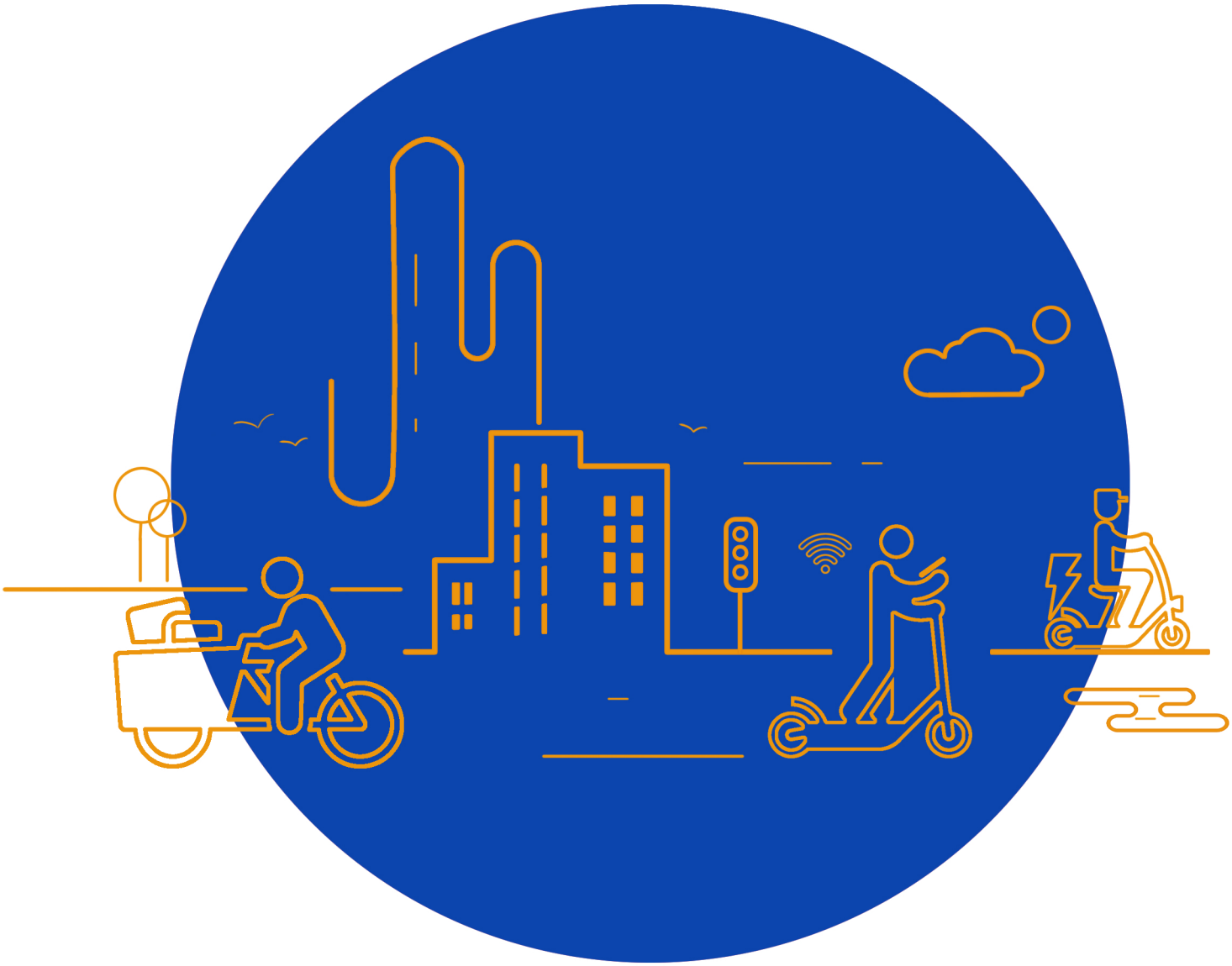
Policy Paper: Micro-Mobility and Last Mile Solutions in Egypt



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CEDARE

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الملخص التنفيذي

بخلاف المشي وركوب الدراجات، شهدت مصر ظهور مزيد من وسائل التنقل المستجدة والمركبات متناهية الصغر الـ"ميكرو-موبيليتي Micro-Mobility "، سواء للاستخدام الشخصي أو للأنشطة التجارية على حد سواء. تعد الآثار المتوقعة للتغيرات المناخية والحفاظ على المساحات العامة وغيرها من سبل التقدم في وضع الاستدامة من الأمور بالغة الأهمية للمدن الضخمة والمكتظة بالسكان.

ومن المتوقع أيضا أن يساهم التنقل متناهي الصغر والصور المختلفة للمركبات متناهية الصغر في تعزيز التحول إلى استخدام وسائل النقل العام المستدام، إذ أن رحلات "الميل الأخير" (على سبيل المثال من المسكن للمحطة أو من المحطة للعمل أو للمدرسة) والرحلات القصيرة أو"الميل الأوحد" يجب أن توفر للراكب المقومات الجاذبة لتشجيع مثل هذا التحول، وبالتالي تساهم في زيادة الإقبال على وسائل النقل الجماعي بسبب تحسين تجربة "الميل الأخير" سواء المشي أو الدراجة أو وسائل التنقل متناهية الصغر الأخرى.

وبهذا يمكن تكوين علاقة مربحة لكافة الأطراف، واستفادة كل من مالكي السيارات الخاصة والفئات الأخرى من الركاب سواء المضطرين لاختيار الوسائل الأرخص (Captive Commuter) أو المهتمين بالاختيارات الأقل ضرراً على البيئة، وهذا تجسيد لأحد تدخلات العدالة المناخية . يعرض هذا التقرير توجه وموقف مصر فيما يخص هذا الشأن ويوجه بالسياسات الإرشادية ذات الصلة.

يبحث التقرير الوضع القائم للتنقل متناهي الصغر في مصر فضلا عن حلول الميل الأخير ومختلف المفاهيم والأطر، وذلك بغية دعم المرحلة المقبلة من تطوير السياسات في مصر في ضوء المشروعات العملاقة التي تنفذ حاليا للتوجه نحو التخطيط في المرحلة القادمة للتنقل فى سياق شديد المحلية في المدينة باستخدام وسائل "من الباب إلى الباب" للرحلة الكاملة.

أفادت الجلسات التشاورية للجهات المعنية والملاحظات الميدانية والمؤلفات المتعلقة بأن المساحات العامة تتقلص يوماً بعد يوم، وأن الاعتماد المتزايد على السيارات أصبح يهدد جودة الهواء وجودة الحياة بشكل عام إذا لم يتم التصدي له. ومن بين مختلف الحلول المتنوعة لبيئة حضرية مستدامة هو تهيئة البيئة الحضرية لخدمة المشي وللتنقل متناهي الصغر، و"التقليص" الكلي للمركبات وأحجامها التي تتصدر المشهد في المدن مرتفعة الكثافة، بالإضافة إلى تطبيق التشاركية وغيرها من الحلول التكنولوجية. غير أن الأمر لا يقتصر فقط على التكنولوجيا، لكنه يتعلق في المقام الأول بخلق بيئات حضرية آمنة وممتعة وتمكين السلطات وكافة الجهات المعنية من تحقيق رؤية المدن المستدامة، وهو ما يتطلب الحفاظ على الطبيعة العمرانية والتقسيم العادل للمساحات العامة وبناء القدرات وغيرها من التدخلات المطلوبة.

تشهد مصر تطورا سريعا في تنوع خيارات المركبات والتنقل متناهي الصغر، لكن تظل إتاحة البيانات عائقا رئيسيا أمام جهود المراقبة والتخطيط الهادفة إلى تحقيق الاستدامة وإلى تعظيم النواتج على المجتمع. وقد أسفر أحد الأبحاث الاستكشافية عن الآتي:

> يعد كل من المشي، ركوب الدراجات، السكوتر الكهربائي والموتوسيكل الكهربائي، الدراجات الكهربائية الهجينة، الدراجات الكهربائية ثلاثية العجل، دراجات البضائع الغير مميكنة وذات البدال/الدواسة، أنظمة مشاركة الدراجات أو الدراجات الكهربائية، مشاركة السكوتر الكهربائي ونماذج الأعمال التي يمكن تشغيلها بها، بالإضافة إلى المركبات الأخرى والحلول التكنولوجية- من الخيارات المستجدة أو المتنامية التي نجحت في غزو السوق المصري بسرعات متفاوتة وفي سياقات مختلفة.

كل ما سبق من خيارات يحرز تقدما في التخطيط لمستقبل ذي بدائل متنوعة للتنقل وشغل حيز أقل في المدن. فيعد تحسين جودة الطرق في مصر من بين العوامل الرئيسية لتحقيق ذلك، بينما يأتي أمان الطريق في المرتبة التالية في الأهمية. يتعلق هذا الأمر بآثار أخرى كزيادة حيازة واستخدام ومشاركة الإناث والتي تتطلب التقييم المستمر والمتابعة الجيدة وجمع البيانات بما يضمن تخطيط أفضل من شأنه تضمين المرأة في خطط التنقل المستدام والبيئة المعززة له، كما يرتبط أيضا بتأثير متوقع على خلق فرص عمل كنتيجة لتنوع وسائل الانتقال التي تخدم الأنشطة التجارية وخاصة بين الشباب.

فيما يلي التوصيات التي نتجت عن مراجعة الممارسات الدولية، وتقييم للوضع والفرص في مصر مع مراعاة محدودية المعلومات حول هذا الموضوع حديث النشأة حتى الآن:

- تعميم خطط التنقل الحضري المستدام بالمدن (**SUMP**): تكليف المدن بتطوير خطط التنقل الحضري المستدام لضمان التخطيط الشامل لكل مشروع ناشئ ولجذب عناصر الاستدامة، والتي عادة ما تغيب عن مجال تخطيط التنقل التقليدي المقتصر على البنية التحتية ويفتقر لعوامل الاستدامة الأخرى في أغلب الأحوال (على سبيل المثال رحلة الميل الأخير، التكامل بين وسائل متعددة، التظليل والأشجار، تعميم المفهوم الجندري، تقليل حدة ازدحام المرور ومعايير سلامة الطريق... إلخ). نُفذت خطة التنقل الحضري المستدام لأول مرة في مصر بمدينة السادس من أكتوبر ومدينة شرم الشيخ كبداية واعدة لتلك الممارسة في تخطيط المدن المستدامة. وجدير بالذكر أن المملكة المغربية تعد نموذجا رائدا بين دول منطقة الشرق الأوسط وشمال أفريقيا لتعميمها خطط التنقل الحضري المستدام (SUMP) أثناء تخطيط المدن.
- دعم إتاحة البيانات من أجل التمكين والتخطيط القائم على الأدلة: تعزيز مشاركة البيانات والمعلومات في قطاع النقل لتمكين الجهات الشريكة وتثقيف واضعي الخطط في المستقبل وتمكين المبتكرين خاصة وأن التحول الرقمي يأتي على رأس أجندة التنمية حالياً في مصر.

- إضفاء الصفة المؤسسية على التنقل النشط والتنقل متناهي الصغر في إدارات المرور بوزارة الداخلية وأحياء المحافظات وهيئة المجتمعات العمرانية الجديدة: حيث أوصي بتعميم المفردات والمصطلحات الفنية ومؤشرات الأداء الخاصة بالتنقل المستدام بين الجهات الرئيسية ذات الصلة ويشمل ذلك تحديد نقطة اتصال، أو وحدة أو إدارة مخصصة للتنقل المستدام بما فيه التنقل النشط، لتوكل بالمهام المحدثة ومؤشرات الأداء والإطار القانوني بحيث لا يقتصر دور الجهات المعنية بالمرور على السعي لتحسين سيولة مرور "السيارات" بل تتوجه لتحسين مرور المشاة وراكبي الدراجات وغير ذلك من وسائل التنقل متناهية الصغر.

تدخلات أخرى موصى بها كالتالي:

- تفعيل سياسات الحفاظ على الأشجار والأصول البيئية: تم بالفعل وضع السياسات والأطر القانونية (الدستور والقانون والإرشادات) بينما يتمثل التدخل الضروري في الاستفادة من هذه الثروة من الأحكام التنظيمية والقانونية عن طريق بناء القدرات من أجل فهم واستخدام أمثل من قبل الجهات المعنية الحكومية وكذلك المنظمات غير الحكومية والمجتمع المدني والأكاديميين والقطاع الخاص. وهذا لما تمثله الأصول البيئية مثل الأشجار من عنصر رئيسي - مهدد - في المدن المستدامة ولازمة لتحسين تجربة المشاة وراكبي الدراجات ووسائل الميكروموبيليتي (لما توفره من ظلال الأشجار، والسلامة النفسية، الراحة الحرارية، العنصر الجمالي والمتعة ..إلخ)، ويعرف كأحد المداخل الرئيسية للتحسين المرتقب نحو مدن ذات قدرة على خفض الكربون ومقاومة تغيرات المناخ وعلى الحد من تأثير الجزر الحرارية بالمناطق الحضرية المزدحمة وغير ذلك من فوائد متعلقة بالتشجيع على وسائل التنقل المستدام.
- المركبات متناهية الصغر وخلق فرص العمل للإناث والذكور: من الفرص الواعدة استخدام مركبات البضائع كمصدر مدر للدخل وما يترتب عليه من آثار اجتماعية وبيئية إيجابية، ويضاف إلى ذلك الأنواع المختلفة من المركبات متناهية الصغر غير المميكنة أو الكهربائية المجهزة بموتور، هذا مع مراعاة زيادة التملك والاستخدام في مصر ومحدودية بيانات سوق العمل المستجدة مما يقيد دعم التخطيط واتخاذ القرار. وليس من الممكن تقديم توصيات بالسياسات دون مزيد من الدراسات وجمع البيانات الموصى بها كخطوة تالية.
- سياسات ركن السيارات واستعادة المساحات العامة: من بين خطوات التطوير الضرورية هي إعداد وتفعيل سياسات ركن السيارات حتى تعكس بصورة متكافئة تكلفة المساحة العامة المستخدمة وتستعيد التوزيع العادل للمساحات العامة وأيضا لتدفع الركاب نحو استخدام المواصلات العامة وخيارات التنقل المتنوعة الأخرى.
- تعميم التخطيط المتمحور حول التنقل النشط في التجمعات الجديدة: مازالت عملية تخطيط المجتمعات الجديدة معتمدة على نمط يتسم بالتناثر والتخطيط المحدود للاستخدامات المختلطة للأراضي. وفي هذا الصدد نوصي بتنمية القدرات ودعم السياسات بما في ذلك دعم تطوير استراتيجيات التنقل النشط على المستوى الوطني وعلى مستوى المدن ،فضلاً عن وضع خطط التنقل الحضري المستدام وتأسيس عمليات التقييم والمتابعة والرقابة على أمان الطرق... إلخ. ويرتبط ذلك ارتباطا وثيقا بالاستعدادات لمؤتمر الأطراف لاتفاقية الأمم المتحدة الإطارية حول تغيير المناخ الـ 27 **(COP27)** والمقرر عقده في مصر، وهو ما يضع مصر في مصاف الدول الرائدة. ومن بين الحلول

البديلة المطروحة للتنقل لبعض فئات المجتمع هو التنقل النشط وغيره من خيارات التنقل متناهي الصغر. تزامنت هذه البدائل مع نتائج أزمة كوفيد 19 والإجراءات الاحترازية الصارمة من تباعد اجتماعي وتوفير بدائل لتقليل الاعتماد على وسائل التنقل الجماعي خلال أوقات الذروة، وهو ما يتطلب الدعم المتسارع لتلك الحلول ونظمها وبنيتها التحتية.

EXECUTIVE SUMMARY

Beyond walking and cycling in Egypt, further forms of micro-mobility and micro-vehicles are emerging, for both **personal** use and for **commercial** activities. Potential implications for climate change, public space conservation, and other sustainability progress are of utmost importance for large and dense megacities.

