs and other community-based organizations as well as inter-settlement and intra-settlement experience exchange. The know-how and material will therefore be accumulated through a bottom-up approach based on continuous field research in informal settlements and stakeholders consultations to extract the abundance of local know-how that can be mined for local solutions and for both the elaborate and subtle compensation strategies and behavioral and cultural adaptations that are all employed to enable potential mobility.

Furthermore, research implications do not only apply to the development of a new perspective on children's mobility in informal settlements, but also on mobility in the formal and more affluent areas of cities as well. A recurring theme in the FGDs emphasizes the perceived contrast between children's skills and knowledge (as well as that of adults) in the formal parts of the city compared to the supposed savvier inhabitants of informal settlements. In this respect, an analysis of the developed skill-set and means of appropriation in informal settlements can add to the body of knowledge about soft skills and favored behaviors and perceptions that can be mainstreamed into children's education and upbringing in the formal parts of the city as a form of an experience-exchange.

6.4.2 A different perspective on approaches to address local culture

The concept of respecting local culture and tradition is often practiced in a simplistic manner, where the notion of respect is sometimes interpreted as *adaptation* to local culture. This is not necessarily always a favored approach, since the understanding of the underlying behavioral aspects can evidently reveal that a perception of social pressure (or any other treatable socio-psychological influence) is often at play. In the case of the apparent gender bias in this study for example, it was revealed in the results that social pressure played a significant role, where there were positive attitudes towards cycling for both genders, yet also an overshadowing perception of restrictive social norms (misperception of other people's attitudes in this case) which were found influential on parents' support to their female children cycling. Here, an opportunity for behavioral intervention would be favored from both sides, the side of the interventionist advocating sustainable practices, and the side of the local community favoring a change in their social environment. Elsewhere as an example, in an operational guidance document by the World Bank (2010) for mainstreaming gender in road transport, an advice provides that

> "bicycles can only be introduced in areas where they are considered acceptable for women to ride, taking into account local cultural norms and traditions" (World Bank, 2010, p.12).

This is representative of a common simplistic and submissive approach of *adaptation* to local culture rather than a participatory approach to explore underlying perceptions and beliefs to explore means to address such controversial issues that might be in reality just caught in a vicious cycle.

Similarly, in an affluent area in Cairo where practices such as carpooling or use of public transport are seen as socially inferior or inappropriate, then interventions should likewise avoid the idea of adapting to such culture and tradition and rather explore more deeply the underlying factors behind such behaviors and perceptions such as to acknowledge and address them in a participatory manner. Accordingly, for planners, the notion of respecting local culture and tradition should not always be understood as *adapting* to local culture and tradition in such cases.

6.4.3 Interventions beyond the physical environment

The analysis of the various socio-cultural, psychological, and behavioral factors associated with mobility of children and the role of their parents point out the potential of expanded domains for interventions in informal settlements found beyond the common discourse of infrastructure provision and imposing regulations for formalization. Such insights are not only attributed to the study of children, but all segments of the settlement, whereas children rather served as a proxy to gain insight on the nature of mobility potential in the settlement. The case study of cycling was insightful in this respect.

In the case of cycling, an overshadowing effect of behavioral factors inhibiting acceptance of cycling was revealed, while cultural differences played a role and gender bias was clearly prevalent throughout the sample, as well as age bias that limits the acceptability of cycling to children only. However, detailed analysis revealed the areas where intervention would be effective. In the case of gender bias, the influence of perceived subjective norms was the key factor inhibiting acceptance of cycling among girls and not personal attitudes, which implies that intervention should not be designed to change attitudes but rather to change the perception of the prevailing norms among others in order to treat the social validation bias that is at play in this case and thereby proceeding to subsequent favored stages of behavior change beyond problem awareness and behavior contemplation (see section 2.5). This specific problem is a form of social proof bias, and can therefore be addressed by the provision of information that reveals the misperception about what other people think, such as through disseminating results of attitudinal surveys (for example, revealing actual data about prevalence of acceptance of cycling for females).

Another example is the approach by which community members communicate and develop coordinated plans for informal collective transport to school, whether using a tuktuk or the typical 9-seat bus, which in either case may provide other transport services throughout the rest of the day to maintain its feasibility. In that case, meeting greater potential in mobility is achieved from either side, through community collaboration and through entrepreneurship respectively, as well as the acceptability and 'normalization' of the solution that has developed among the community. These various forms of appropriation may be threatened by enforced regulations to formalize transport services in the traditional sense, or they can otherwise be left unattended. The latter option may leave out opportunities for improvements by the government, such as in addressing the prevalence of under-aged drivers or the safety of sub-standard vehicle conditions, both of which can be addressed in manners that should not necessarily compromise the prevalent virtues of community collaboration, entrepreneurship, and favorable attitudes and norms.

There is space for intervention beyond the currently commonly used tools. As an example, in 2014, Egypt's Cabinet imposed a ban on importing tuktuks (Al-Ahram Weekly, 2014, February 24). The government initiated a clamp-down on tuktuks throughout the main cities, fining the drivers and confiscating the vehicles. The decision of the cabinet was spearheaded by the Ministry of Interior, which viewed tuktuks as vehicles of crime and a threat to traffic safety, while no social impact mitigation strategies were undertaken. In the absence of knowledge about mobility in informal settlements, such interventions are likely to keep recurring. On the other hand, examples exist within Egypt where interventions made use of this phenomenon of informalities. In a project by the UNFPA together with the Ministry of Health of Egypt, the use of the tuktuk was central to a programme conducted to reduce infant mortality in poor areas in Upper Egypt. The programme involved training midwives to assist women in labor in disadvantaged areas and facilitating the mobility of midwives to access the difficult-to-reach areas on time using the tuktuk (UNFPA, 2013, March 27). The program thereby reduces a key cause of infant mortality during labor in disadvantaged areas, which is access to necessary medical care from trained personnel on time, and it addressed a specific mobility problem creatively and using local assets and resources: The mid-wives are known to the community and are accessed at a personal level through telephone communication, i.e. the operationalization is conducted in ways that are characteristic of community-based informal services. Midwives are recruited from among the locals (who had formerly been providing the service but without receiving training). Such an intervention design is an example of the reconciliation of the formal and informal, where necessary formal interventions are introduced while leveraging existing tools, means of appropriation, and social resources.

