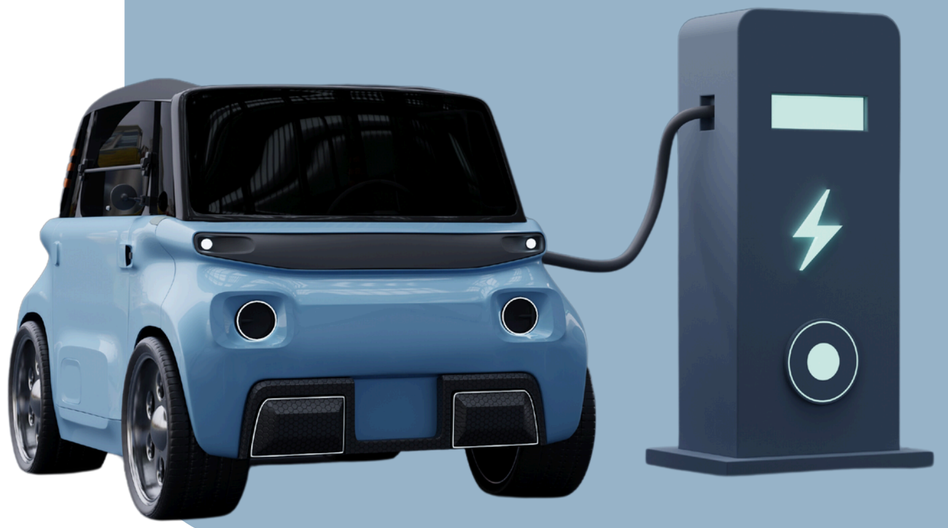
Mobilising South Africa's eMobility Regional Innovation Ecosystem

A MISSION BASED APPROACH

The Case of an Institute-Convened Mission



Dr. Radhika (Mia) Bhuyan
Research Fellow at Department of Industrial Design | Faculty of Art, Design and Architecture | Visual Artist
Department of Civil Engineering and Built Environment | Process Energy Environmental Technology Station (PEETS)

UNIVERSITY OF JOHANNESBURG

DEPARTMENT OF INDUSTRIAL DESIGN

Lack of Action

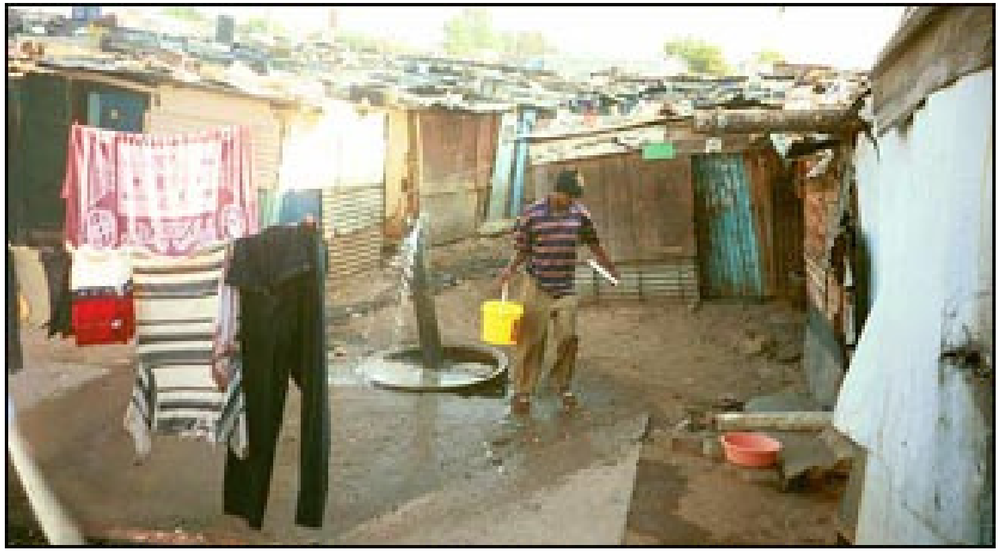
A global phenomenon

paets
PROCESS ENERGY & ENVIRONMENTAL TECHNOLOGY STATION

- Mining sector 7.53 % of GDP (ore reserves valued at US $ 2.5 trillion (2022); deli
- 70% of electricity generated by coal ; unstable electricity supply (cheapest cost of electricity in the world) and the electricity system is *locked-in* to coal generation
- Arid region; water scarcity
- 45.5% unemployment rate among young individuals (aged 15-34 years); significant % of youth not in employment, education & training ; Limited educational attainment, as well as social and economic disadvantage

Soweto Township - 1 million

Business centre in Johannesburg - Sandton



Alexandra Township

Why focus on Regional Innovation Ecosystem?