Micro-mobility and various forms of micro-vehicles are also a potential contributor to encourage **mode-shifting** from carbon-intensive car use towards sustainable public transport since the **"last-mile"** trip (e.g., from home to a station, or from a station to work or school), and short trips or the **"only-mile",** must all be *attractive* enough to encourage such a transition. This implies a win-win situation for both car owners and the less affluent or 'captive' commuters and other sustainable commuters, a demonstration of a **climate justice** area of intervention. This report aims to provide both orientation about the topic and its status in Egypt and provide policy guidance.

The report explores the current situation of micro-mobility in Egypt as well as last mile solutions, and the various definitions and scopes. This is done with the intention of supporting a next stage of policy development in Egypt beyond the existing megaprojects in process and further on towards considerations of the **hyperlocal context** of commuting and **door-to-door experiences** of moving in the city.

Findings of stakeholders' consultations, field observations, and relevant literature, note that public space is becoming scarce, and the accelerated car dependence is threatening air quality and the quality of life in general if not addressed. Among the wide diversity of solutions for sustainable urban environment is the advent of micro-mobility and the general 'shrinking' of vehicles, which is of interest in large dense cities, along with concepts of sharing and other tech-enable solutions. However, this is not an issue of technologies only, but more importantly an issue of developing and enabling safe and enjoyable urban environments and empowering the authorities and all relevant stakeholders to realize the vision of sustainable cities. This implies the **conservation of urban nature** and the equitable distribution of **public space**, capacity building, and other needed interventions.

A diversity of micro-mobility options and micro-vehicles are rapidly expanding in Egypt, but data availability is a major limitation to efforts for monitoring and planning to maximize impacts on society and to sustainability. Exploratory research indicated the following:

***Walking, cycling, electric kick-scooters, electric scooters and motorbikes, hybrid electric bicycles, electric three-wheelers, non-motorized utility bicycles, pedal-assist utility bicycles, bicycle sharing, e-bike sharing, electric kick-scooter sharing*, and the various business models with which they may operate, as well as other vehicles and tech-enabled solutions, are all either emerging or *accelerating* in their penetration at different speeds and in different contexts in Egypt.**

These are each advancing with their respective implications for planning for a future of **diversified mobility options** and **reduced area footprint** in cities. **Improvement in road quality** in Egypt is among the notable factors facilitating this, but **road safety** then becomes the issue of next concern. The topic also relates to other implications such as increased female ownership, use, and involvement, which warrants adequate monitoring and data collection to better plan for **gender-mainstreaming** in sustainable mobility plans and the enabling environment, and it is also associated with a foreseeable impact on **job creation** enabled by diversification of modes of mobility, especially among youth.

Following a review of international practices and evaluation of status and potential in Egypt with the limited information about this novel topic to date, the policy recommendations are as follows:

- **Mainstreaming SUMPs for cities:** Sustainable Urban Mobility Plans (SUMPs) mandates for cities to ensure a holistic approach to every new project, and to capture the elements of sustainability that are often not in the conventional transport planning scope which is often limited to hard infrastructure and missing other elements of sustainability (e.g. last-mile commuting, intermodal integration, shading and trees, gender mainstreaming, traffic calming and road safety measures, etc). The first SUMP has been implemented in Egypt has been in 6th of October City, and prospects for replication are foreseeable. A leading example in comparable country in the MENA region having mainstreamed SUMP in planning practices in cities is Morocco.
- **Support data accessibility for empowerment and evidence-based planning:** Enhance data- and information-sharing in the transport sector to empower stakeholders and educate future planners and empower innovators, especially as digital transformation ranks high in the current development agenda in Egypt.
- **Institutionalize NMT and micro-mobility in traffic departments of the Ministry of Interior, governorate districts, and new settlements authorities:** It is recommended to mainstream vocabulary and performance indicators associated with sustainable mobility among key relevant authorities, including establishment of a focal point, unit, or department, dedicated to sustainable mobility including NMT, and empowered by updated mandates and performance indicators and legal framework.

Other recommended areas of interventions are as follows:

- **Enforce conservation of trees and ecological assets:** Policies and legal frameworks are already in place (constitution, law, and regulations) but the necessary intervention is to leverage this wealth of legal and regulatory provisions by building capacity to understand and use it among relevant authorities, NGOs and civil society, academia, and private sector. It is a fundamental (and threatened) element of sustainable cities and the commuter's experience (shading, psychological well-being, thermal comfort, aesthetics and enjoyability, etc.). This has been

identified as one of the key areas of potential improvement in the move towards low-carbon and climate-resilient cities and addressing the heat island effect in dense urban areas.

- **Micro-vehicles and job creation for women and men**: A promising area of positive social and environmental impact is in income-generating uses of utility vehicles and various types of non-motorized or motorized electric (or cleaner) micro-vehicles noting the increase in ownership and use in Egypt, yet with limited availability of data monitoring this job market to better plan for its future. Policy recommendations cannot yet be provided without further studies and data collection, which is recommended as a next step.
- **Car parking regulations and public space reclamation:** Among the necessary developments in regulation and enforcement is the advancement of car parking policies to adequately reflect cost of space and to reclaim equitable distribution of public space, as well as nudge commuters towards public transport and diversified mobility choices.
- **Mainstreaming NMT-oriented planning in new settlements:** new settlements continue to be planned with sparse development and limited mixed land use planning. Capacity development and policy support in this respect is therefore recommended, including support in development of national strategies and city-level strategies for NMT in addition to development of SUMPs, and establishment of monitoring and evaluation processes, road safety audits, etc. This is especially of relevance in consideration of the preparations for the 27th Conference of Parties planned to be held in Egypt **(COP27)** positioning Egypt in a leadership role. NMT and other micro-mobility options are also among the alternative mobility solutions for segments of society following high **COVID-19** precautionary measures of social distancing and providing options to minimize dependance on collective transport modes in peak hours, requiring accelerated support to such mobility options and required regulations and infrastructure.

1 “Peak Car”

Whether or not a country is reaching a ‘peak’ and eventual decline in car dependence is an important question that researchers and planners are exploring to understand how to plan for sustainable cities; cleaner air, improved quality of life, improved pedestrianization and cycling-friendliness, and equitable distribution of public space.

In observation of the historical trends in advanced countries, a peak car phenomenon is indeed noted as a common trajectory[1,2]. This has been attributed to demand saturation, improved accessibility catering to sustainable travel behavior, along with constraints on less sustainable modes, but all preceded with a common trajectory of accelerated car dependence and ownership, which is a stage that many cities of developing countries are in today, but trying to learn from history elsewhere to avoid repeating mistakes.

1.1 Transport Policy Development Cycle

In observation of global trends, similar cycles of development have been found to be in common in many cities with regards to transport policy and planning. In a wide-scoped study of motorization trends in advanced countries, led by Prof. Peter Jones (2016) of University College London (UCL), an assessment of several decades of urban transport policy development in various cities was informative about a common trend. It revealed a common trajectory of car dependence, peaking, and decline[3]. The cities investigated included north-west European cities, advanced Asian cities, and some identified north American cities, which together indicated valuable insight about what the future may hold for developing countries that are in earlier stages of such evolution.

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, which 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.

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[1] EC (European Commission) (2004). Reclaiming City Streets for People: Chaos or Quality of Life? Luxembourg: Office for Official Publications of the European Communities. ISBN 92-894-3478-3. Retrieved http://ec.europa.eu/environment/pubs/pdf/streets_people.pdf.

[2] Metz, D. (2013) Peak Car and Beyond: The Fourth Era of Travel, Transport Reviews: A Transnational Transdisciplinary Journal, 33:3, 255-270, DOI: 10.1080/01441647.2013.800615

[3] Jones, P. (2016). The evolution of urban transport policy from car-based to people-based cities: is this development path universally applicable? Paper presented at the 14th World Conference on Transport Research, Shanghai 10-15 July 2016.

In the cities studied, the 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. In such later stages, owning a car no longer becomes an important status symbol and culture is adapted to livable people-centered cities.

- **Stage-1:** Low car ownership.
- **Stage-2:** Car-oriented development advances along with increasing dependance on private cars and urban planning focused on roads and highways, but later planners notice the impacts on public space, air quality, and quality of life in general, which reaches its peak and demands response to recover from such impacts.
- **Stage-3:** As cities realize impact on health, environment, and society, a wide range of solutions are implemented to reduce car-dependance and enhance the livability of cities, and sustainable lifestyles and cultures follow.

Not all cities however are aligned with this entire trajectory, but there are rather several common factors that are noted 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 or to accelerate such evolution and mitigating the impacts expected.

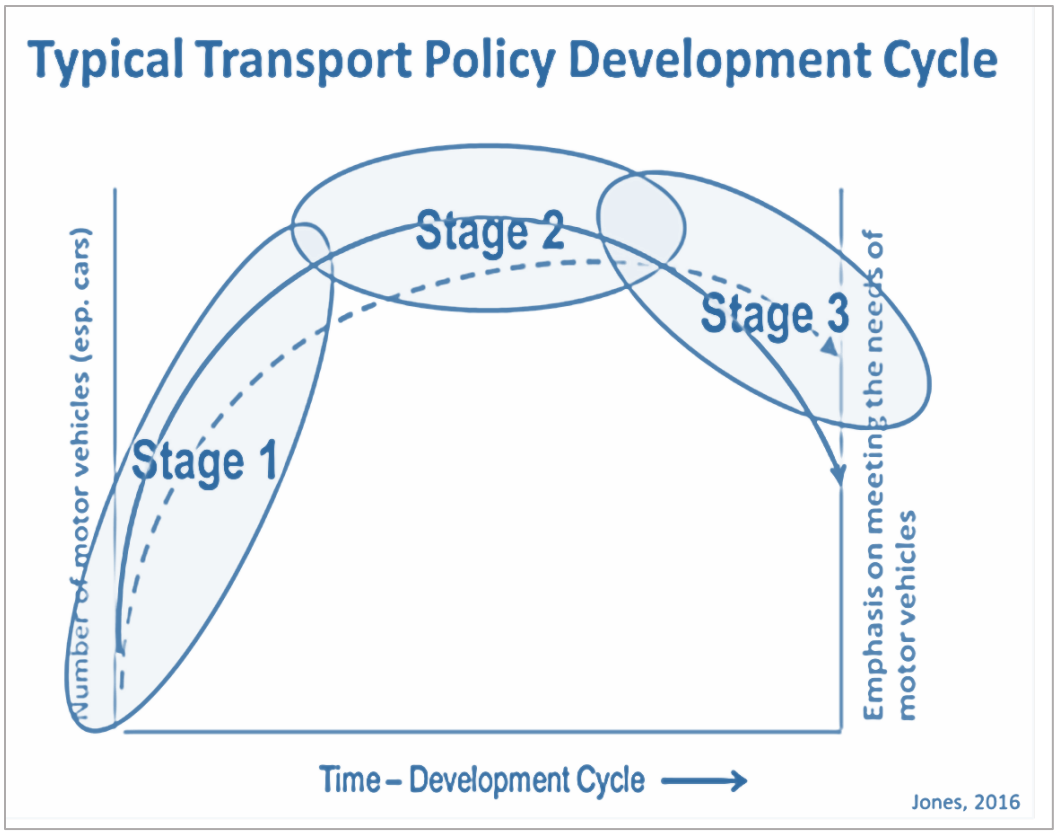


Figure 1 Stages of transport policy development seen in the history of many advanced cities around the world

1.2 How is the world responding?

In response to the long-known threats of exponential growth in car-dependence, key principles of improving planning have been mostly revolving around the following concepts:

- **Mixed-use and compact development:** Having various needs within walking or cycling distance facilitates lifestyles with low-car dependence.
- **Travel Demand Management (or "Mobility Management") Measures:** Policies and regulations and other 'soft' measures to encourage a shift to more sustainable mobility practices helps shift people's behavior (e.g., constraints on cars such as parking policies and congestion charges, but facilitation of walking, cycling, and public transport on the other hand).
- **Street transformations and reclaiming the street:** Mistakes made in the past due to car-centered planning can be treated, and spaces replanned to regain livability of cities (e.g. recovery of lost public space, urban greenery and elements of sustainable and complete streets reintroduced to cater to walking, cycling, public transport, while considering safety, comfort, heritage, and enjoyability).

- **Re-thinking and diversifying mobility options**: Diversifying mobility options enables people to respond to necessary policies and regulations. Also, novel ideas for mobility further advance the experimentation needed to explore means to reduce the area-footprint of commuters and environmental impact.
- **Developing Sustainable Urban Mobility Masterplans**: Among the key developments in improving mobility planning is the establishment of best practices for planning in a holistic manner that revolves around improving the quality of life.

Among the areas of much interest are opportunities for development in the realms of *electrification, automation*, and *shared mobility* (connectivity), referred to by some as the *three revolutions* of urban transportation[4]. As cities grow denser in population, vehicles will need to have a smaller area footprint, be low- or zero-emission, and be provided through sharing schemes where suitable.

1.3 How is Egypt responding?

Egypt is in a very early stage of car-dependence despite the apparent congestion in the dense cities. Car ownership is low (but density is high and air pollution is significant due to low fuel quality). However, despite the low car ownership, the steady economic growth implies likely acceleration of car-ownership and continued dependence if no adequate policies are set in place to enable mode-shifting.

In this respect, substantial investments have been made to advance collective transport systems in Egypt in recent years (metro lines, light rail transit, bus rapid transit systems, monorail lines, etc), a steady move towards improved sustainability of cities in this respect. However, among the controversial issues is the expansion of road networks (and road widths) within residential areas. This, on one hand relieves congestion, but on the other hand can make way for future further 'induced' traffic if constraints are not put in place. Another concern being addressed is also the link to higher risks of road accidents due to increased speeds.

Awareness of such aspects is in gradual development, with gradual introduction of improved parking restrictions and regulations, demonstrated interest in introducing cycling-friendly and pedestrian-friendly upgrade interventions, and gradual reduction of fuel subsidies, which incentivizes fuel efficiency and consumption reduction. Elsewhere, concepts of park-and-ride,

[4] Fulton L., Mason, J., Meroux, D. (2017). Three Revolutions in Urban Transportation: How To Achieve the Full Potential of Vehicle Electrification, Automation, and Shared Mobility in Urban Transportation Systems Around the World by 2050. University of California, Davis, and Institute for Transportation and Development Policy. https://merritt.cdlib.org/d/ark%253A%252F13030%252Fm52c3sbx/1/producer%252FSTEPS-2050.pdf

bike-sharing, and other ideas that are novel to Egypt are being gradually introduced, all of which are in early stages of learning and trial-and-error, but in progress.

Key concerns of cultural heritage activists and environmental organizations however are about the irreversible losses in cultural and ecological assets of old cities in favor of road expansion programs, as well as the mentioned risks associated with road safety for pedestrians. In this respect, awareness about such drawbacks is necessary, and means to mitigate such impacts are of concern.

Such topics are key areas for development and improvement in the present stage in the evolution of transport policy. Improvements in this respect would promise better pedestrian friendliness and better commuter experiences when accessing public transport, and therefore enable the shift from cars to alternative modes.

1.4 Awareness about laws and regulations

In terms of legal frameworks, considerations for pedestrians and their safety are already included in the Traffic Law and its executive regulation of 2008. This includes details that are not sufficiently practiced or enforced in practice, such as how a car driver should behave when approaching a zebra crossing, etc. Dissemination and awareness activity about existing regulations is therefore an area where improvement is necessary in parallel to the improvement of the enabling infrastructure.

1.5 Less space for cars and more space for other modes?

Among the areas of interest in this learning journey are the alternatives associated with conservation of public space in the dense cities. This can be indicated in the plans of introducing bicycle sharing in the central business district, integrated with the accompanying measures implemented in Cairo's downtown area as well as in other cities in Egypt. Concern over the scarcity of 'space' in the city is increasingly coming to the attention of planners, adding this concern to the list of other threats of excessive car-dependence.

Concepts associated with 'micro-mobility' are therefore also relevant to accelerate progress towards sustainable cities in Egypt and socially equitable distribution of public space. Various novel modes and systems of micro-mobility have also been adding to the 'playfulness' of urban environments and the enjoyability of commuter experiences.