Annex-3 provides suggested simplified guidance for motility-based interventions, which targets NGOs, schools, mosques, churches, etc, as likely actors, further to planners and policy makers. This was developed throughout the research process in response to pressing interest from community leaders and NGOs about elaborating the practical implications of the present research.

6.4.4 Leveraging the virtues of informal settlements

Despite the many disadvantages, there are also numerous virtues of informal settlements that have been identified throughout the study that relate to various ways of compensation for economic constraints and marginalization. Compensation builds on assets and resources available, including social resources and behavioral adaptation so as to meet mobility needs and maintain an adequate state of motility. It may therefore become debatable whether government interventions aiming for formalization and traditional sequences of urban development should be imposed or not.

Should Tuktuks be banned as they have been in the formal areas? Should pickup trucks be restricted from servicing passengers? Should children be banned from claiming the street to play football? Should the informal vegetable markets catering to the heavy flow of pedestrians at the settlement's entrances be relocated to reduce traffic congestion and unlicensed use of public space?

In only these four selected examples of controversial questions, many virtues accompany the nuisances; Tuktuks cater to hard-to-reach areas in the dense informal settlements, paratransit pickup trucks offer a cheap service during peak hours that wouldn't be feasible if the truck was only dedicated to passenger transport, children provide themselves with needed space during off-peak hours, and the fruit market at the entrance enables residents to buy their needs during their regular commute all while enhancing the sense of safety. Many other examples apply as well. Further advantages can also be found in the habits, norms, values and tradition that mostly enable the residents to meet their mobility needs.

Recognition of local social and cultural assets have been discussed and advocated in the work of previous researchers studying the case of Haggana from the perspective of other domains such as housing and water infrastructure (El-Mouelhi, 2014; Bremer and Bhuiyan, 2014; Wahby, 2013), as well as in policy guidance developed by Shehayeb (2011) referring to urban informal settlements in Egypt in general. However, what the present study further adds to this discourse is the alternative approach of positioning the commuter's perspective as the measure of own accessibility and potential.

Accordingly, a valid intervention would be targeting the commuter to improve her mobility potential within the same unaltered setting. Such an approach has been partly recognized in previous research such as in the acknowledged role of social marketing or individualized marketing (e.g. Gärling and Fujii 2009; Thogersen, 2007) and programs for Travel Behavior Change (TBC) such as noted in Handy and Kizek (2009) naming concepts such as travel blending, travel smart, or personalized travel planning, as various examples of labels given to programs that aim to change travel behavior through working with individuals or households. The context however has remained associated with behavior change only, and specifically targeting the shift from car use toward more sustainable modes of transport and travel behavior.

Furthermore, from the viewpoint of motility, insights from FGDs herein indicate means of appropriation (strategy-making) that are associated with *lack* of certain factors, specifically lack of formal regulation and law enforcement that characterize informal settlements. Such appropriation of this vacuum allows for flexibility and creativity in meeting mobility needs, while other means of informal governance (e.g. through norms) prevail. What is noted in the research results, is that this acknowledged creative and entrepreneurial adaptation is therefore not only from the supply side as noted in much of the earlier research on paratransit (e.g. Neumann, 2014; Cervero and Golub, 2007), but also demand-side creativity and strategy-making to meet mobility needs as in various examples elaborated in section 5.5.3. This observation should not be interpreted as praising the lack of formalization and lack or law enforcement, but rather *recognition* of assets and resources that are available during the delayed introduction of formalization, which are (and will continue to be for substantial time) a reality, while features of local self-help compensation must therefore be recognized and supported in the meantime rather than combated as a stigmatized symptom of informality.

Many phenomena in the case study of Haggana demonstrate enabling conditions for mobility that accompany the commonly known poverty-related constraints or 'problems' that are frequently noted in development literature. What is meant here by recognizing virtues and enabling conditions should by no means lead to a conclusion that the settlement does not need developmental intervention and that they should be "left to adapt" as they tend to. It must be repeatedly reminded, as a disclaimer, that this is not the message. What is rather implied is that such coincidental virtues and enablers should be recognized, maintained (as long as it fills a gap that is not otherwise fulfilled) and leveraged in (or until) the implementation of any intervention.

Secondly, the local know-how and ingenuity can further be a source for ideas and solutions elsewhere. Home-grown solutions found in informalities can be a source for inspiration for planners, social workers, development professionals, and entrepreneurs. Examples included existing sharing practices comparable to modern day carpooling and ridesharing, which have for long been practiced in concept in Haggana, but have only recently been promoted elsewhere in Egypt in the media as 'novel' practices to encourage fuel savings. Other examples include the use of tuktuks for individual and collective transport in poor areas, which has later been adopted as a solution in a rich touristic gated community in Egypt in pursuit of practicality and avoiding car use using app-based ride hailing services (Cairoscene, April, 1,

2016), and more recently the launch of app-based ride-hailing services dedicated to tuktuks covering the public street network as well (Hany, M., November 8, 2017).