- Regional Innovation refers to the collective efforts of actors in a given region to create, develop, and implement new solutions, technologies, and practices that address complex challenges and foster economic growth and social progress.

- In South Africa, the mandate for HEIs/Universities is:
  - To play a vital role in not only driving research and innovation, but addressing societal challenges
  -To engage with local communities, providing expertise, resources, and support (such as skills development and job-creation opportunities)

- Mazzucato (2021): A different type of private-public partnership; and exploring the role of Universities in building these symbiotic relationships within ecosystems

- As a society, we need to learn and develop new mechanisms to co-create and generate “shared value”.

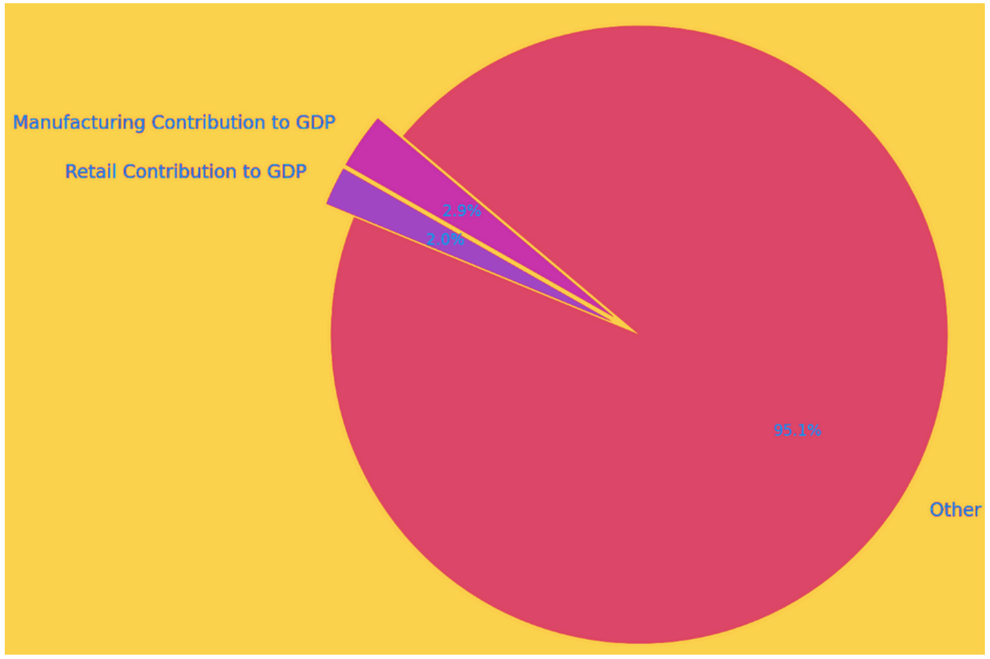
Research Objective

- To understand and develop ways in which UJ can strengthen its contribution to the Regional Innovation Ecosystems for greater social impact
- South Africa’s National Innovation System: **E-Mobility** (2023 &2024) and Circular Economy / **Textile Waste** (2024 -)

401–500th World University Rankings 2024	=36th Impact Rankings 2024	=60th Young University Rankings 2024