Within a large mix of solutions for improved door-to-door commuting experiences, this paper is focusing on one of these aspects, the shrinking of the vehicles of the future in the context of improved connectivity and electrification and looking beyond cycling and walking for the short first- and last-mile as well as the 'only-mile' commutes, exploring a future of more diversified options for mobility.

2 What is Micro-mobility?

Micro-mobility is a relatively new term in many countries. The various definitions revolve around three main characteristics with few variations. First, they are lightweight vehicles, that can weigh up to 50 kg while some planners recognize 500kg. It is also characterized by operating at relatively low speed which is up to 25 km/hr., while some planners may recognize up to 50 km/hr. Lastly, it is driven by the user personally. These vehicles can either be human-powered or with an electrical motor. The most common examples for these vehicles are Bikes, kick-Scooters, and skateboards [5].

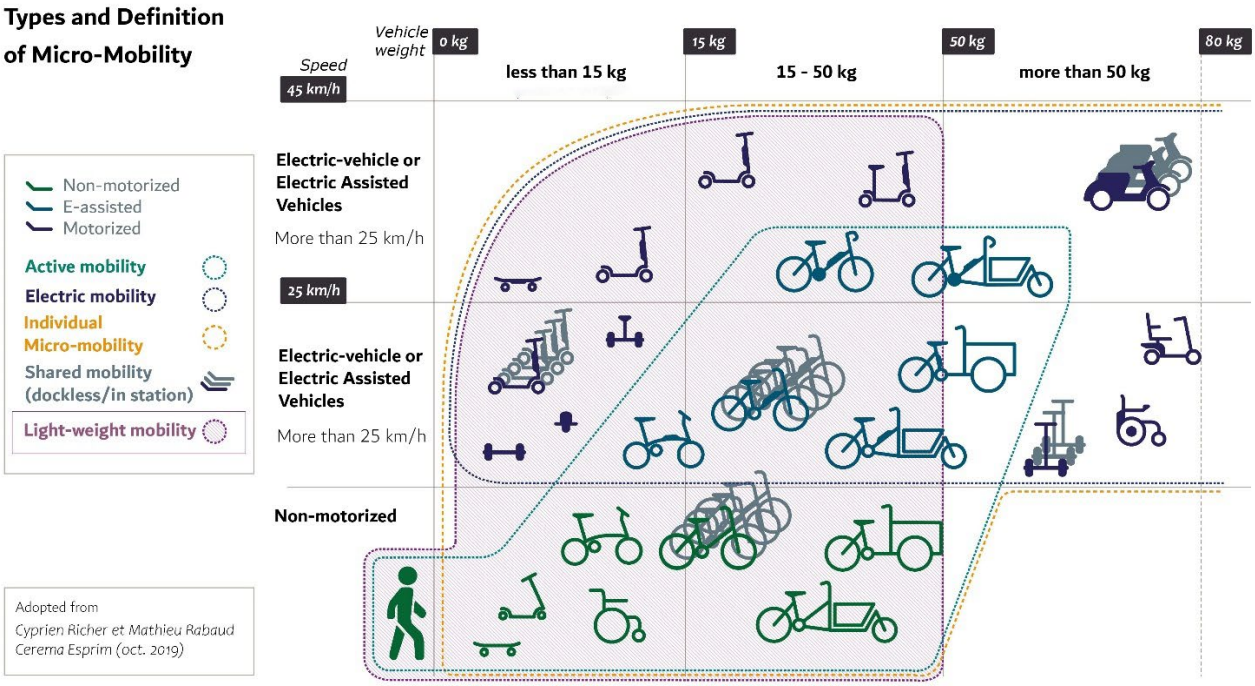


Figure 2 types and characteristics of micro-mobility

Micro-mobility is growing rapidly worldwide in densifying cities. Despite their basic characteristics, micro-mobility is considered by some planners the future of mobility, as well as one of the promising tools to reduce private car ownership [6]. In this paper, the existing situation and challenges are explained, and the opportunities in the field of micro-mobility are highlighted.

[5] Institute for Transportation and Development Policy. 2021. As the Impacts of Coronavirus Grow, Micromobility Fills in the Gaps. [online] Available at: <https://www.itdp.org/2020/03/24/as-the-impacts-of-coronavirus-grow-micromobility-fills-in-the-gaps/> [Accessed 14 October 2021].

[6] CB Insights Research. 2021. Micro Mobility Revolution: Startups, Companies & Market Solutions l CB Insights. [online] Available at: <https://www.cbinsights.com/research/report/micromobility-revolution/> [Accessed 15 October 2021].

Mirco-mobility and Micro-vehicles vary in definitions

Micro-mobility can easily be confused with a similar term, Micro-vehicles, which refers to the vehicles themselves and not the nature of mobility, and they also further include other vehicle types that are considered smaller than the usual private car, i.e., motorcycles, quadricycles, motorized three-wheelers, etc. Micro-vehicles definitions vary between different countries, but in essence the reduction in size and the implied reduced space requirements in dense cities is the common theme.

Cycling Case study: BiTiBi (bike-train-bike) in the Netherlands

The BiTiBi (Bike-Train-Bike) logic entails combining the most energy-efficient modes into a mode capable of competing with a private vehicle for last mile solutions. The European Commission funded this experiment to explore effective adoption in the Netherlands before replicating it in other regions and cities.

Safe bicycle parking (first mile), shared bicycle (last mile), integration of services, and integration of payment are four of the service's building blocks. The railway-connected system differs slightly from the more extensively used urban bicycle-sharing systems. Bicycles are hired for 24 hours and must be returned to the station where they were picked up (round-trip station-based system). The operator's costs are greatly reduced because of this. It enables the Dutch railways to operate the service at a break-even cost, which is difficult for other urban bicycle systems with bicycles that are only used occasionally.

Observed behavioral change was as follows: Approximately 10% of cyclists who park their bikes at railway stations had previously driven the entire distance in a car and a further 15-20% of people stopped driving to the train station. The impact of implementing the BiTiBi approach across Europe was also calculated as part of the project. In 2030, it was estimated that 20% of railway passengers would ride their bicycles to the station. This is less than half of the actual Dutch share, but more than five times the estimated 4% of all EU railway users. As a result, there will be an additional 250 million railway users in the EU[7]. In addition to that, there will be a reduction in CO2 emissions and energy. Moreover, due to the increase in physical activity, 1200 premature deaths will be avoided each year[8].

[7] European Environment Agency, 2020. The first and last mile: the key to sustainable urban transport : transport and environment report 2019.

[8] Bitibi.eu. 2017. Bike Train Bike. [online] Available at: <http://www.bitibi.eu/dox/BiTiBi_Booklet_WEB_Feb2017.pdf> [Accessed 11 September 2021].

3 Sustainable mobility planning

A widening variety of mobility modes are offered to use within the cities today. Many hierarchies of the sustainability of different options are under continuous discussion and being promoted among environmental activists. An example of a simplified list of priorities for planners is as follows:

1. Walking
2. Cycling
3. Utility bicycles
4. Public transport
5. Taxis and shared/ride-hail cars
6. Private cars, whereas *single-occupancy* car use is the lowest rank in priorities.

Planning approaches are guided by the emerging concepts of Sustainable Urban Mobility Plans (SUMPs), the Avoid-Shift-Improve (A-S-I) frameworks, the compact city planning concept, among others, all interrelated.

The Sustainable Urban Mobility Plan (SUMP) is a planning strategy introduced by the European Commission in late 2013. This framework of planning aims to provide sustainable mobility in cities to satisfy the mobility needs of people for a better quality of life. The main characteristic of the SUMP is its emphasis on participatory and integrated development principles. It is a long-term vision for a city, with a clear implementation plan.

Figure 3 Sustainable Urban Mobility Planning Guidelines

Egypt's First SUMPs: 6th of October City, Cairo, and Sharm El-Sheikh

The first SUMP developed in Egypt is developed for a New Urban Community in West Cairo called 6th of October City. It aims to tackle the present and future mobility challenges in the city until 2030. The plan is focused on passenger mobility and includes all modes of transport; public and private as well as motorized and non-motorized. The SUMP is developed by a Consultancy called Transport for Cairo in cooperation with the New Urban Community Authority (NUCA), which is the authority responsible for all New Urban Communities in Cairo, including 6th of October.

The 6th of October SUMP follows the European Commission Guidelines, however, focuses on localizing the steps and strategies to fit the context. It starts with a diagnostic of the city, developing a vision and objectives and arriving at specific projects at the end. [9]

In the same year, another landmark SUMP for Sham El-Sheikh city was implemented by the ITDP in cooperation with UNHABITAT, South Sinai Governorate, and the General Authority for Physical Planning (GOPP), including proposed NMT facilities and bikeshare systems among a wide range of integrated solutions.

Source: Sustainable Urban Mobility Plan in 6th of October City, Transport For Cairo

[9] Transport for Cairo, 2021. Sustainable UrbanMobility Plan in 6th of October. URL: https://transportforcairo.com/portfolio/ (accessed on 16 September 2021)

The Sustainable Mobility Plan process is divided into several phases: Preparation and assessing the current situation of the city, identifying its potentials and challenges, creating a vision and setting specific goals for the city to achieve within the set timeframe, and then planning the process, setting clear projects and *action items,* and finally the implementation and monitoring phase. The cycle ends with a clear review of the results and lessons learned[10]. The SUMP is a framework that contributes to having integrated interventions in cities, which all contribute to the overarching vision, and avoids ad hoc interventions. Accordingly, synergies between projects are highlighted, emphasizing the effectiveness and success of each project and intervention.

Elsewhere in the MENA region: Cities of Morocco Implementing Sustainable Urban Mobility Master Plans (SUMPs)

Over the past years, the Moroccan government developed a national policy to address the current and future challenges of Moroccan cities and improve urban mobility.

In 2016, Morocco, the host of COP22, committed to reducing GHG emissions by 13% by 2030. It was one of the first countries to join the MobiliseYourCity Partnership (MYC), a good example of international cooperation to mainstream SUMPs[11]. MYC has established itself as one of the leading global partnerships for sustainable urban mobility planning, with around 100 partners. It supports in SUMP implementation, policy development and sustainable transport investment in developing and emerging cities.

In Morocco, MYC has provided technical support to implement a SUMP in several Moroccan cities. MYC assisted Casa Transports, the entity responsible for the SUMP implementation in Casablanca through guidance, technical expertise and review of the SUMP. Furthermore, MYC assists other cities of Morocco to implement a SUMP, such as Rabat and Oujda.

Mobilise Your City

source: Mobiliseyourcity, 2021

[10] Eltis, 2020. SUMP process. URL: https://www.eltis.org/mobility-plans/sump-process (accessed on 10 October 2021)

[11] Mobiliseyourcity. 2021. Morocco | MobiliseYourCity. [online] Available at: <https://www.mobiliseyourcity.net/node/214> [Accessed 1 September 2021].

3.1 Avoid-Shift-Improve Principle

Within the *Avoid-Shift-Improve* framework or principle for addressing sustainable mobility planning and choices, micro-mobility offers multiple *Shift* options. In observation of global trends, several solutions are receiving a lot of attention from planners, such as vehicle-sharing, mode integration and infrastructure for nonmotorized modes (walking, cycling, utility vehicles, etc.), but also through improved urban planning.

In this respect, micro-mobility is not about vehicles only, but also about the *urban planning* (compact and mixed-use) and digital infrastructure that would enable it, along with the regulatory framework and enforcement to ensure safety.

3.2 Compact City / Neighborhood planning Concept

In order to enable reduced needs for transport ('avoid') **Transit Oriented Development (TOD), compact, and mixed-use city planning** is key**.** One popular simplification used to summarize such concepts to the broader public is to envision the so-called *15-minutes* city where educational, commercial, leisure, medical and employment facilities are provided in a compact mixed-use neighborhood within 15-20 minutes walking or cycling, and accordingly avoid any unnecessary traffic between the city's neighborhoods[12].

[12] Deloitte. 2021. 15-Minute City. [online] Available at: < https://www2.deloitte.com/global/en/pages/public-sector/articles/urban-future-with-a-purpose/15-minute-city.html > [Accessed 16 September 2021].

Paris, and origins of the 15-minute city

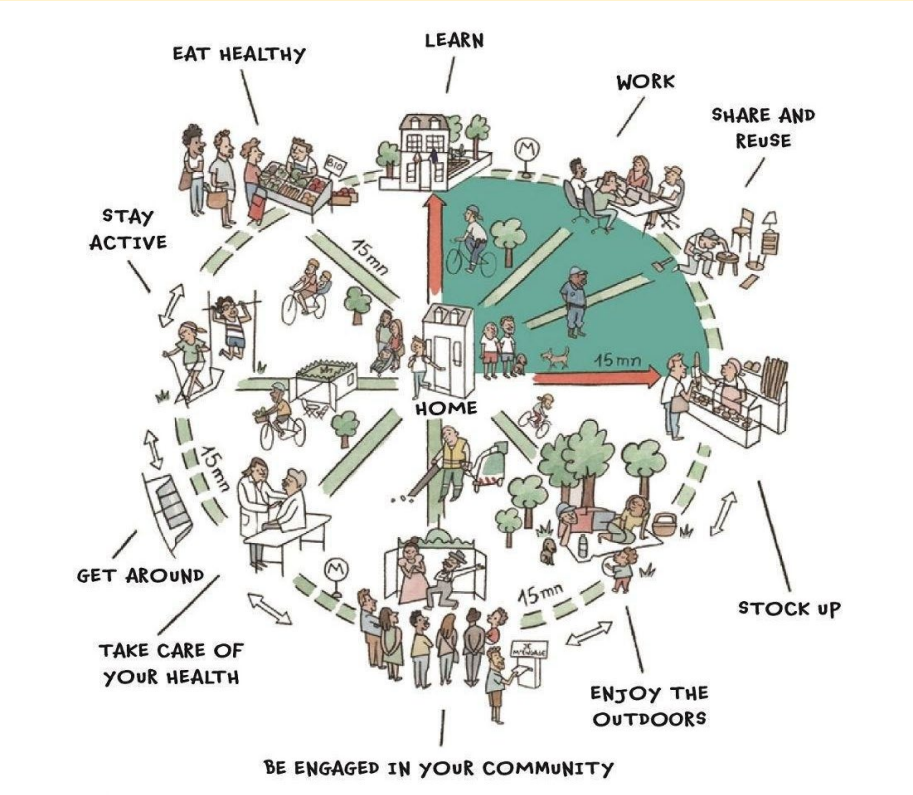


Figure 4 The concept of the 15 minutes City. Illustration: Micaël Dessin / for Paris-en-commun

The concept of 15 minutes cities was popularized by Anne Hidalgo, Mayor of Paris, who was inspired by French-Colombian scientist Carlos Moreno in 2016. It has been described as a *return to a local way of life.* In an article published in 2021, Moreno et al. introduced the 15-minute city concept as an approach to ensure that urban residents can fulfil six essential functions (living, working, commerce, healthcare, education, and entertainment) within a 15-minute walk or bike-ride from their homes. According to Moreno, 66% of the public space in Paris is streets for cars, but individual cars move only 17% of the population.

The Mayor of Paris's goal has been to improve the quality of life since her appointment in 2014. She banned high-polluting vehicles as well as car traffic along parts of the Seine and, in February 2020, restricting it to pedestrians and cyclists. She initiated the creation of mini green spaces across the city, in addition to more than 40 Parisian school grounds transformed into green *oasis yards*. Since the pandemic, more than 50 km bike lanes have been added, which are known as *coronapistes*. Hidalgo also put a budget of €1bn euros per year for maintaining and beautifying streets, gardens, and squares.[13]

[13] Postaria, R., 2021. "15-minute city" – how do we get there? - citiesforum.org. [online] citiesforum.org. Available at: <https://www.citiesforum.org/news/15-minute-city/> [Accessed 7 September 2021].