6.4.5 Who should champion behavioral/social interventions?

An open question is whether or not the discourse of 'intervention' must always imply governmental intervention, and refer to the state planners and policy makers. For this purpose, the validity of various actors are implied in the suggestions mentioned in Annex-3. Notably, much of the needs and services in the informal settlements of Cairo (as with many informal settlements elsewhere) are met through community-based initiatives or actors other than the government (e.g. NGOs, or vote-seeking politicians, etc), such as noted in the work of Bremer and Bhuiyan (2014), El-Mouelhi (2014) and Wahby (2013) on Haggana. It can therefore be argued that from a practical viewpoint, the key actors in the past, such as community-based organizations (CBOs) including formal NGOs that have filled in the role of the government, should be considered as the agents of interventions as well. In this respect, tailored educational modules on the topic of sustainable mobility and children's motility should be recognized as tools for empowerment and mainstreamed into the agenda of developmental activities offered in the informal settlements and supported by development agencies through community based organizations and other actors with a track record of interventions. Furthermore, the culture of CBO development would need to be supported in recognition of the role it plays in expanding the fields of possibilities associated with people's mobility in such context. Support can be in the form of providing facilitating laws and regulations, or simply refraining from introducing constraining laws and regulations that may stifle CBO activity for example, and this was confirmed throughout the field research experience throughout discussions with NGOs.

6.4.6 Generalizing results

It must be noted that although the present research focuses on children in informal settlements, there are many arguments and discussions that are also valid in their application to other contexts that involve poverty-related or scarcity-related constraints, and they are not necessarily in developing countries only and not only related to financial poverty. Examples of relevant context include the study of mobility in disadvantaged settlements hosting Pakistani and Bangladeshi immigrants in a *developed* country, namely the UK, as discussed in Christie et al. (2011), or countries that experienced energy crisis such as Cuba in the early 1990s leading to the adoption of travel behaviors that are coincidently more sustainable (Enoch et al., 2004). Bastian and Borjessen (2015) highlighted that a third of the adult population in Stockholm county today are 'foreign-born' residents and found that this demographic exhibits more car-use affinity; they exhibit higher GDP-per-capita elasticity and higher fuel-cost elasticity with respect to car distances traveled per adult when compared to the local-born Swedes.

With regards to generalization, some findings also apply to other demographic segments, such as obesity being a similar problem among adult women as with children in Egypt (MOHP, 2014), or elder people in rural England and Whales studied in Shergold et al. (2011), who witnessed motility constraints that limit access to social capital and community activity. Research findings may also relate to other cultures, such as in the examples of similarly gender-biased perspectives on cycling found in research in Ghana as noted in Porter et al. (2011).

Therefore, focusing on the setting of the informal settlement of Haggana throughout the research does not mean that features and characteristics explored are exclusive to this setting (whether Haggana in specific or informal settlements in Egypt in general) but might also share many elements that are found

in other settings and some elements that are partly valid for other cultures and demographics as well, providing much inspiration for future research.

6.5 RESEARCH LIMITATIONS

Several methodology limitations have been detailed in the methodology chapter (Chapter 4) of the study. However, this section notes the limitations imposed on research findings and interpretation in specific. One key limitation relates to the lack of longitudinal data to understand the trends associated with research observations. This was revealed in the course of the field research, as numerous interviewees and participants of focus groups noted that despite their description of the status quo of the settlement and of the culture, the perceived social norms and attitudes, there are nevertheless rapid notable changes being experienced. Such trends include the rapid penetration of smart-phones and hyper-exposure of children to 'the outer world' through international media and expanding connectivity provided by social media, which may have profound impact on local cultures in an almost 'as-we-speak' pace. Furthermore, rapid change in culture is also noted in the reported gradual loss of community spirit that characterized the informal settlement and most poor areas in general, while trends of individualism and materialism are felt to be increasing. Such feedback during the FGDs and interviews draws attention to the limitation of lacking longitudinal data to confirm changing trends in perceptions and trends in the social and cultural context with further objectivity. The physical environment is also in flux, where buildings are continuously demolished and constructed and flows of immigration and emigration are substantial and continuously shaping up and reshaping the streetscape and influencing the local subcultures.

Another key limitation is in the lack of macro data about the settlement and about the administrative district in which it is situated, which would have put much of the findings in perspective. The lack of census data, and the lack of any type of reliable quantitative background data in general about the settlement and its citizens is a handicap to research (see section 2.7.3 about uncertainty of available information), which was therefore compensated with best available information from past researchers and information from the local NGOs.

6.6 SUGGESTIONS FOR FUTURE RESEARCH

This study investigated children's appropriation of mobility options and how parents may influence it and how features of the informal settlement and the community enable it. However, one interesting finding was that there are instances where children seem to have a role in influencing parents' mobility and perceptions about it, or even possibly influence on their respective surrounding community. This direction of influence, from child to parent, is partly as a result of parents needing to cater to the children (passive influence of merely having a child in the family), but also the influence that I find of specific interest is that of children transferring skills, knowledge, attitudes and changing perceptions among parents directly and indirectly (passive and *active* influence). There have been past studies on such bi-directional influence that are not directly discussing mobility but are indirectly related, such as influence on parents' attitudes, values and personal behavior found in Knafo and Galansky (2008) and Kuczynski et al. (2016), and influence on parents' knowledge about environmental issues in Istead and Shapiro (2014), and on parents' technology uptake as in Correa (2014), as well as much preceding research on the topic of children themselves as agents of socialization and change in parental attitudes and norms in various domains (e.g. McDevitt and Chaffee, 2002; Ballantyne et al., 1998; Peters, 1985).