Key Factors in rising global demand for NEVs

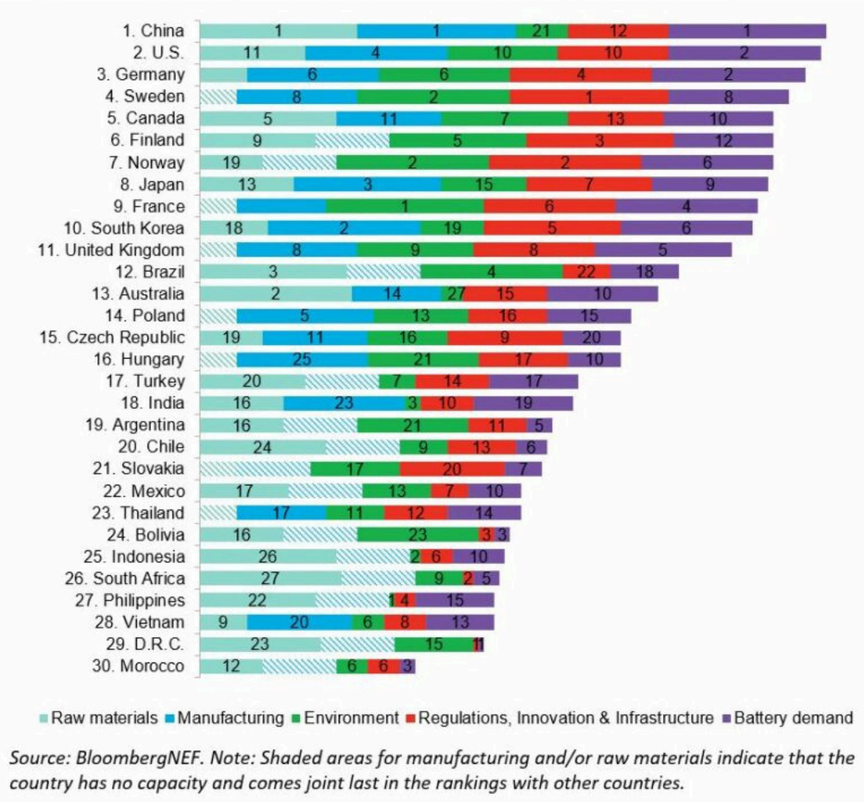
- About 37 global OEMs plan to spend nearly $ 1.2 trillion (R22-trillion) through 2030 to develop and produce millions of electric vehicles, along with the batteries and raw materials to support that production.
- EU ban on on new petrol and diesel vehicles; phasing out of ICEs by 2035
- Developed countries support the transition to New Energy Vehicles (NEVs). These countries implement demand-side measures (e.g subsidies for purchasing EVs) and supply-side measures (e.g investment tax allowances and tax credits)
- Global sale of EVs made up 13% of light vehicles sale in 2022; global sales are expected to overtake sales of ICE cars by 2040 (IEA, 2021).
- System integration capabilities and design an manufacturing capabilities of incumbent OEMs pose as entry barriers to new entrants in EVs



The South Africa automotive industry accounted for 4.9% of the GDP, with 2.9% from manufacturing and 2% from retail (2022).

Economic Impact of the Automotive Industry

- Automotive Industry's Role: The automotive manufacturing industry is crucial to South Africa's economy, accounting for 2.9% of GDP and 12.4% of exports in 2022.
- 70% sales of cars manufactured in exported to the EU
- Employment and Wages: The industry supports significant employment and pays over ZAR 30 billion in wages annually



Source: BloombergNEF. Note: Shaded areas for manufacturing and/or raw materials indicate that the country has no capacity and comes joint last in the rankings with other countries.

Global Lithium-ion Battery Supply Chain Ranking

SA has the natural resources for the production of lithium battery. Only EV Metals Group produces battery materials for EVs and exports

South Africa: Locked-In to Foreign OEMs

8 electric vehicles coming to South Africa in 2024

- SA automotive industry established in 1924; entirely dependent on foreign OEMs and the EV development trajectory is dependent on them
- The SA automotive industry contributes 4.9 % to the GDP ; approx. 70% of all vehicles produced in South Africa are exported
- High proportion of imports of components for assembly and re-export; therefore low knowledge transfer and capabilities to local firms
- Small number of hybrids are produced locally by Toyota and Mercedes Benz. Mercedes in partnership with *Chargify*, will be building 127 new local electric vehicle (EV) charging stations across South Africa valued at R40 million.
- South Africa is not a EV priority for OEMS, determined by patents (Lema, et al., 2024)
- Latecomer in terms of policy response. e.g **EV White Paper** 2023; 2018 (focus on air pollution)

The transition to the emerging EV paradigm is slow and constrained in South Africa for a number of reasons Lema et al. (2024):

* Foreign OEMs, on which the country depends, are yet to decide whether to adapt to EV production or potentially close operations. OEMs may find reduced local attractiveness due to competition from other EV manufacturing hubs elsewhere.