3.3 Mobility as a Service (MaaS)

Most cities offer a variety of mobility options for people to move within it. With regards to mass transit, one key challenge is that they cannot compete with the door-to-door service that a private car can offer. To address this, cities started approaching integrated mobility systems to offer a door-to-door experience for mass-transit commuters.

Integrated mobility enables the lining up of different mobility modes together to organize the door-to-door trip. One promising long-known approach to enable integrated mobility systems is to conceptualize transportation as a tech-enabled service providing *mobility* rather than transport modes or vehicles, i.e., **Mobility-as-a-Service (MaaS)**. MaaS leverages the development in information and communication technology (ICT) sector and widespread availability of smartphones today to provide a digital platform for mobility services such as planning, booking, and paying for various modes. Railways, buses, taxi services, ride-hailing services and even car/bike/scooter sharing services can be integrated in a MaaS platform, or separate businesses can provide various forms of MaaS with different levels of integration (e.g. in freight transport, in novel sharing services, specialized fleets, etc.).

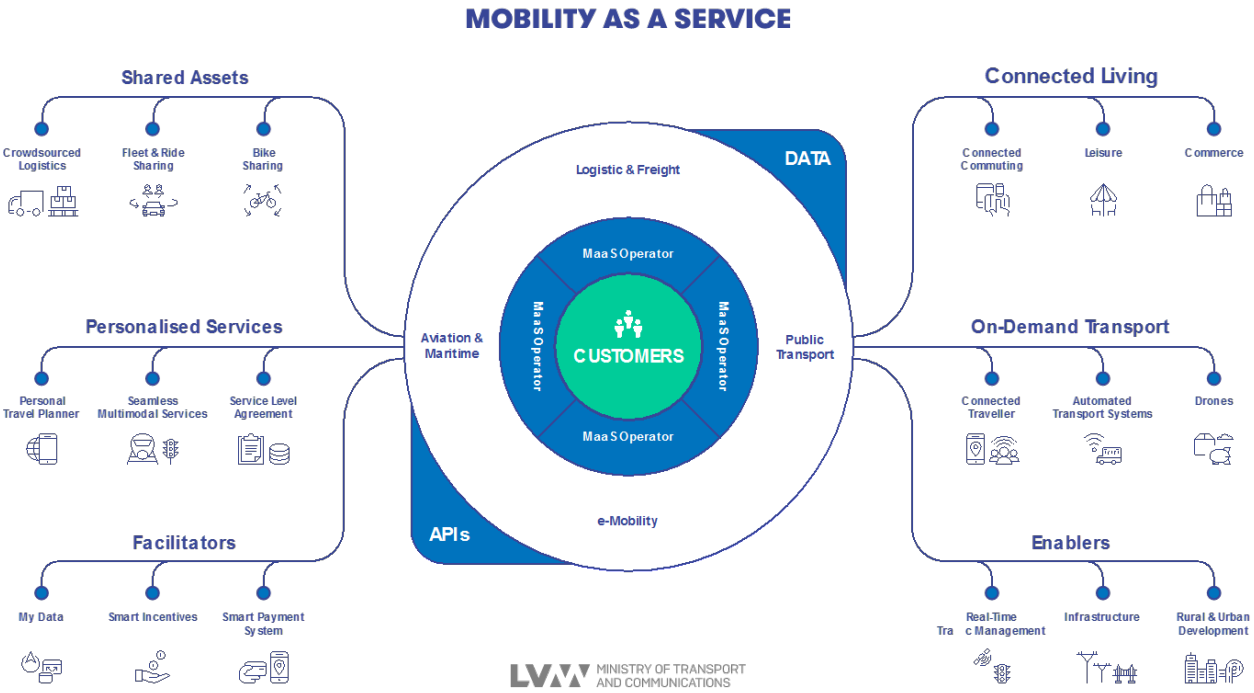


Figure 6: Mobility-as-a-Service (MaaS) improves efficiency and mobility offer. Photo: Ministry of Transport and communications, Finland

MaaS gives the commuter the options of **integrated ticketing and pricing** for all mobility trips even if these trips are within different mobility modes. Accordingly, a common practice in city-level planning is to offer **mobility packages** and **season tickets** to encourage users to try their integrated mobility experience. MaaS platforms therefore enable alternative door-to-door mobility and facilitate sustainable mobility choices and eventually contribute to overall system efficiency and reduction in emissions.

However, the main challenge facing MaaS operators is the geographical coverage of the existing modes. If the existing modes in the city do not cover the distance from the origin of the user to her destination, then the utility of the application rapidly declines, and commuters may be compelled to use private cars or modes that score less in the sustainability scale.

To ensure suitable door-to-door commuting experiences, such short-distance connecting trips (or sole short trips in general) must therefore be subject to extensive planning as well. This challenge is the main issue facing integrated mobility systems in cities, and it is therefore studied as a fundamental category of trips referred to as the *Last Mile* or also referred to as First Mile/Last mile, or First, Last, and Only mile (FLO), etc., all of which refer to the similar concepts associated with door-to-door coverage[14,15].

[14] UITP. 2019. Mobility as a Service. [online] Available at: <https://www.metropolis.org/sites/default/files/resources/Report_MaaS_final.pdf> [Accessed 5 September 2021].

[15] Matyas, M. and Kamargianni, M., 2018. Survey design for exploring demand for Mobility as a Service plans. Transportation, 46(5), pp.1525-1558.

4 Beyond megaprojects: The *missing mile* challenge

The *first and last mile* refer to the trip from the commuter's location to the nearest mass-transit stop and from the final stop to the destination (e.g., home to metro, metro to work). It is also common to refer to both as the *last mile* for brevity.

The '*only mile'* term represents the trips in which the destination can be reached directly from the origin without the need for an interchange between mobility modes (e.g., short cycling trip from home to school). Ideally, most of the mobility trips in a compact city should fall under the category of only mile trips.

Figure 5 First and Last Miles trips are fundamental to encourage the shift away from cars. Source: ONN Bikes, Medium

Improved first and last-mile experiences may directly affect mass transit as well and are therefore increasingly becoming a concern of major transit projects as well. In one study of the residents of New Cairo City in Egypt, results indicated alarming results[16]:

(1) The insufficient first and last mile mobility options in New Cairo is the second most affecting factor for the residents' choice to avoid mass-transit modes.
(2) 49% of mass-transit users in New Cairo reported that the first mile of their trip is the most challenging part of their trip that needs most development.
(3) 90% of New Cairo residents use private cars for their *only mile* trips to get their weekly household needs. This indicates the lack of offering sustainable only mile solutions.

[16] Hussin, H., Osama, A., El-Dorghamy, A. and Abdellatif, M., 2021. Towards an integrated mobility system: The first and last mile solutions in developing countries; the case study of New Cairo. Transportation Research Interdisciplinary Perspectives, 12, p.100469.

On the other hand, Egypt is investing substantially in numerous transportation mega projects, especially in the Greater Cairo Region (GCR). Mega projects like the monorail, light rail, Bus Rapid Transit systems, and the new metro lines are expected to improve the mass transit services in the GCR and connect its districts together. However, the main challenge will be how to connect the users to these modes. In other words, what will be the last mile solutions (and commuter experiences) to reach these future mega projects to be sufficiently enjoyable to attract and retain commuters who would otherwise prefer private cars.

4.1 Understanding First, Last & Only (FLO) mile concepts

First, Last & Only (FLO) mile issues are among the greatest challenges for developing an integrated mobility system, but various solutions are becoming widespread today. There are several FLO mile solutions proposed such as park-and-ride, car-sharing, car-pooling, ride-hailing, micro-transit, internal buses feeder networks, other micro-mobility options, and walking.

4.2 Park & Ride to reduce cars in the city

Park-and-ride encourages users to use their private cars for the last mile trips to use the mass-transit service as their main mobility mode. However, to be convenient for the users, the location of these stops should be closer to the *origin* location of the users rather than their destination location. Furthermore, the parking fees are often subsidized either by the city council or the mobility operators to encourage ridership as well as ensure the enjoyability of the commuting experience and spaces.

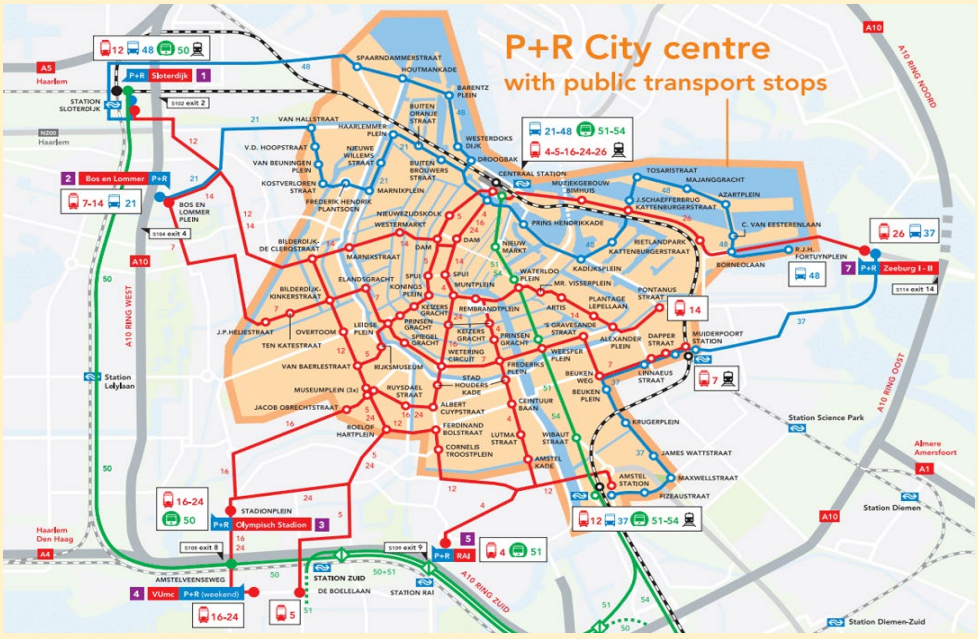
Furthermore, offering convenient services at the stations (e.g. catering to commercial, religious, or social activity) is among the common approaches. One key disadvantage however can be the space requirements for the car parking and the opportunity cost of land. Another arguable disadvantage is the possible car traffic impact at the stations, requiring careful design. Park and Ride stations are therefore strategically placed around the outskirts of cities.

(P+R) in Amsterdam

The city of Amsterdam has created a unique Park & Ride (P+R) scheme in 2011, which allows visitors to park their cars at a discounted rate at a P+R site and then take public transportation to the city center. Only one condition applies: they must complete their journeys to the city center.

The final check-in back to the car must therefore take place at a public transportation stop in the city center. The focus is primarily on a specific target group of commuters: day-trippers and tourists.

Amsterdam purchased new vending machines for public transportation tickets and the city center check as part of the P+R concept's new approach. As a result, **over 1.3 million people visit one of the P+R sites each year**. This equates to 500,000 cars parked rather than driving to the city center. 3,000 cars are parked at the P+R sites in Amsterdam during rush hour. This is the number of vehicles usually parked in the city center for an extended period during peak hours[17]**.**



Amsterdam's P+R City Centre with public transport stops.

[17] Rijkswaterstaat Environment. 2021. Case study Park+Ride in Amsterdam. [online] Available at: <https://rwsenvironment.eu/subjects/sustainable-mobility/toolbox-smart-mobility-management/multimodal/map/case-study-park-ride-amsterdam/> [Accessed 1 September 2021].

4.3 Sharing and Ride-hailing Services beyond cars

Ride-hailing services can be used as a last mile solution. They are not necessarily the most sustainable solution as they offer individual vehicles for their users in involve cars circulating in traffic. However, they can be seen more sustainable than the park-and-ride option if implemented with such intention to facilitate last-mile trips with the associated incentives. Another key advantage is that they offer suitable last mile services for the elderly and people with disabilities that allows them to integrate with the mass-transit services easily.

The door-to-door trips enabled by ride-hailing or sharing services are attractive to many users, and they recognizably help in increasing the mass-transit ridership in many cities. One example is Los Angeles[21]. One program in LA involved subsidizing ride-hailing that was connecting to public transport services, with a 15km catchment area coverage, and proved successful in promoting new ridership[18,19].

To further encourage the users to decrease the use of private cars, cities and service providers tend to subsidize the fare for the ride-hailing services if connecting to the mass-transit stations[20]. Furthermore, the city council and mobility planners can compare various door-to-door trips to account for total monetary costs, but also total comfort and time. These variables tend to encourage citizens to use ride-hailing for short trips, while in the case of long trips they can be a connecting mode[21]. Although ride-hailing is known for mobilizing *cars*, such services are continually expanding to mobilize other vehicle types such as motorcycles, three-wheelers, and other vehicle types that can be used as last mile and only-mile solutions.

[18] Brown, A., Manville, M. and Weber, A., 2021. Can mobility on demand bridge the first-last mile transit gap? Equity implications of Los Angeles' pilot program. Transportation Research Interdisciplinary Perspectives, 10, p.100396.

[19] Lewis, P. and Puentes, R., 2021. Mobility Lessons Learned: A Summary of the MOD Pilots in the Los Angeles and Puget Sound Regions. [online] Enotrans.org. Available at: < https://www.enotrans.org/wp-content/uploads/2021/04/Mobility-Lessons-Learned-A-Summary-of-the-MOD-Pilots-in-the-Los-Angeles-and-Puget-Sound-Regions.pdf > [Accessed 1 September 2021].

[20] Sand, L., Beckerman, S., Blair, C.C., 2016. First and Last Mile Connections: New Mobility.

[21] Tirachini, A., 2020. Ride-hailing, travel behaviour and sustainable mobility: an international review. Transportation 47, 2011–2047. https://doi.org/10.1007/s11116-019-10070-2

Formal & Informal First and Last Mile Solutions in Egypt: Moto-Taxi

The Moto-Taxi is a form of a FLM solution that was developed informally by people in Cairo as an informal demand-response phenomenon. It is characterized by its small size and low fuel consumption compared to other vehicles. One of the most popular uses is in high-traffic areas where the moto-taxi would be faster than any other vehicle. It is also used in high-density areas with narrow streets. It is also used by workers in areas under construction where adequate transport services are not in place or do not reach the specific construction sites.

Moto-taxis' drivers cluster together near a bus station or a popular drop off location to form their own moto-taxi station and cover convenient distances. Safety concerns is an issue, but affordability and the convenience of at-door drop-off is meeting a substantial market need.

Recognizing the popularity and functionality of moto-taxis in the streets, **ride-hailing** service providers also started adding a motorcycle option to their fleet options. This service has improved the issue of safety of the moto-taxi commuters and is gradually being used by females as well.

Figure : Informal Sector filling in a gap of last-mile needs, including services for trips to school.

4.4 Catchment area planning for walking and cycling

Planners often define a suitable distance to ensure proximity of pedestrians to public transport services, such as 5-minute walk distances (e.g. 400m), which is seen as the most convenient for commuters. However, a common travel distance for first and last mile trips, as well as only mile trips, vary largely between cities depending on the urban planning. People may start choosing alternative travel modes as distances gradually increase. This does not only depend on distance, but also the commuting experience.

Many tools are available to assess such criteria addressing the commuting experience and pedestrian friendliness of cities, beyond distance. A prominent example that has been utilitized in training in many developing countries, including Egypt, is the ITDP Pedestrian First Toolbox, and elsewhere other tools and assessment efforts are being rapidly mainstreamed in common planning practices[22,23].

[22] ITDP (2018). Pedestrian First Toolbox. https://www.itdp.org/publication/walkability-tool/

[23] McKinsey, 2017. Public–private collaborations for transforming urban mobility | McKinsey [WWW Document]. URL https://www.mckinsey.com/business-functions/sustainability/our-insights/public-private-collaborations-for-transforming-urban-mobility# [Accessed 1 September 2021].