Today's children in the informal settlements are mostly literate, better educated than their parents, they are tech-savvy, and they are more exposed to other cultures through access to the internet and social media. To my knowledge, research on children's influence from this perspective is scarce in the domain of transport research. In informal settlements in specific such research would provide insight about a new channel of intervention that can affect parents through children, and can aim to enhance the motility of parents and elders in general in the community. This is especially important in a world where the population is generally aging, while many forms of empowerment are extending to children.

Another suggested topic for future research refers to the provisions of Sustainable Development Goal 11 noted in the introduction, to "make cities and human settlements inclusive, safe, resilient and sustainable" (UN Resolution 70/1), with explicit mention of children among the vulnerable groups. The phenomena of self-help initiatives and independence of informal settlements, and *interdependence within* informal settlements, are hypothesized to contribute to the resilience of such settlements. The present research already highlights the diversity of competences and creative resource mobilization and behavioral adaptation enjoyed in the case study area, as well as the distinct accumulation of life-skills to adapt to experienced hardships and various means of adaptation. In this respect, the discussion in section 6.4.4 about the virtues of the communities of informal settlements implies that there are various forms of adaptation in such contexts that can be recognized and studied under the rubric of resilience. Furthermore, the conceptualization of interchangeable and complementary components of motility as developed herein offer an expanded framework of analysis that is deemed necessary for the study of resilience, adaptation and empowerment, and is expected to contribute to the body of knowledge about resilience to serve various contexts in both the developing and developed countries.

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ANNEX-1: Original Arabic questionnaires

إستطلاع رأي عن تنقل الأطفال فى المناطق الشعبية

-لو اتعمل أماكن أمان لركن العجل على السنة الجية كده عند محطات ومواقف المواصلات والأماكن المعتاده زي الكافيهات وأماكن التسوق وكده - أحنا هنا بنشوف لو الناس ممكن تشجع ولادها يبتدوا يركبوا عجل للمشاوير القصيرة فى مشاويرهم اليومية.

□ ذكر □ أنثى السن: <25 <30> <40> <50> <60> <70> ساكن فين؟ ..... عشت كام سنة فى المنطقة دى؟ ..... أهلك عاشو معظم حياتهم فين؟ المحافظة:..... □فى القرى □ فى المدينة	التعليم: □ أمى □ قراءة وكتابة □ إبتدائى □ إعدادى □ ثانوية/فنى/مهنى □ جامعة □ دراسات عليا الوضع الحالى: □بتدرس □بتشتغل □فى البيت □آخر: وضع الزوج/الزوجة: : □بتدرس □بتشتغل □فى البيت □آخر:

عدد الأطفال: أكبر طفل فى سن مدرسة: □ ذكر □ أنثى السن:	الوضع الحالى: □بيدرس □بيشتغل إسم االمدرسة بالكامل والحي:

وسائل النقل المستخدمة بالترتيب... فى مشوار الطفل المعتاد فى الذهاب (ممكن أكتر من رقم فى نفس الخانة لو فى تكرار):

الوسيلة	ترتيب	وقت	تكلفة		الوسيلة	ترتيب	وقت	تكلفة
مشي					دورة (ميكروباص/فان)			/
توكتوك					دورة (عربية)			
ميكروباص					أتوبيس مدرسة			
أوتوبيس عمومى					موتوسيكل			
عربية خاصة					أخرى (.....)			

المصروف: ..... تكلفة المدرسة: ..... فى السنة

(طفلك) ركب عجلة فى السنة اللى فاتت؟ (تقريبا كل يوم) 1___ 2___ 3___ 4___ 5 (ولا مره)

كذا مره قليل نادر

□ لوحده □ تأجير
□ مابيعرفش □ مع صحابه
□ بيعرف □ بتاعته

□ مع حد كبير

عندكوا إيه من وسائل النقل فى البيت؟ (والعدد)

الوسيلة	العدد	

رأيك ... لو فى أماكن لركن العجل زي عند المحطات والأماكن المعتادة....هاتبتدى تشجع (طفلك) يركب العجلة؟

(بالتأكيد آه) 1___ 2___ 3___ 4___ 5 (أكيد لأ)

ايه أكتر حاجة توقفك؟ .....

طيب لو فى وضع تانى مافيهوش الموضوع ده... ساعتها هتشجع طفلك؟

(بالتأكيد آه) 1___ 2___ 3___ 4___ 5 (أكيد لأ)

فى الحالة دى لو فى أماكن لركن الدراجات فى محطات المواصلات والأماكن المعتادة تفتكر هاتجيب عجلة لطفلك؟

(بالتأكيد آه) 1___ 2___ 3___ 4___ 5 (أكيد لأ)

قد إيه بتستعمل وسائل النقل دي فى السنة اللى فاتت؟ (عادة الولاد لما بيكبروا بيبقو شبه الأهالى فى استخدام المواصلات)

الوسيلة	ولا مره	قليل (أقل من مره فى الشهر)	كتير (أكتر من مره فى الشهر)	أكتر من مره فى الإسبوع	تقريباً كل يوم
مشى أكتر من ربع ساعة	□	□	□	□	□

توك توك	□	□	□	□	□
ميكروباص	□	□	□	□	□
أوتوبيس نقل عام	□	□	□	□	□
عَـجَـلـة	□	□	□	□	□
موتوسيكل / سكوتر (كراكب)	□	□	□	□	□
موتوسيكل / سكوتر (كسواق)	□	□	□	□	□
عربية خاصة	□	□	□	□	□
نص نقل أو ربع نقل	□	□	□	□	□
تاكسى	□	□	□	□	□
أخرى.....	□	□	□	□	□