* It extensively relies on international knowledge transfer for capacity expansion and production in the automotive industry

* It has a small domestic market and its economic viability is fully dependent on production for export, and therefore a high risk that foreign OEMs might decide against local EV production.

The Electric Vehicle (EV) White Paper released by South Africa in November 2023 outlines a strategic roadmap to transition the country's automotive industry from internal combustion engines (ICE) to electric vehicles. Here are the key highlights:

Objective and Vision

- Transition to Dual Production: By 2035, the goal is to have a dual production platform that includes both EVs and ICE vehicles.

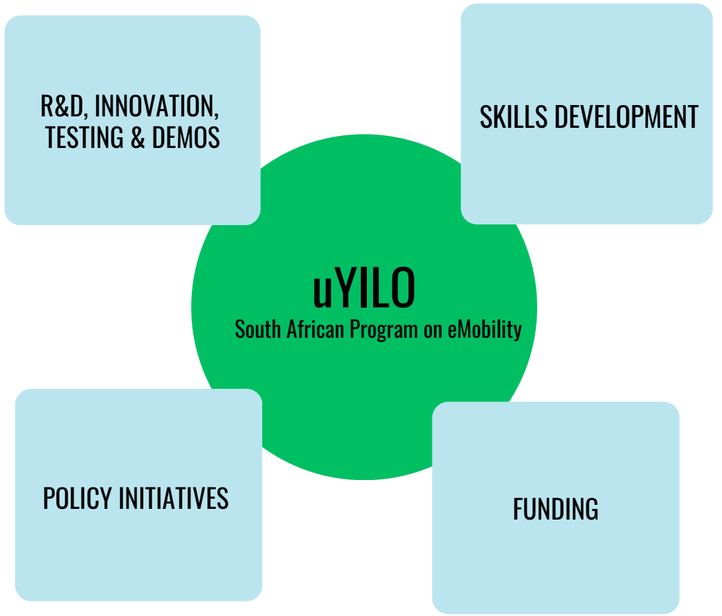
Strategic Actions

1. **Investment in Manufacturing**: Encouraging investments in the development and expansion of new and existing manufacturing plants for EV production.
2. **Development of EV Infrastructure**: Implementing greater energy reforms and developing a regional electric battery chain.
3. **Tax Incentives and Financial Support**: Providing R&D tax incentives and reducing import duties for EV components to stimulate local production.
4. **Consumer and Market Incentives:** Introducing consumer incentives for EV purchases and securing duty-free exports for EVs and components produced locally