New Cairo Case-Study

New Cairo is a satellite city that has a very high car dependency rate. Almost 74% of the residents use private cars as their main mobility mode. In response to that, New Urban Communities Authorities (NUCA) has planned feeder buses network in order to connect the origin's location of the commuters to the nearest mass transit station. However, this system did not yet meet its expected goals as these buses were not accessible from most of the city. By applying a basic **catchment area** radius of 400 and 800 meters, neglecting the existing street network and the **gated communities** and the buildings that are blocking the direct routes, limited coverage is still observed. Only **22.7 %** of the Urbanized study area were covered within 5 minutes walking distance, while **47.7 %** of the area were covered within 10 minutes' walk. Practical coverage is even less when considering other factors like physical barriers of gated communities[24].

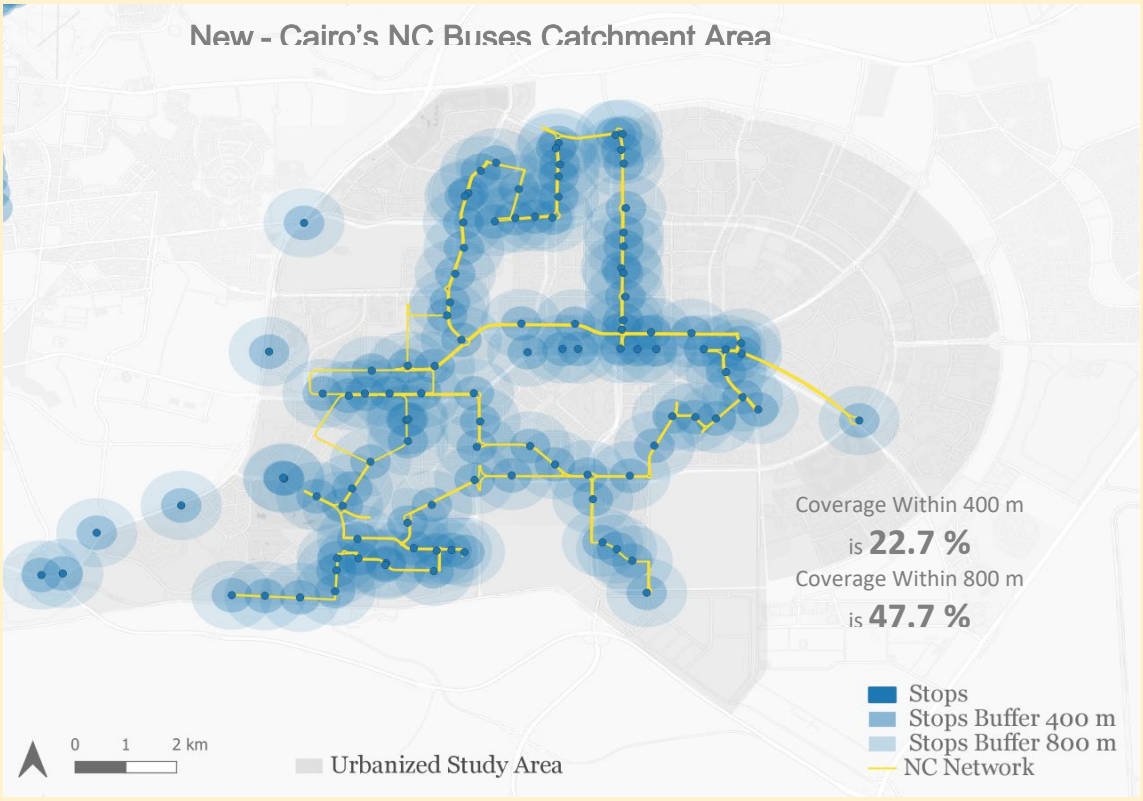


Figure : New Cairo's NC Buses Catchment Area. Source: Hussin 2020 [23]

[24] Hussin, H., 2020. Towards an Integrated Mobility System; The First and Last Mile Solutions The Case Study of New Cairo. [online] Iusd.asu.edu.eg. Available at: <https://iusd.asu.edu.eg/wp-content/uploads/2021/03/6-MT-Final_Hassan_Hussin.pdf> [Accessed 2 September 2021].

Samples of integrated mobility system's trip anatomy in Egypt

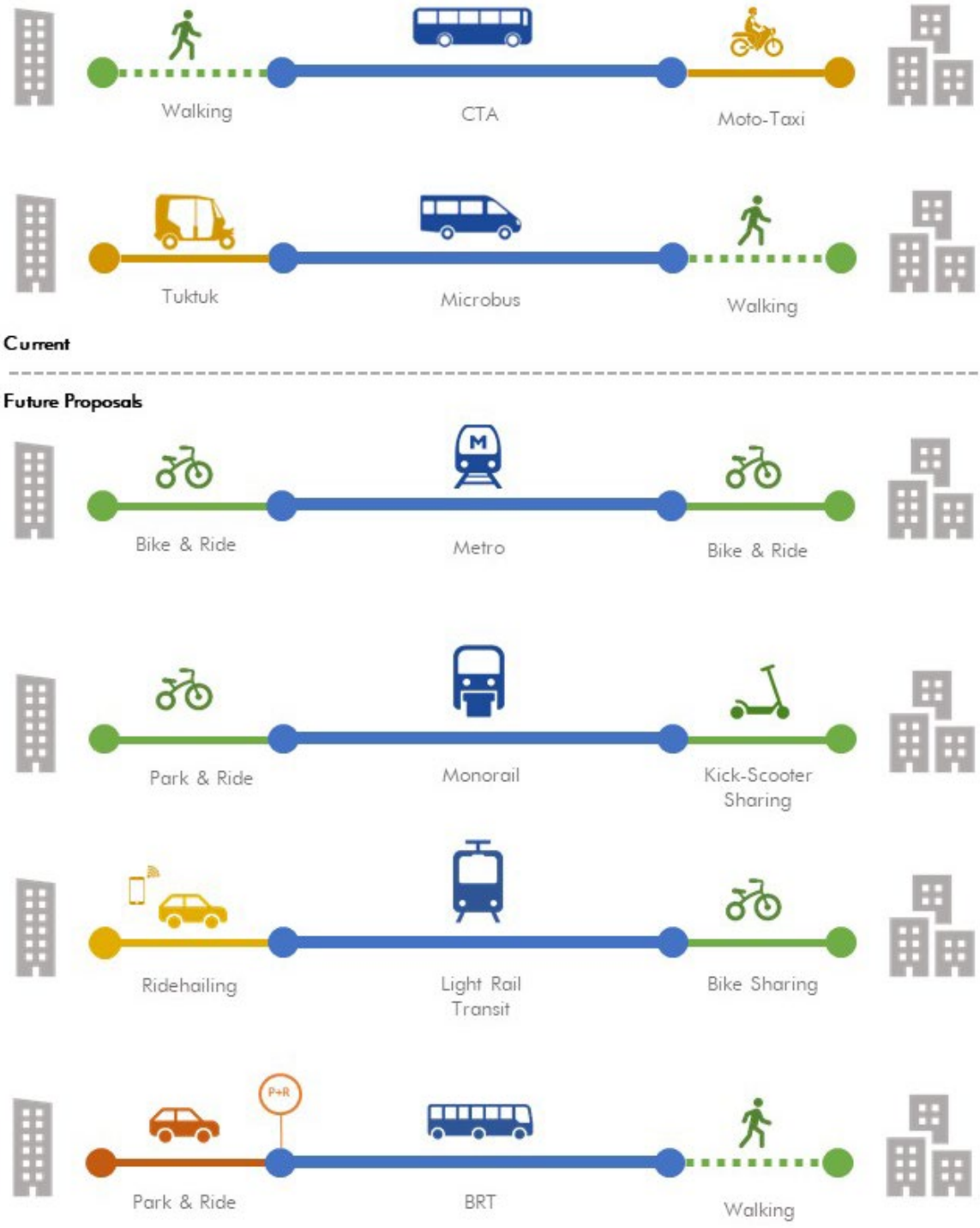


Figure 6 Integrated mobility system's trip anatomy in Egypt

5 Micro-mobility and possibilities for Egypt

Micro-mobility is considered by many to be a significant feature in the future of mobility. It suits short trips and requires little space in dense cities and is often fun. It is also more sustainable than other mobility modes due to its limited energy consumption and it small size, and has a lower environmental impact.

Micro-mobility can also play an important role in long trips. It is among the most sustainable and efficient first and last mile solutions that can provide a pleasant door-to-door mobility experience if properly planned for in the city and with integration with mass-transit stops.

5.1 Micro-mobility for commuters

Micro-mobility is mainly characterized by three main elements: lightweight vehicles, operating at low speed and driven directly by the users. However, this simple combination can offer a variety of vehicles that are suitable for almost everyone including children, youth and the elderly. One of the main advantages of micro-mobility is that its vehicles are available in several sizes that can vary based on the user's age and size.

Figure 7 cycling in rural Egypt. Daily news Egypt

The small vehicles can be two-wheelers, three-wheelers, or four wheelers which satisfies the needs of more user groups and various ages. Micro-mobility vehicles can either be human-powered or with a partially or fully electric engine assistance. The electric engine helps overcoming hilly terrain and extend the distances that can be comfortably covered.

Although micro-mobility vehicles don't occupy a large space in the streets, some micro-mobility vehicles have a feature of folding. This feature facilitates parking them on streets or storing them at homes or offices. It also facilitates carrying these lightweight vehicles within the city.

Figure 8 E-kick scooter. Source: Spousepro

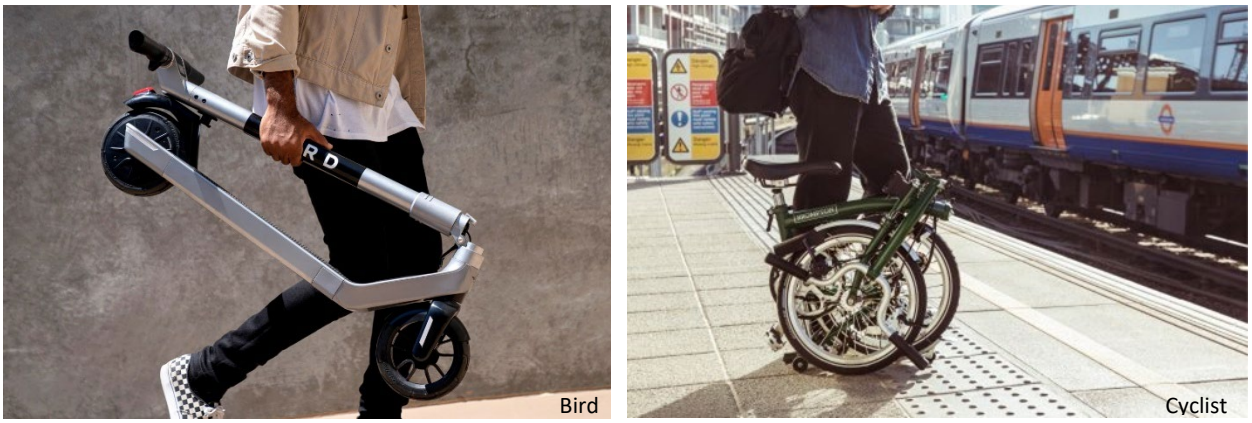


Figure 9 On the left, Foldable kick Scooter. On the right, Foldable bicyle.

Examples of emerging Micro - mobility Vehicles in Egypt [25]

Novel forms of micro-mobility vehicles are already available in Egypt since several years. They are most popular in relatively low speed but paved areas such as Zamalek, Downtown and Maadi. They are also used in many gated communities in New Cairo and El Sheikh Zayed, as well as many coastal cities such as cities along the North Coast, and elsewhere along the Red Sea such as Hurghada, Marsa Alam and Al Gouna. Currently, they are either used as an *onlymile* mobility mode, or for leisure and entertainment. The usage of micro-mobility as a Last mile solution is yet to be discovered.

There is a variety of novel micro-mobility vehicles in Egypt, but the most popular and growing vehicle novelties are the e-kick scooters and the e-bikes. Indicative examples of specifications and prices are noted below. Significant demand from female buyers is noted in interviews with suppliers.

E-kick scooters

Battery Type	Lithium Battery
Trip Range/ charge	20 -50 km
Max. Speed	25-45km/h
Charging time	3-4 hours,
Weight	15-30 kg
Manufacturer /Provider	Imported from China, spare parts and maintenance available in Egypt
Price Range	12,000 - 16,000 EGP (Q3 2021)
Existing models	Roll n'go , Ninebot.

[25] Mohamed, A., (Aug. 01, 2021). Personal Communication: Interview with Electrified's co-founder, Ayman Mohamed.

Figure : Micro-mobility in Egypt. On the left, Roll'ngo. On the right, ninebot.

E-Bikes

Battery Type	Portable Lithium Battery
Trip Range / charge	35-40 km
Max. Speed	30 km/h
Charging time	4-6 hours
Weight	25 - 40 kg.
Manufacturer/ Provider	Ecobike (Ghabour), Glide Smart Mobility
Price Range	9,900 – 15,500 EGP (Q3 2021)
E-Bike types	City E-bike, Mountain E-bike, and Foldable E-bike
Existing Models	Ecobike, Bykee.

Figure : Micromobility in Egypt; Ecobike By Ghabour

Figure : E-bikes in Egypt; Bykee by Glide Smart Mobility.

5.2 Cargo and utility bikes

Cargo bikes and utility bikes in general are among the practical and emission-free solutions for personal or freight transport, and cater to mobility with goods, children, pets, or for other utilities. Cargo-bikes are designed in multiple configurations that allow for a wide range of loads in terms of weights and volumes from 45 kg for a two-wheeled bike, up to 600 kg for a 4-wheeled couch bike. They therefore provide a versatile solution for a diversity of trip purposes from personal shopping trips, moving household items and moving with children to urban logistics trips for small and medium enterprises, nonprofits, and courier services.