معاك موبايل بتاعك؟ ...موبايل العادى ولا اللى بشاشة اللى فيه انترنت؟

□ أيوه - موبايل عادى □ أيوه - موبايل بإنترنت □ معنديش

طفلك معاه موبايل بتاعه؟ ...موبايل العادى ولا اللى بشاشة اللى فيه انترنت؟

□ أيوه - موبايل عادى □ أيوه - موبايل بإنترنت □ معنديش

أد إيه بتستعمل الإنترنت السنة اللى فاتت؟ (تقريبا كل يوم) 1___ 2___ 3___ 4___ 5 (ولا مره)

كتير كام مره فى الشهر — قليل — مره أو أكتر فى السنة

ركوب العجل عامةً حاجة: ممتعة/مش ممتعة؟

(ممتعة) 1___ 2___ 3___ 4___ 5 (مش ممتعة)

**ركوب العجل عامةً حاجة كويسة/وحشة لابنك/بنتك؟*

(مفيدة) 1___ 2___ 3___ 4___ 5 (مضرة)

ركوب العجل عامةً حاجة مفيدة/مضرة للصحة للبنت؟

(مفيدة) 1___ 2___ 3___ 4___ 5 (مضرة)

*ركوب العجل عامة فى المنطقة بتاعتك أمان/خطر ؟

(أمان) 1___ 2___ 3___ 4___ 5 (خطر)

- بالنسبة للولاد عامةً... إنك تشجع إبنك يركب عجلة دى حاجة كويسة/مش كويسة...

(كويسة) 1___ 2___ 3___ 4___ 5 (مش كويسة)

- بالنسبة للبنات الصغيرة (أقل من 13) عامة... إنك تشجع بنتك تركب دى حاجة كويسة/مش كويسة...

(كويسة) 1___ 2___ 3___ 4___ 5 (مش كويسة)

بالنسبة لبنتك لو كبيرة (13 أو أكبر) أنت رأيك (أوحاسس) إنه لو تركب عجلة فى الشارع دى حاجة عيب/كويسة

(عيب) 1___ 2___ 3___ 4___ 5 (لائق - "حاجة كويسة" -)

طيب رأيك (أو حاسس) إنه راجل كبير يركب عجلة فى الشارع للمشاوير دى حاجة تعيبه/كويسة...

(مش منظر) 1___ 2___ 3___ 4___ 5 (لائق - "منظر حلو" -)

طيب رأيك (أو حاسس) إن لو واحدة ست كبيرة تركب عجلة فى الشارع للمشاوير دى حاجة عيب/لائقة...

(عيب) 1___ 2___ 3___ 4___ 5 (لائق - "حاجة كويسة" -)

طيب رأيك (أو إحساسك بصراحة) إنه إنت شخصيا لما تبتدى تركب عجلة فى الشارع للمشاوير دى حاجة عيب/كويسة...

(عيب) 1___ 2___ 3___ 4___ 5 (لائق - "حاجة كويسة" -)

*ركوب العجل كويس عامةً عشان توفير الفلوس فى المشاوير القصيرة

(بالتأكيد آه) 1___ 2___ 3___ 4___ 5 (أكيد لأ)

*ركوب العجل كويس عامةً فى المناطق الشعبية عشان بتبقى عملية وأسرع فى وسط الشوارع الزحمة والضيقة.

(بالتأكيد آه) 1___ 2___ 3___ 4___ 5 (أكيد لأ)

*أنا حاسس إن الناس المهمة فى حياتى... يعنى من الأهل والجيران وكده... لو شايفيننى بشجع (طفلى) يركب العجلة هايقولوا إن دى حاجة كويسة

(بالتأكيد آه) 1___ 2___ 3___ 4___ 5 (أكيد لأ)

*أنا حاسس إن الناس المهمة فى حياتى... يعنى من الأهل والجيران وكده... لو شايفيننى بشجع (طفلى) يركب العجلة هايقولوا إنه عيب

(بالتأكيد آه) 1___ 2___ 3___ 4___ 5 (أكيد لأ)

أتوقع أصحابى ومعارفى يبتدوا يشجعوا (ولادهم/بناتهم) يركبوا عجل لو اتعمل أماكن أمان لركن العجل عشان التشجيع

(بالتأكيد آه) 1___ 2___ 3___ 4___ 5 (أكيد لأ)

لو اصحابى ومعارفى ابتدوا يشجعوا (ولادهم/بناتهم) يركبوا عجل، أنا ساعتها هبتدى بردو أشجع بنتى/إبنى

(بالتأكيد آه) 1 ___ 2 ___ 3 ___ 4 ___ 5 (أكيد لأ)

*أنا واثق إنى هقدر أشجع (طفلى) يركب عجلة للمشاوير القصيرة لوأنا عايز

(بالتأكيد آه) 1___ 2___ 3___ 4___ 5 (أكيد لأ)

*المواضيع اللى زي دى مش أنا اللى باخد القرار

(بالتأكيد آه) 1___ 2___ 3___ 4___ 5 (أكيد لأ)

*الطرق الغير مريحة حاجة تخلينى معرفش أشجع (إبنى/بنتى) يركب عجلة

(غالباً آه) 1___ 2___ 3___ 4___ 5 (غالباً لأ)

*أتوقع يبقى فى شباب فى الشارع هايدايقو (إبنى/بنتى) لو إبتدى يركب العجلة للمشاوير القصيرة

(بالتأكيد آه) 1___ 2___ 3___ 4___ 5 (أكيد لأ)

*عشان تكاليف العجلة وصيانتها مقدرش عليها متوقعش إنى أشجع إبنى/بنتى يركب عجل

(بالتأكيد آه) 1___ 2___ 3___ 4___ 5 (أكيد لأ)

لو فى يوم رياضى لتشجيع ركوب الدراجات، تحب تسجل (طفلك) للمشاركة؟ □ أيوه □ لأ

لو فى برنامج بيوفر (عجلة بنات/عجلة صبيان) بالتقسيط، تحبوا تشاركوا فيه؟ □ أيوه □ لأ □ عجلة صبيان بس.