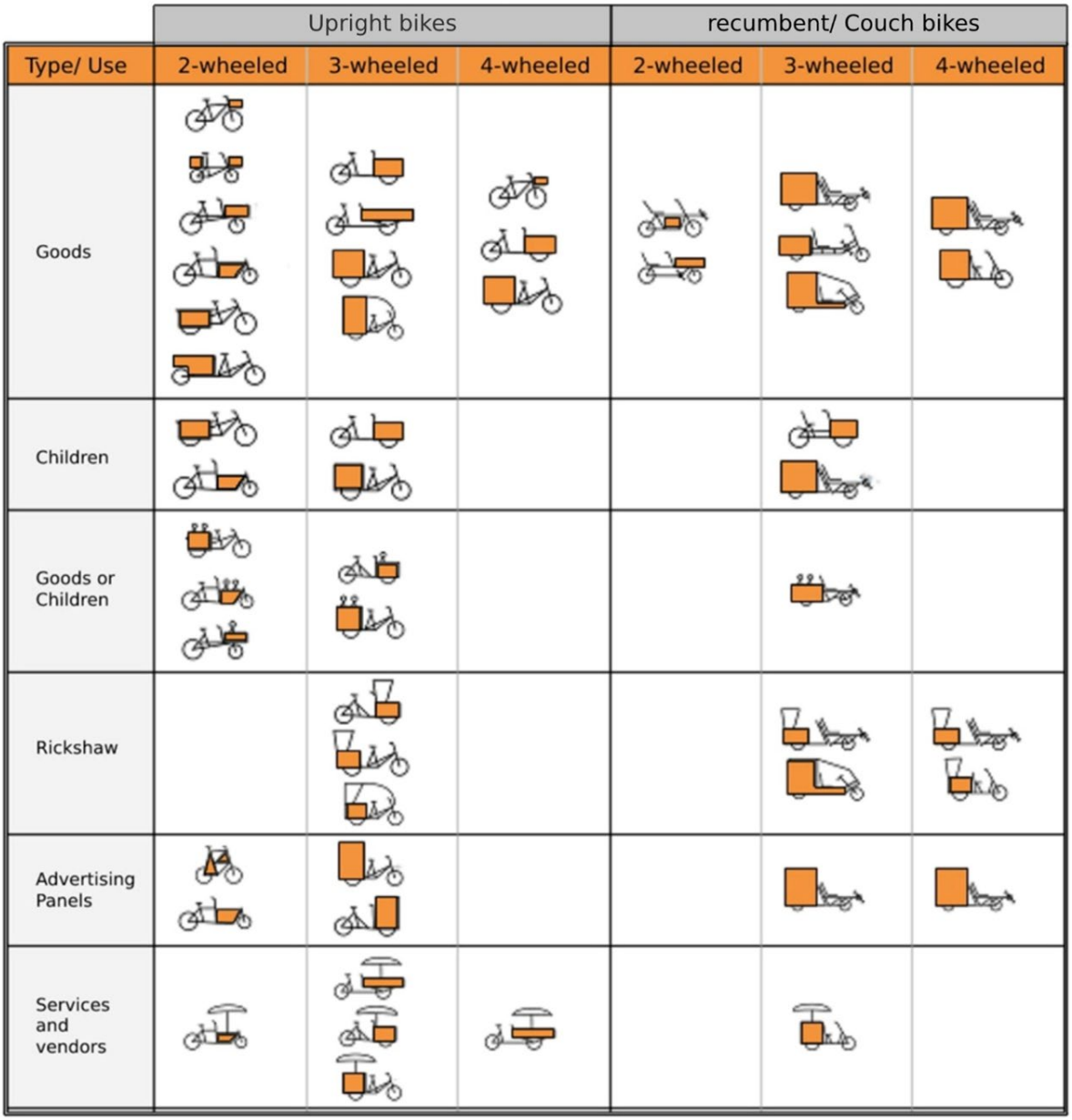
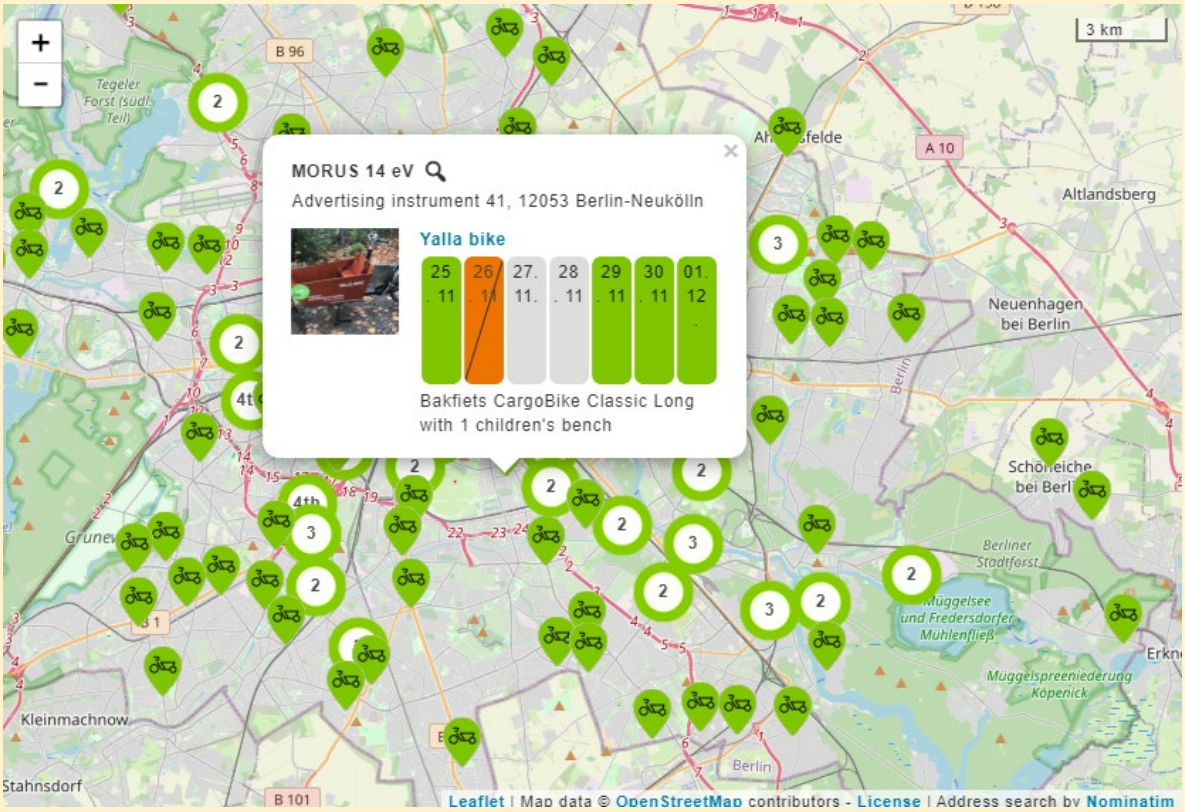


Figure 10 Cargo-bikes types and uses

Subsidized Cargo - bike sharing in Berlin: Flotte Kommunal

In an initiative by the German Bike Association (ADFC), a scheme is set in place to allow residents of Berlin to borrow cargo-bikes for free for up to three days. The cargo-bikes are placed in public buildings like public libraries, youth centers and museums and can be booked through an online platform that shows the distribution and availability of bikes in each neighborhood. The project was funded by the senate of Berlin with a partial contribution from the boroughs where the bikes are deployed with a total funding of 80,000 Euros. Since the start of the project in 2018, a total of **107 cargo-bikes** were deployed in public institutions rented by more than 5000 users. Around **30-40%** of the trips by cargo-bikes from the Flotte Kommunal fleet were replacing private car trips.



Flotte Kommunal fleet map showing the availability of bikes in public buildings.

5.3 Emergence of novel cargo bikes in Egypt

Cargo-bikes are not new to Egypt, tricycles, and the classic short-john (bicycles with baskets built in the frame) can be found in use among fruits and vegetable vendors, pharmacies and local supermarkets. However, contemporary cargo-bike models that provide ease of movement and efficient mobility, especially electric cargo-bikes, are lacking in the Egyptian bike market. The diversification of the cargo-bike models available in the market can help a variety of sectors like food services, retail, maintenance, and manual workers, as well as urban freight shifting to micro-mobility especially for last-mile-delivery.

Figure 11 Recently rolled out formal waste collection utility bike (source: Tabdeel)

In the race towards decarbonizing urban mobility, many European cities set schemes to support the use of cargo-bikes for individuals and businesses including subsidizing cargo-bike purchases, tax exemptions and free or heavily subsidized cargo-bike sharing. These public investments are made due to the high purchasing cost of cargo-bikes and e-cargo-bikes that start from 1000-2000 EUR (approx..18,000 – 35,000 EGP), but planners recognize the positive impacts of replacing car trips in urban areas.

One baseline study for an EU project, *CycleLogistics*, surveys showed that 51% of all motorized trips in European cities are linked to moving goods and can be replaced by cargo-bikes. Potential savings by category included 25% of urban freight transport, 50% of business and services trips and 77% of shopping trips[26]. Weighing the costs and benefits of shifting from cars or various conventional vehicles to e-cargo-bikes show a substantial economic advantage as well since it costs 17% of of what conventional car trips cost.[27].

[26] Wrighton, S. and Reiter, K., 2016. CycleLogistics – Moving Europe Forward!. Transportation Research Procedia, 12, pp.950-958.

[27] Becker, S. and Behrensen, A., 2021. Cargo Bikes: Sustainable and Resilient Transport | Heinrich Böll Stiftung | Brussels office - European Union. [online] Heinrich-Böll-Stiftung. Available at: <https://eu.boell.org/en/cargo-bikes-sustainable-and-resilient-transport> [Accessed 21 September 2021].

Cargo-bike sharing in Egypt

In Egypt, an experimental cargo-bike sharing was introduced by the social enterprise *Tabdeel* in Cairo. The cargo-bike model used is a two-wheeler cargo bike that can be used for moving goods and people. The users can book the bike and determine how much would they pay per rental day. Such novel vehicle designs and system solutions are gradually being introduced in Egypt.

Cargo-bike used for personal trips in Egypt(source: Tabdeel)

5.4 Facilitating Micro-mobility

Several approaches can be taken to encourage users to use micro-mobility vehicles as last-mile solutions and short trips, especially to facilitate and encourage use of larger mass transit systems if proper integration is ensured. Integration is not only in terms of infrastructure but also through integrated digital services and other integration enablers, including promotional campaigns.

5.4.1 Promoting Park & Ride for Bikes

Similar to the Park & Ride idea used for private car users, the same approach here is needed to encourage micro-mobility users to leave their micro-mobility vehicles at the mass-transit stations without the fear of being stolen or broken. This option is most convenient at bus stops and metro stations, etc., as most mass transit systems do not have space to allow all the users to take their bicycles vehicles on board, although some micro-vehicles such as kick-scooters would be accommodated. Bike Park & Ride is more common as a first-mile solution in specific, such as home-to-station. In the last-mile however (e.g., station-to-work or station-to-school) more suitable options are also needed in addition to the conventional walking option.

5.4.2 Promoting Bike & Ride

In case there is a lack of last-mile solutions, there can be an option for users to take their vehicles onboard. Boarding the vehicles can either be by making a cantilever dock from the bus, or by having it in the vehicle itself if there is enough space. This approach is more convenient in railways and less popular in buses, as railways have larger spaces. However, *foldable* micro-mobility vehicles can ease the process of boarding the mass-transit trips with your vehicle, such as kick-scooters, foldable bikes, etc.

Figure 12 Mounting bikes to buses. Source: sportworks

5.4.3 Promoting X-sharing Systems

- **Example-1: Docked/Station-Based-Sharing System:**

Tech-enabled sharing systems are becoming a popular trend in many advanced cities that continuously explore ways to diversify mobility options and encourage entrepreneurship in this field Vehicles are provided for public use through registration, and the booking and payment process is through a mobile application. However, in order for this system to succeed as a last-mile solution or for short only-mile trips in general, the stations should be distributed so as to form a dense network with adequate distances to common origins and destinations of commuters. This is easier to achieve in dense and mixed-use cities.

Figure 13 Bike sharing systems in Egypt. Ahmed Al Dorghamy

Participatory Planning for Downtown Cairo Bikeways

With a planned fleet of 500 GPS-tracked bicycles at 45 stations, Cairo Governorate in partnership with the enabling partner, Drosos Foundation, and through technical assistance by the Institute for Transport and Development Policy (ITDP) and UN-Habitat are jointly introducing Egypt's first public bicycle sharing system. It aims to provide a low-cost, environmentally friendly mobility option to the residents of Cairo, covering Downtown, Garden City and Zamalek.

Bicycle sharing is a key element in Cairo's strategy to expand the use of sustainable transport modes. It is expected to boost the use of public transport by providing crucial last-mile connectivity, thereby expanding the catchment areas for the region's rapid transit systems such as the expanding Metro and bus lines, while also serving short *only-mile* trips as well. By encouraging a shift to sustainable modes, the bicycle sharing system will be a contribution to the reduction of car-dependency. It will also encourage healthier and environmentally responsible lifestyles so that youth can gradually grow into a culture of environmental responsibility and lead the necessary change in lifestyles.

Cairo Governorate and relevant government agencies are accordingly striving to develop safe facilities for cycling in conjunction with the rollout of the bicycle sharing systems in Cairo including cycling lanes where necessary, especially in zones where traffic may exceed 30km/hr. The vision involves an integration with the cultural scene of Cairo, reaching cultural centers, museums, concert halls, many youth hotspots, and tourist attractions.

Map: Network of suggested bike-sharing stations and cycling lanes discussed during earlier stakeholder consultation sessions with the cycling communities (courtesy of UN-Habitat and ITDP)

- **Example-2: Dockless e-kick-scooter sharing system**

In other trending sharing-system approaches, some mobility operators started dockless sharing systems, where the clutter of a physical docking station is replaced with no more than a virtual allocation of stations or painted stations, or combinations of such ideas. Users only need to open their mobile application and check the nearest vehicle to them and head to it. After finishing their trip, users do not need to park it at a specific station. The trip is simply ended through notification on the app. This service is still limited in operation to special cities with high safety measures. Elsewhere, some companies also developed a driverless micro-mobility vehicle, in which the vehicle can autonomously return to a specific station by using only GPS coordinates after the user's trip is ended. High costs and the necessary subsidies are usually justified by the positive impact on the urban environment, such as conserving space, improving health and air quality, etc.

Figure 14 Dock-less sharing system. City of Santa Monica

Shared Micro-mobility Operators in Egypt

Rabbit and Vesstoss are examples of two emerging micro-mobility start-up operators in Egypt. Their fleets consist of e-kick-scooters and e-bikes. They offer their services through an online mobile application. Currently, they offer dockless sharing services in gated communities, as well as daily rentals in any place in Cairo and sometimes in the North-Coast[28] [29]. There is however a gradual experimentation with offering services in public spaces in the city, such as in the confinement of Zamalek Island in Cairo.

Rabbit users can unlock and hop on their dockless shared vehicles wherever the system is installed, such as the gated communities of New-Giza, Mivida, Sodic West, and Marassi, and using online payment. Vesstoss scan-and-go services are similarly available in some of Palm Hills, Aura and Ahly Sabbour development groups such as Hacienda, Amwaj, and Zed Park. Their model uses regular online payment, prepayment, or cash payment options. Furthermore, both operators have plans to expand their services in Egypt and are gradually appearing in public spaces.

Dock-less sharing system in Egypt. Rabbit & Vesstoss.

[28] Ehab, M., (August, 1, 2021). Personal Communication: Interview with Rabbit's head of operations, Mohamed Ehab.

[29] Jabril, B., (August, 2, 2021). Personal Communication: Interview with Vesstoss co-founder.

5.5 Last mile Delivery Services

Last mile delivery is one of the urban mobility challenges that is increasing in recent years due to the growing e-commerce market and growing demand on delivery for goods and services, along with the impact of Covid-19 on further accelerating demand for e-services. The e-commerce market in Egypt is estimated to have grown substantially in 2020. Orders are increasing in numbers and decreasing in size giving an opportunity to shift the delivery services from vans and mini-vans that are often not fully loaded towards micro-mobility that is better tuned to the size of cargo. An example of this shift is food deliveries in Egypt with multiple companies relying on a fleet of individual bike and motorbike users who register as delivery service providers.

Figure 15 DHL in the Netherlands replaced 10% of its vans fleet with cargo-bikes saving 430,000 Euro in operational costs and 27% of its urban transport emissions, as road quality and safety improves in Egypt, such opportunities become relevant

There is limited data on delivery services and their growth, but there are insights however indicating that much of delivery in Egypt is for small packages. For example, research on Black Friday in year 2020 showed that most orders delivered were indeed small orders. This is indicated by the value of the orders of which 41% were below 250 EGP (approximately 15 USD) and only 11% of the orders were above 1000 EGP in value (63 USD), which is often a proxy for size. Such small orders are mostly clothes and accessories in small packages that accounted for 89% of delivery on black Friday orders and should not require large fuel-powered vehicles to deliver. This indicates a high potential of avoiding vans and motorized last mile mobility and reorienting the last mile mobility services towards micro-mobility and the use of cargo-bikes and e-cargo-bikes for at least a portion of the service.

Urban logistics trips can therefore be broken down to smaller trips giving way to multiple smaller vehicles for faster and more efficient delivery. This might require intermediary consolidation

centers where larger loads that might have traveled between cities or for longer distances are delivered to be redistributed for the last mile. Based on the type of goods, consolidation centers can vary from small containers to small buildings equipped to receive food, electronics or other special goods.

Cycling Logistics and city-level innovations

The city of Berlin has introduced a new type of cooperative consolidation center that supports micromobility last mile delivery by placing container and **open storage units** in an open space that can be **shared** by different companies. The rationale behind the project is to encourage companies to shift from space-consuming vans in the inner city by saving the high cost of space rental in the city center. The project called **KoMoDo** has **shifted more than 28000 km of motorized trips** to cycling trips saving 11 tons of CO2 emissions in one year.

innovative Last mile delivery services ideas.

5.6 Key challenges facing Micro-mobility

Safety and comfort

One of the most critical challenges affecting micro-mobility is the design of the city's street network and traffic calming and safety measures. Since Micro-mobility vehicles operate at low speed, most of its users feel unsafe to share the same streets with the high-speed vehicles. Furthermore, unpaved or damaged roads would create serious safety issues to micro-mobility users and discomfort. On the other hand, use of most micro-vehicles can cause accidents with pedestrians if used on sidewalks. A combination of traffic calming measures and regulations and enforcement are often the approach in most cities aiming to support the healthy diversity of mobility options, whether for walking and cycling, or for further options of novel micro-vehicles.

Figure 16 Khaleefa el Maamoun Street infrastructure after the current stage of development. Ahmed Al Dorghamy

Weather Conditions

Although incidents of rain and stormy weather may only occur occasionally, the weather in Egypt is otherwise moderate, and the most common weather discomfort is on sunny days of the summer. Simple interventions such as providing shading and reducing local temperatures through urban vegetation (e.g., tree conservation and planting) are among the common means

of improving the commuters experience and comfort, while also improving aesthetics and reducing the heat island effect in general.

Thefts and Vandalism

Novel micro-mobility modes, such as electric vehicles or publicly available bikeshare bicycles, are considered to be relatively new in many cities and costs are still high, especially for battery-powered options. Batteries alone are a substantial cost and their current expected life span is averaging between two to five years, or around 1000 cycles of charging, and replacement is still expensive.

Figure 18 Lithium-ion portable battery with theft-proofing design

With high value and public access, vandalism and thefts are a major concern, and can determine the success or failure in various cities. Strict hardware security measures are therefore needed along with public awareness and law enforcement.


Figure 17 Piles of abandoned and broken bikes in China.

5.6.1 Designing for micro-mobility

Designing streets to enable diversified modes of transport is not only limited to the conventional approach of providing wide sidewalks and protected bicycle lanes. Solutions depend on the local context and needs. In streets with speeds of 30 km/hr. (actual or imposed), traffic allows for shared use of streets or even space for 'play'. With higher speed traffic, various forms of separation of vehicles are then necessary. A separate lane can vary in its design, whether being protected or not, elevated or at street level, or either one-way or two-way based on the street's speed and width, among other criteria and treatment of intersections and round-abouts. Furthermore, signage and street crossings play an important role in street transformations needed[30]. Common scenarios and needed elements are indicated in Figure 37 as an example[5].

[30] NACTO urban street design guide. [New York], 2012: National Association of City Transportation Officials.

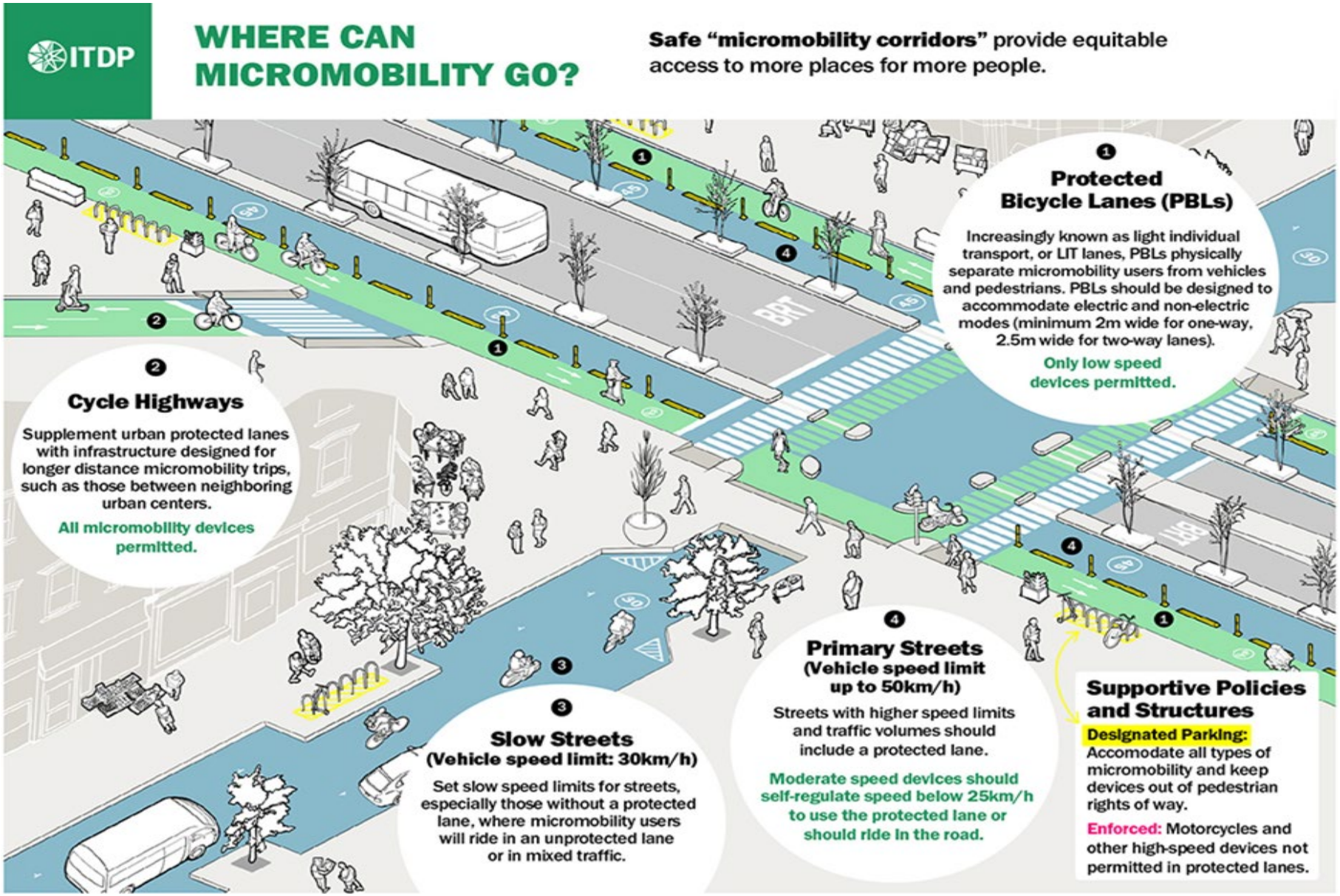


*Figure SEQ Figure * ARABIC 37 : Illustrative explanation of micromobility considerations advocated by leading global think tanks (Source: ITDP, 2020)* NOTEREF _Ref90370761 \h * MERGEFORMAT 5

6 Other Micro-vehicles

The ‘shrinking’ of vehicles is largely a response to the densification of cities and the growing interest in saving space, energy, and emission reduction. Micro-vehicles include scooters, three-wheelers (like tuk-tuks), microcars etc. Micro-mobility modes in most definitions often do not include all micro-vehicle types, to exclude the larger and high-speed variants. So micro-vehicles often refer to a wider range of options, such as scooters and microcars. These are also emerging products in Egypt.

6.1 Scooters

E-scooters are one of the most popular electric micro-vehicles in Egypt. The combination of its reduced size, relatively high speed and range compared to smaller vehicles attracts a wide range of early adopters. Some e-scooters also have the option of an attached sidecar to add more space for luggage, children, or an additional passenger. Their price ranges are however relatively high, preventing any notable penetration in the market to date. This is especially the case due to the low costs of comparable fuel-powered scooters and relatively cheap fuel available.

Figure 19 e-Micro-vehicles in Egypt, City-coco

There is nevertheless a variety of e-scooter models in Egypt. So far, most of them are imported from China, and the market is still in its early stages as maintenance and after-sales services are gradually developing, such as door-to-door maintenance services available today by some companies.

Specifications vary widely between models and the target markets. Examples of common models of such e-scooters in the market vary in price ranges within approx. 17,000-35,000 EGP (Q3, 2021) with speeds ranging from 40-60 km/h, ranges of 40-60km, and charging times of 4-6 hours and limited warranty periods that can be from *none* to 6 or 12 months (e.g., City Coco, Mitu Max, and G1, G2, G3 with sidecars, etc.). After-sales services remain limited, and batteries are not all portable lithium batteries but are in some cases lead acid batteries.

Figure 20 Other Micro-vehicles in Egypt. Glide's E-Scooters

6.2 Microcars

Microcars can vary from three-wheeler to four-wheeler vehicles and can be a three-seater, four- or a six- seater vehicle. Electric three-wheelers are available in Egypt (e.g. ride-hail tuktuks in Gouna and other touristic areas) as well as emerging affordable four-wheeler microcars (e.g. E-motion, Glide Smart Mobility, etc.) that are more affordable than high-end electric microcars elsewhere. Data on performance and on after sales services however is very limited, and the niche is still in a very early stage of learning.

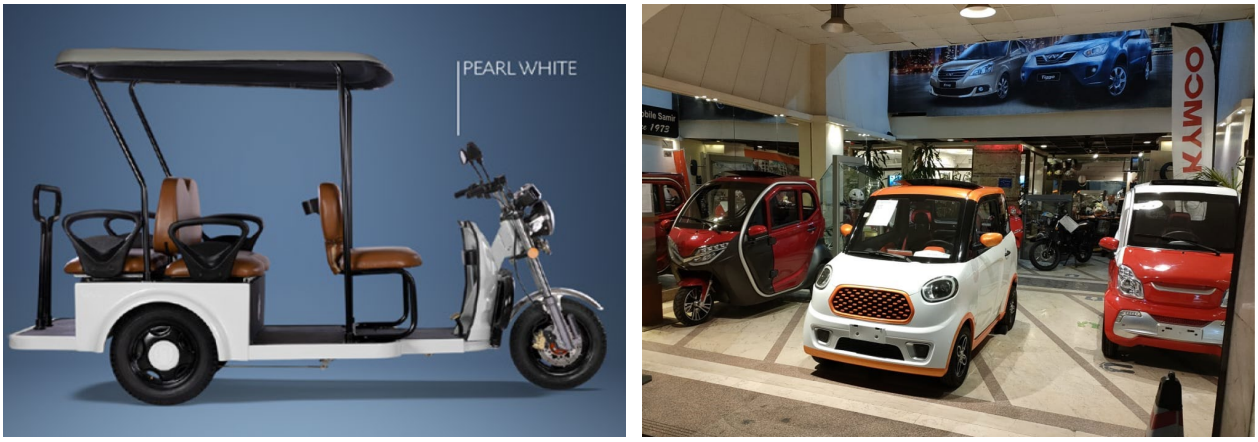


Figure 21 micro-vehicles in Egypt. Glide's BB2 micro-vehicle (left), E-motion micro-vehicles in a show room in Alexandria (right)

7 Green Recovery, Covid-response, and calls by civil society

Throughout 2020-2021, there was substantial activism by civil society calling for improved road safety and reclamation of public space. This was most prominent in the dense residential areas where major road-widening interventions were implemented without safety measures, leading to high rates of casualties, including among children.

Among the constructive activism efforts were the dissemination of street transformation case studies through social media (Figure 41 shows an example of case studies among the widely circulated examples related to the themes of greenery, public space, and road safety). This was

disseminated widely and continuously in groups such as those dedicated to cycling (e.g. *Sekketak Khadra* and *Tabdeel* for promotion of cycling, and *Trees of Egypt* for conservation of urban green space) as well as those dedicated to road safet (e.g. *Association of victims Masr El-Gedida road developments injuries and casualties*)[31,32,33,34].

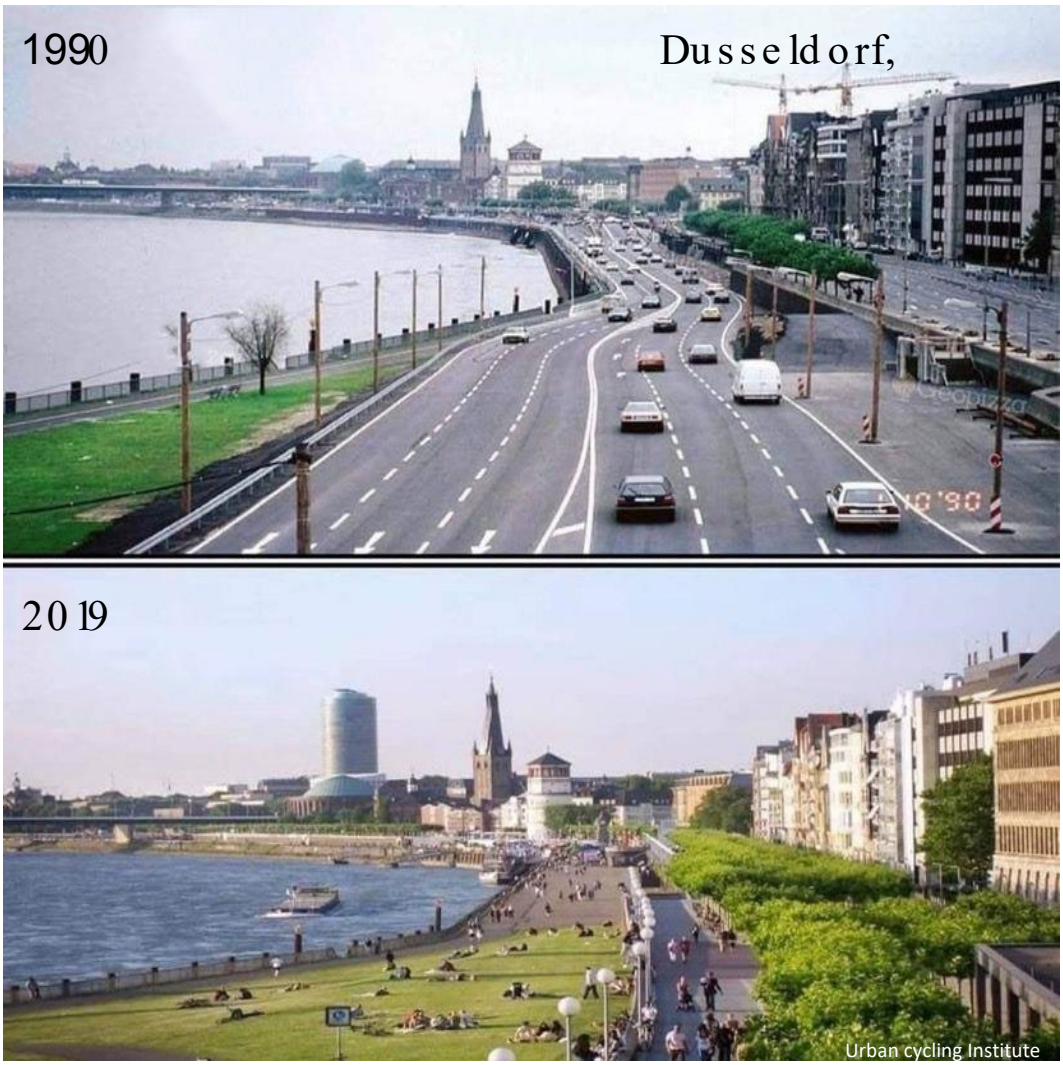


Figure 22 An example of a meme widely circulated in Egyptian social media by civil society (Edited by Authors)

[31] Trees of Egypt (Ashgarek Ya Masr) [FB civil society organization page] https://www.facebook.com/groups/507271750082384/ Accessed: Dec. 01, 2021.

[32] Association of victims Masr El-Gedida road developments injuries and casualties [FB civil society organization page] https://www.facebook.com/groups/3745413018885484 Accessed: Dec. 05, 2021.

[33] Sekketak Khadra [FB civil society organization page] https://www.facebook.com/sekkhadra Accessed:Dec. 07, 2021.

[34] Tabdeel [FB civil society organization page] https://www.facebook.com/tabdeel4 Accessed: Dec. 02, 2021.

The following illustrations aim to facilitate future discussions and reflect the observed concerns and ambition of civil society, while illustrating possibilities of Egyptian streets passing through the expected stages of development (rise and peaking of car-dependence, and eventual final decline and recovery).

Illustrations build on a training program for sustainable mobility advocates held in spring of 2021 in a program jointly implemented by CEDARE and FES Egypt. This envisions a possible future of stages of change as indicated in chapter-1 of this report. This is especially important in response to the rising need to provide alternative modes of diversified mobility options amid the precautionary measures needed to mitigate Covid-19 impacts, such as the 'pop-up' bike lanes that have been rolled out in many cities around the world and other programs incentivizing diversification of mobility options to ease pressure on crowded mass transit while encouraging healthier and active lifestyles and climate-sensitive development.