إيه الأماكن التانية إللى بتروح فيها بنتك/إبنك مره أو أكتر من مره فى الأسبوع فى التلت أشهر اللى فاتو؟ وأد إيه مشي من البيت؟

النادى:.....

للعب والرياضة فى أماكن تانية غير النادى:.....

لدروس تقوية / دروس خصوصية:.....

شغل جوه العزبة:.....

شغل بره العزبة: ..... (وقت الرحلة؟)

تحقيظ قرآن:.....

الكنيسة:.....

تجيب العيش: .....

مشتريات تانية: .....

زيارة عيلة أو أصحاب:.....

(حاجة تانية مره فى الإسبوع أو أكتر) .....: .....

ANNEX-2: Regression weights and parameter effects of SEM Results

Standardized Regression Weights:

			Estimate
Att	<---	Child_Gender	-0.168
SN	<---	Child_Gender	-0.797
SN	<---	ORIG_Upper	0.069
Att	<---	ORIG_Upper	-0.342
Att	<---	No_Edu	-0.147
SN	<---	No_Edu	-0.134
PBC	<---	No_Edu	-0.159
PBC	<---	Child_Gender	-0.344
BI	<---	Att	0.496
BI	<---	SN	0.403
BI	<---	PBC	0.057
SN_decent	<---	SN	1
SN_good	<---	SN	0.659
PBC_encourage	<---	PBC	0.758
PBC_Role	<---	PBC	0.751
ATT_Good	<---	Att	0.712
ATT_Safety	<---	Att	0.33
BI_Encourage	<---	BI	0.766
BI_Buy	<---	BI	0.831
ATT_Practical	<---	Att	0.58
ATT_Econ	<---	Att	0.511
SN_Harrass	<---	SN	0.753
PCF_afford	<---	PBC	0.194
PCF_Rd_comfort	<---	PBC	-0.093

Regression Weights:

			Estimate	S.E.	C.R.	P
Att	<---	Child_Gender	-0.202	0.137	-1.48	0.139
SN	<---	Child_Gender	-2.63	0.19	-13.824	***
SN	<---	ORIG_Upper	0.228	0.208	1.092	0.275
Att	<---	ORIG_Upper	-0.414	0.156	-2.653	0.008
Att	<---	No_Edu	-0.197	0.157	-1.255	0.21
SN	<---	No_Edu	-0.49	0.224	-2.189	0.029
PBC	<---	No_Edu	-0.302	0.209	-1.441	0.15
PBC	<---	Child_Gender	-0.589	0.195	-3.02	0.003
BI	<---	Att	0.937	0.265	3.538	***
BI	<---	SN	0.278	0.07	3.974	***
BI	<---	PBC	0.076	0.13	0.584	0.559
SN_decent	<---	SN	1			
SN_good	<---	SN	0.539	0.064	8.44	***
PBC_encourage	<---	PBC	1			
PBC_Role	<---	PBC	1.126	0.27	4.171	***
ATT_Good	<---	Att	1.749	0.373	4.69	***
ATT_Safety	<---	Att	0.806	0.277	2.905	0.004
BI_Encourage	<---	BI	1			
BI_Buy	<---	BI	1.154	0.155	7.445	***
ATT_Practical	<---	Att	1			
ATT_Econ	<---	Att	0.754	0.196	3.844	***
SN_Harrass	<---	SN	0.794	0.075	10.545	***
PCF_afford	<---	PBC	0.302	0.166	1.825	0.068
PCF_Rd_comfort	<---	PBC	-0.136	0.159	-0.85	0.395

Standardized Total Effects:

	Child_ Gender	ORIG_ Upper	No_Edu	Att	PBC	SN	BI
Att	-0.168	-0.342	-0.147	0	0	0	0
PBC	-0.344	0	-0.159	0	0	0	0
SN	-0.797	0.069	-0.134	0	0	0	0
BI	-0.424	-0.142	-0.136	0.496	0.057	0.403	0
PBC_Afford	-0.067	0	-0.031	0	0.194	0	0
PBC_Rd_comf	0.032	0	0.015	0	-0.093	0	0
BI_Buy	-0.352	-0.118	-0.113	0.412	0.047	0.335	0.831
ATT_Practical	-0.097	-0.198	-0.085	0.58	0	0	0
ATT_Econ	-0.086	-0.175	-0.075	0.511	0	0	0
BI_Encourage	-0.325	-0.109	-0.104	0.38	0.044	0.309	0.766
ATT_Safety	-0.055	-0.113	-0.049	0.33	0	0	0
ATT_Good	-0.119	-0.244	-0.105	0.712	0	0	0
PBC_Encourage	-0.261	0	-0.12	0	0.758	0	0
PBC_Role	-0.258	0	-0.119	0	0.751	0	0
SN_Harrass	-0.6	0.052	-0.101	0	0	0.753	0
SN_Good	-0.525	0.045	-0.088	0	0	0.659	0
SN_Decent	-0.796	0.069	-0.134	0	0	1	0

Standardized Direct Effects:

	Child_ Gender	ORIG_ Upper	No_Edu	Att	PBC	SN	BI
Att	-0.168	-0.342	-0.147	0	0	0	0
PBC	-0.344	0	-0.159	0	0	0	0
SN	-0.797	0.069	-0.134	0	0	0	0
BI	0	0	0	0.496	0.057	0.403	0
PBC_Afford	0	0	0	0	0.194	0	0
PBC_Rd_comf	0	0	0	0	-0.093	0	0
BI_Buy	0	0	0	0	0	0	0.831
ATT_Practical	0	0	0	0.58	0	0	0
ATT_Econ	0	0	0	0.511	0	0	0
BI_Encourage	0	0	0	0	0	0	0.766
ATT_Safety	0	0	0	0.33	0	0	0
ATT_Good	0	0	0	0.712	0	0	0
PBC_Encourage	0	0	0	0	0.758	0	0
PBC_Role	0	0	0	0	0.751	0	0
SN_Harrass	0	0	0	0	0	0.753	0
SN_Good	0	0	0	0	0	0.659	0
SN_Decent	0	0	0	0	0	1	0

Indirect Effects:

	Child_ Gender	ORIG_ Upper	No_Edu	Att	PBC	SN	BI
Att	0	0	0	0	0	0	0
PBC	0	0	0	0	0	0	0
SN	0	0	0	0	0	0	0
BI	-0.966	-0.325	-0.344	0	0	0	0
PBC_Afford	-0.178	0	-0.091	0	0	0	0
PBC_Rd_comf	0.08	0	0.041	0	0	0	0
BI_Buy	-1.114	-0.374	-0.397	1.081	0.087	0.321	0
ATT_Practical	-0.202	-0.414	-0.197	0	0	0	0
ATT_Econ	-0.152	-0.312	-0.149	0	0	0	0
BI_Encourage	-0.966	-0.325	-0.344	0.937	0.076	0.278	0
ATT_Safety	-0.163	-0.333	-0.159	0	0	0	0
ATT_Good	-0.353	-0.724	-0.345	0	0	0	0
PBC_Encourage	-0.589	0	-0.302	0	0	0	0
PBC_Role	-0.663	0	-0.34	0	0	0	0
SN_Harrass	-2.089	0.181	-0.39	0	0	0	0
SN_Good	-1.418	0.123	-0.264	0	0	0	0
SN_Decent	-2.63	0.228	-0.49	0	0	0	0

ANNEX-3: Guidance for practitioners for Motility-based interventions in informal settlements

The guidance herein is provided as a suggestion to build on, so as to give an example of how the research results can be linked to practical application. Accordingly a potential approach is synthesized as a suggestion for future development of guidance material for practitioners. This is summarized in the table below in the form of the main steps to planning for and identifying points of intervention based on the developed understanding of motility in the context on informal settlements.

This table was developed during the final stages of the research process in order to provide orientation to the local NGOs that have been assisting in the research activity as voluntary hosts of the FGDs. It was done in the spirit of demonstrating practical relevance of the research activity in contrast with *research for the sake of research* as cautioned by some of the interviewees, and it is intended to be accompanied with illustrative explanations of the developed conceptualization of motility when shared and explained to the NGOs, schools, or other actors.

The hypothetical actor in this example is an NGO, but can likewise be the school, a governmental body, etc. A hypothetical story line is further provided as an example to clarify the suggested steps taken towards the articulation of Motility-based interventions.

Although the examples used here are inspired from actual field observations and stakeholder consultations, they should however not be considered as actual research results by any means since they are not intended to be anything more than indicative for the sake of explanation, and they are therefore presented as 'hypothetical' to avoid misuse.

STEPS	EXPLANATION	HYPOTHETICAL EXAMPLE
1) SETTING OBJECTIVES.	- Why is this motility-based research conducted, and what is the suspected improvement that 'I' (as in policy maker, community-based organization, NGO, school, parent, mosque, church, etc) can offer to the suspected problem at hand (see discussion in section 6.4.1). This does not necessarily always mean foreseen *change* that is necessary, but can also mean foreseen safeguarding of certain elements of motility that are seen as endangered or not equitably distributed. It can also target an aspect that seems to require actions that appear to contradict local culture at a first impression (see discussion in section 6.4.2).	- 'I' as a local NGO (for example) realized that children in my neighborhood are not sufficiently accessing opportunities for sports and leisure. There is also much less space to play in the street like their older siblings in the past. - I suspected that we can work together to improve this situation. For example, it seems that some families don't know about the nearby sports club, others don't know that the dark area on the way to the club is now inhabited, crowded, and lit with streetlights, and also I've recently seen children in other places in the settlement go to places with the help of their smart phones to order tuktuks or to navigate, so there seem to be some new tools that we don't know about. I also noticed some families might be excessively conservative and constraining the options of their female children compared to the other families in the neighborhood that give more permits to their girls. Three issues to address are therefore identified.
2) SCOPING.	- Who is the subject (agent) under investigation, such as a child or a family belonging to a certain subculture, or geographic context, or other characteristics for relevant segmentation. - What other scope limitations can be considered for practicality (e.g. preset set of behaviors of interest, or other delimiting themes such as access to certain priority needs, or use of technology, etc).	I decided (through consultation) that the agent under investigation will be the nuclear family unit having at least one child within the age range of primary school. They shall be belonging to the poorer families within the settlement (the beneficiaries resorting to my NGO), specifically within the surrounding east section of the settlement, from the east entrance and until street-X where we are active. I focused on: (a) the suspected untapped potential offered by improved use of smart-phones, which are rapidly penetrating their social circles, (b) ..., (c)... , etc.
3) ASSESSMENT OF *ACTUAL* STATE OF MOTILITY.	Identifying elements of actual and potential mobility through both observation and consultation with the subject to inquire about potential, including assessment of community and	- For topic 'a', I (the NGO) conducted focus group discussions and surveys to explore the actual mobility and access to leisure activity, extent of smart phone penetration in the sampled families, who uses them, how they are used, and what are the familiar and acceptable potential uses for