[Stage 1]

Heliopolis, Cairo 2012

Abdelazeez Fahmy st.

Figure 23: Stage-1: Low car dependence in earlier days, abundant public space and greenery.

[Stage 2-a]

Heliopolis, Cairo 2020

Abdelazeez Fahmy st.

Figure 24: Stage-2A: Increasing car dependence, so planners prioritize more space for cars, but soon they are filled up again and pollution continues to increase

Figure 25: Stage 2B

Figure 26: Stage-3

8 Policy Recommendations

Policy recommendations are provided as follows, with respective visions and examples for explanatory purposes.

- **Sustainable Urban Mobility Plans (SUMPs) Mandates**: Require SUMPs (*or equivalent*) to be developed in all major cities (e.g., capital cities of all governorates) as a prerequisite to future sustainable mobility interventions and allocation of resources in the transport sector in the governorates, and for integration with urban upgrade plans.
    - **Vision & Examples**: A future where transport plans are within a broader framework of sustainable mobility and aligned with the SDGs and the Paris agreement as well as sustainable cities concepts. Examples of possible implications are as follows:
        - Governorates have allocated budgets to develop SUMPs and are empowered through capacity building and gradual decentralization of governance.
        - For example, the large cities of Tanta and Mansoura (for example) in 2025 want to introduce modes of mass-transit (e.g. tramways, metro, BRT, etc). Here, they would be required to first demonstrate a prerequisite SUMP, and show that this project is part of this holistic plan. This aims to confirm integration into a carefully developed broader SUMP before receiving approvals. The approach avoids ad hoc projects being implemented, and to ensure integration with other modes and ensure incorporation of last mile needs and consideration of walking, cycling, and other elements that ensure commuters' safety, comfort, and enjoyability beyond the scope of each individual project.

- **Data and information sharing:** Policy development is largely depending on reference to international trends and expert opinions. However, for effective development of plans policies and programs, there is a need for *evidence-based* planning, enabled by provision of *accessible* updated data, and policies of sharing of information and avoiding redundancy in data collection and limited quality control and standardization. This ensures cost- and impact-effectiveness and relevance of interventions. Capacity building in this respect and exchange of experience is recommended, along with capacity building on security and privacy regulations practiced in leading countries, aligned with national visions of digital transformation and youth empowerment.

    - **Vision & examples:** The vision is a future where data related to mobility is available in reader/user-friendly and researcher-friendly form, supporting all stakeholder groups interested in sustainable mobility and enabling the growth of upcoming young leaders, scientists, innovators, and entrepreneurs. This caters to the private and public

sector, NGOs, students, etc. An example of data subject to disclosure and accessibility are as follows (selected examples):

- Total vehicle stock separated by vehicle type (technical criteria not administrative criteria) including two-wheelers, three-wheelers, and bicycles, and historical trends, geographic segmentation, etc.
- Disaggregated data of mobility indicators (e.g. *clearinghouse* or data warehouse for data and studies related to age- and gender-disaggregated data of trip choice, vehicle ownership, etc, and other forms of disaggregated data related to vulnerable groups, other socio-demographic segments, etc).
- Open-source Street network and classifications data.
- Disclosure/provision of data for Egyptian case studies for academia and localized curriculum development and accumulation of practical experience and linking academia to practice empowering future generations of academics and professionals.

- **Traffic Departments of the Ministry of Interior and Governorates:** Ensure that concepts of *Sustainable Mobility* in its broader sense and it's relevant sub-topics associated with urban planning, climate change, gender mainstreaming, road safety, behavioral change, urban sociology, etc., are all gradually mainstreamed into the relevant authorities' awareness and mandates. There has been much progress in this respect. However, in observing the limited recognition of pedestrians and cyclists in (1) Existing laws and regulations, and (2) Authorities' written *mandates* and *Key Performance Indicators (KPIs)*, it is notable that acceleration of such mainstreaming is still needed, *before* venturing into more advanced steps such as incorporation of micro-mobility, electrification, etc. Here, a key beneficiary of capacity building and experience-exchange is recommended to be the Traffic Departments and local governments, in parallel with interventions in the legal framework, authority mandates, and KPIs. An institutional set up is recommended (e.g., focal point, unit, or department dedicated to Sustainability or Climate Change is to be established).
    - **Vision & examples:** A future where *improving traffic* also means improving *pedestrian traffic* and *bicycle traffic*, and a future where the commuter *experience* (and not only speed and time) is what is being measured as an indicator of success through adequate indicators. This implies a future where authorities responsible for traffic are *empowered* (through capacity building, experience exchange, and legal/regulatory empowerment) to safeguard the comfort and safety of pedestrians and all vulnerable groups and with the equitable distribution of space. An example of the outcomes of such a shift is as follows (selected examples):
        - Traffic is improved by widening a sidewalk to improve pedestrian-traffic safety and comfort. This intervention (in the envisioned future) is then part of the

performance indicators for traffic authorities reviewed in their evaluation of performance.

- Roads in residential areas are subject to speed-limits and *traffic calming* measures, including speed humps and safe pedestrian crossings (e.g. elevated zebra crossing), with enabling legal and regulatory interventions to govern street-calming and road safety measures. This intervention (in the envisioned future) is then part of the performance indicators for traffic authorities reviewed in their evaluation of performance.
- Traffic impact assessments and Environmental and Social Impact Assessments (EIAs/ESIAs) and other types of assessments, incorporate the mobility of pedestrians, cyclists, and vulnerable groups including women, children, elders, and disabled persons (and not only vehicle traffic) championed by local authorities that are empowered to adopt such expansion of scope.

- **Trees and ecological assets:** Protection of trees, green spaces and their associated human rights aspects are referred to in the Egyptian constitution (articles 27, 32, 45, 46 and 78) as well as the Egyptian criminal code of 1937 (articles 162 and 376), and Environmental Law No.4/1994 (articles 27 and 28) including references for the protection of wildlife biodiversity and their habitats, as well as article 10 referring to Environmental Impact Assessment mandates. In this respect, policy development and legal frameworks are not the identified gap in protection of trees but mainly *awareness* among all stakeholders about the range of legal and regulatory provisions and the empowerment of relevant authorities for *enforcement.* This can be initiated with needs assessment and capacity development.
    - **Vision & Examples:** A future where trees (and green spaces as well as public space in general) are firmly established as a natural asset, an element of sustainability of the city and pedestrian-friendly streets (shading, thermal comfort, psychological wellbeing, aesthetics, etc), and a habitat for urban wildlife, and where protection by law is *enforced*, and compensation for losses is ensured and accounting of natural assets (e.g. digital mapping, valuation, etc) is mainstreamed.

9 Other recommendations for future policy development research

- **Microvehicles and job creation for women and men**: Throughout the research process and stakeholders consultations it was noted that despite the limited availability of data on trends in job creation and gender mainstreaming, it is notable through expert interviews, field observation, and mainstream media observation, that there is a rapid increase in the use of microvehicles for income-generation (as well as re-purposed vehicles, utility vehicles, and motorized two-wheelers, etc). Secondly, a notable penetration of *females* into this job market is observed, although in very early stages. Such observations reinforce the need to enable continuous monitoring of mobility trend and accessibility to such information for researchers,

as well as stressing the need to cater to this segment of commuters and initiate the discussion of regulations and policies to ensure their safety and rights, and to enhance the inclusivity of such new areas of job opportunities, i.e., at this stage what is recommended is to ensure *recognition* and *initiation of discussions*. Technology may provide improved comfort and inclusion (e.g. pedal-assist hybrid electric cargo bikes, etc.), but the enabling physical and cultural environment as well as adequate laws and regulations are fundamental parallel measures to guide the developments of this emerging phenomena through a sustainable pathway.

- **Car parking regulations and public space reclamation:** A key challenge in conserving public space is the accelerated car-ownership trend and car-dependence, which is also threatening the future of walking, cycling, and other modes of micro-mobility, as well as safe access to transportation services (metro, monorail, BRT, etc.). It also threatens other elements of sustainability such as the observed drive to remove trees and green spaces and sidewalks in order to park cars or to store old or discarded cars for free. Accordingly, important accompanying measures and prerequisites for true impact is the gradual development of national and city-level strategies for parking policies following international best-practices and building on the accumulation of local know-how and experiences of trial-and-error interventions. At the present early stage of this pressing issue, a dedicated baseline study is necessary first to enable further planning. This may be part of the SUMP products or a separate activity.

- **Mainstreaming NMT in plans of New Urban Communities:** Although pedestrianization and micro-mobility interventions are foreseeable in existing cities with substantial compact and mixed-use development (relatively old cities), the new urban community authority (NUCA) may face a significant challenge in developing successful interventions in its *new* settlements that have been already developed with segregated land uses and sparse development. Even if bicycle lanes and high-standard sidewalks and pedestrian safety interventions are all implemented, the next question to answer shall be about distances, thermal comfort given the lack of shade, and sense of personal safety given the lack of *natural surveillance* found in vibrant streets (safety in numbers) and prevalence of extensive fences of the gated communities limiting accessibility.

  Distance is among the key factors: *how will urban planning be improved to reduce distances to various destinations in new settlements*? This can at least be done in settlements that are still in the *planning stage*. Accordingly, development of a national strategy for NMT to support this effort is recommended so as to gradually mainstream such considerations in planning for sustainable cities.

References

[1] EC (European Commission) (2004). Reclaiming City Streets for People: Chaos or Quality of Life? Luxembourg: Office for Official Publications of the European Communities. ISBN 92-894-3478-3. Retrieved http://ec.europa.eu/environment/pubs/pdf/streets_people.pdf.

[2] Metz, D. (2013) Peak Car and Beyond: The Fourth Era of Travel, Transport Reviews: A Transnational Transdisciplinary Journal, 33:3, 255-270, DOI: 10.1080/01441647.2013.800615

[3] Jones, P. (2016). The evolution of urban transport policy from car-based to people-based cities: is this development path universally applicable? Paper presented at the 14th World Conference on Transport Research, Shanghai 10-15 July 2016.

[4] Fulton L., Mason, J., Meroux, D. (2017). Three Revolutions in Urban Transportation: How To Achieve the Full Potential of Vehicle Electrification, Automation, and Shared Mobility in Urban Transportation Systems Around the World by 2050. University of California, Davis, and Institute for Transportation and Development Policy. https://merritt.cdlib.org/d/ark%253A%252F13030%252Fm52c3sbx/1/producer%252FSTEPS-2050.pdf

[5] Institute for Transportation and Development Policy. 2021. As the Impacts of Coronavirus Grow, Micromobility Fills in the Gaps. [online] Available at: <https://www.itdp.org/2020/03/24/as-the-impacts-of-coronavirus-grow-micromobility-fills-in-the-gaps/> [Accessed 14 October 2021].

[6] CB Insights Research. 2021. Micro Mobility Revolution: Startups, Companies & Market Solutions l CB Insights. [online] Available at: <https://www.cbinsights.com/research/report/micromobility-revolution/> [Accessed 15 October 2021].

[7] European Environment Agency, 2020. The first and last mile: the key to sustainable urban transport : transport and environment report 2019.

[8] Bitibi.eu. 2017. Bike Train Bike. [online] Available at: <http://www.bitibi.eu/dox/BiTiBi_Booklet_WEB_Feb2017.pdf> [Accessed 11 November 2021].

[9] Eltis, 2020. SUMP process. URL: https://www.eltis.org/mobility-plans/sump-process (accessed on 10 October 2021)

[10] Transport for Cairo, 2021. Sustainable UrbanMobility Plan in 6th of October. URL: https://transportforcairo.com/portfolio/ (accessed on 16 November 2021)

[11] Mobiliseyourcity. 2021. Morocco | MobiliseYourCity. [online] Available at: <https://www.mobiliseyourcity.net/node/214> [Accessed 1 November 2021].

[12] Deloitte. 2021. 15-Minute City. [online] Available at: < https://www2.deloitte.com/global/en/pages/public-sector/articles/urban-future-with-a-purpose/15-minute-city.html > [Accessed 16 November 2021].

[13] Postaria, R., 2021. "15-minute city" – how do we get there? - citiesforum.org. [online] citiesforum.org. Available at: <https://www.citiesforum.org/news/15-minute-city/> [Accessed 7 November 2021].

[14] UITP. 2019. Mobility as a Service. [online] Available at: <https://www.metropolis.org/sites/default/files/resources/Report_MaaS_final.pdf> [Accessed 5 September 2021].

[15] Matyas, M. and Kamargianni, M., 2018. Survey design for exploring demand for Mobility as a Service plans. Transportation, 46(5), pp.1525-1558.

[16] Hussin, H., Osama, A., El-Dorghamy, A. and Abdellatif, M., 2021. Towards an integrated mobility system: The first and last mile solutions in developing countries; the case study of New Cairo. Transportation Research Interdisciplinary Perspectives, 12, p.100469.

[17] Rijkswaterstaat Environment. 2021. Case study Park+Ride in Amsterdam.

[18] Brown, A., Manville, M. and Weber, A., 2021. Can mobility on demand bridge the first-last mile transit gap? Equity implications of Los Angeles' pilot program. Transportation Research Interdisciplinary Perspectives, 10, p.100396.

[19] Lewis, P. and Puentes, R., 2021. Mobility Lessons Learned: A Summary of the MOD Pilots in the Los Angeles and Puget Sound Regions.

[20] Sand, L., Beckerman, S., Blair, C.C., 2016. First and Last Mile Connections: New Mobility.

[21] Tirachini, A., 2020. Ride-hailing, travel behaviour and sustainable mobility: an international review. Transportation 47, 2011–2047. https://doi.org/10.1007/s11116-019-10070-2

[22] ITDP (2018). Pedestrian First Toolbox. https://www.itdp.org/publication/walkability-tool/

[23] McKinsey, 2017. Public–private collaborations for transforming urban mobility | McKinsey [WWW Document]. URL https://www.mckinsey.com/business-functions/sustainability/our-insights/public-private-collaborations-for-transforming-urban-mobility# [Accessed 1 September 2021].

[24] Hussin, H., 2020. Towards an Integrated Mobility System; The First and Last Mile Solutions The Case Study of New Cairo. [online] Iusd.asu.edu.eg. Available at: <https://iusd.asu.edu.eg/wp-content/uploads/2021/03/6-MT-Final_Hassan_Hussin.pdf> [Accessed 2 September 2021].

[25] Mohamed, A., 2021. Interview by the authors with Electrified's co-founder about Micromobility in Egypt.

[26] Wrighton, S. and Reiter, K., 2016. CycleLogistics – Moving Europe Forward!. Transportation Research Procedia, 12, pp.950-958.

[27] Becker, S. and Behrensen, A., 2021. Cargo Bikes: Sustainable and Resilient Transport | Heinrich Böll Stiftung | Brussels office - European Union. [online] Heinrich-Böll-Stiftung. Available at: <https://eu.boell.org/en/cargo-bikes-sustainable-and-resilient-transport> [Accessed 21 November 2021].

[28] Ehab, M., 2020. Interview by the authors with Rabbit's head of operations

[29] Jabril, B., 2021. Interview by the authors to Vesstoss co-founder.

[30] NACTO urban street design guide. [New York], 2012: National Association of City Transportation Officials.

[31] Trees of Egypt (Ashgarek Ya Masr) [FB civil society organization page] https://www.facebook.com/groups/507271750082384/ Accessed: Dec. 01, 2021.

[32] Association of victims Masr El-Gedida road developments injuries and casualties [FB civil society organization page] https://www.facebook.com/groups/3745413018885484 Accessed: Dec. 05, 2021.

[33] Sekketak Khadra [FB civil society organization page] https://www.facebook.com/sekkhadra Accessed:Dec. 07, 2021.

[34] Tabdeel [FB civil society organization page] https://www.facebook.com/tabdeel4 Accessed: Dec. 02, 2021.