	socio-cultural assets and resources, and understanding of habits, norms, and representations, etc; Elements of **Access**, elements of **Skills / competences / aptitudes**, and elements of **Appropriation** are accordingly identified.	potentially improved mobility and access, etc. Elements of access, skills (and competences/aptitudes) and appropriation were identified and mapped out. Examples of some highlights include that the majority of children were found to have smart phones, but very few had access to internet. Access among those who had internet was however affordable. Children who did not have smart phones with internet access were still skillful in using them since their peers shared their phones with them for playing games and surfing Facebook and taught each other. Some mothers had smart phones donated from the households that they work for in the richer areas of Cairo so that they remain accessible to their employer. It was noted that their respective children sometimes use these phones at home. ... - For topic 'b' ...
4) ASSESSMENT OF *POTENTIAL* STATE OF MOTILITY.	This is a difficult task, since there is no absolute definition of what the 'potential' must be or who should set this target. Therefore, a certain convenience-benchmarking is suggested, such as comparison with other contexts deemed comparable or similar, within the settlement's own diversity, or elsewhere. The following two joint approaches of benchmarking are suggested in order to be context-specific: (a) Investigating the nature of mobility and travel behavior of peers within the settlement and of other similar settlements (through field research and assessments of valid sets of skills, access elements, and appropriation elements). (b) Comparison with theoretical potential that is deemed feasible and desirable (based on expert opinion, stakeholder consultations, previous research, etc).	Gaps in access, skills and appropriation were identified. Among the highlights for topic 'a' were the following gaps: - The FGDs revealed anecdotal information about some workers in Haggana that have been spotted using smart phones to explore the road network of the settlement during the delivery of goods. None of the families interviewed however explored this use or knew how to access it except for a few children. - The NGO has been informed that a new ride-sharing service is available to inhabitants of informal settlements that specifically caters to Tuktuks. It has been gaining users from informal settlements but none of the interviewed families were aware of this option. - Parents (and some children) did not know the typological difference between Facebook and internet, and they used the terms synonymously. The use of online maps altogether was unknown to most of them. Understanding of available smart phone related tools was notably lacking altogether. - One of the two local cafés installed Wi-Fi recently, however, only older youth seem to be using it; they were all young men. It seems as an opportunity as a venue for learning, or an opportunity as a hub for local calibers that can share and teach their skills. - ...

5) ARTICULATION AND ANALYSIS OF OBSERVED GAPS IN ACCESS, SKILLS, AND APPROPRIATION.	- Identified gaps (between actual and suggested-potential motility) are articulated, prioritized and analyzed (do we *really* understand what's going on? Are they really correctly expressing what's going on?) - Gaps in access and skills or competences might be easier, while the appropriation-gap is more complex. This involves in-depth consultations and behavioral research for the analysis of appropriation gaps, to understand the enabled or inhibited appropriation of access, and appropriation of skills, and other inhibiting and enabling influences on cognitive appropriation. This includes the recognition or elicitation of underlying behavioral constructs as well as key secondary functions associated with the investigated behaviors among the subjects. Appropriate conceptual tools of behavioral and social sciences can accordingly be used as seen fit, in order to breakdown, analyze, and diagnose the phenomena of interest (see the examples as extensively provided in the overall research results summarized in section 5.7).	Among the developed list of potentials, one example of the aforementioned gaps is the identified controversial representation among parents and children about advanced uses of smart phones (internet use). Several underlying factors influenced this suspected gap in appropriation: - Some parents (and local school teachers) believed that internet is only used for *playing* with no other use, and will distract children from studying, and it is also dangerous for girls to use because Facebook is deemed bad for girls since it is not monitored by parents, and it allows posting their pictures for the public, which is seen as a taboo by some. Further investigation studied whether this is predominantly associated with past experience/incidents/rumors, or with inherited cultural norms, or simply personal convictions, etc. With support of social and behavioral theory and iterative consultation with stakeholders, this revealed that... - Most children who did own smart phones were not aware of features that already existed, which offer options for viewing maps, way-finding, recognizing topographic or land use features (like empty spaces or a soccer field), etc, and others were not aware that free internet can be obtained through the smart phone at the local cafe using the available Wi-Fi access and support from peers or the local 'familiar-strangers'. The propensity of children to negotiate such permits from parents and to act upon it varied widely between children character types and between genders, which was further investigated in depth. This revealed that ... - ... Another gap was .... - ...

6) IDENTIFYING POINTS OF INTERVENTION.	- In this final step, an in-depth understanding of the motility-gap of interest is now available and is used in order to prescribe the suitable interventions for *empowerment* or *safeguarding*. This can be developed and iteratively refined in consultation with the subjects and the relevant community, and can also comprise no-action options if suitable. - The central discourse is that empowerment of this sort does not aim to replace hard interventions or financial support, but rather to fill in the gap observed in resource constrained contexts through the mentioned intangible assets and resources and capabilities.	(1) With regards to the sub-item related to use of technology, the following points of intervention are identified: - 1.1. Parents were segmented into three common types based on the nature of their inclination or reluctance (or passiveness) to understand and acknowledge the growing role of technology in facilitating mobility and expanding children's realm of possibilities; the main types were as follows, enlisted with respective suggested interventions: (a) *Fear of empowerment:* These parents typically used 'dangers' of internet-use as the *stated* excuse, but in reality they mainly feared that they lose authority over their potentially empowered children, especially when exceeding them in capabilities. For this segment, detailed behavioral analysis was conducted leading to recommendation for a multi-component intervention: (i) Establishing a local peer group of mothers to improve their technology use skills with the support of local leaders; (ii) ..., (iii)... (b) *Lack of interest:* ... (c) ... ... - 1.2. Children were segmented by gender, revealing the following sets of influencing factors and respective recommended points of intervention: ... ... (2) ....