Political Agenda Setting and Civic Engagement

Clear Targeted Missions

Portfolio of projects and bottom-up experimentation



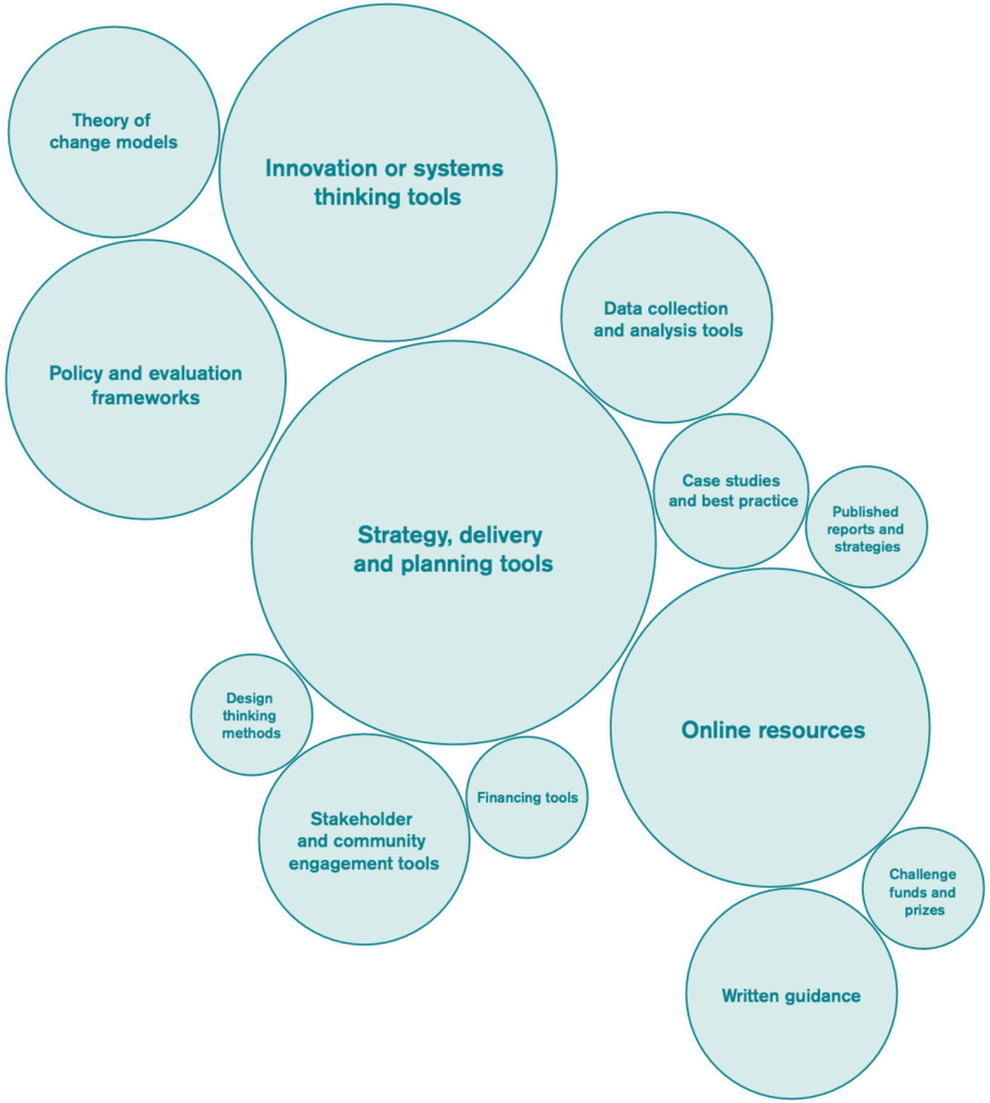
The Key Objectives of the National uYilo Program 2013

How can UJ can Strengthen its Contribution to the Regional Innovation Ecosystems for Greater Social Impact

"Pick problems, not solutions" (Mazzucato, 2017)

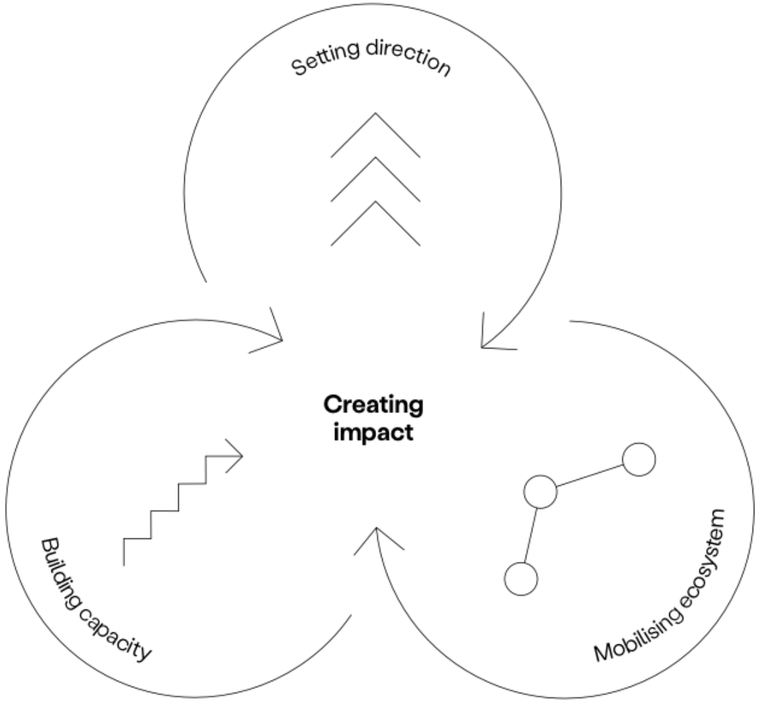
South Africa's National Innovation System: E-Mobility (2023 & 2024)
and Circular Economy / Textile Waste (2024 -)

Designing for Action



Tools practitioners are using to design and implement missions (2024)
UCL Institute for Innovation and Public Purpose (IIPP)

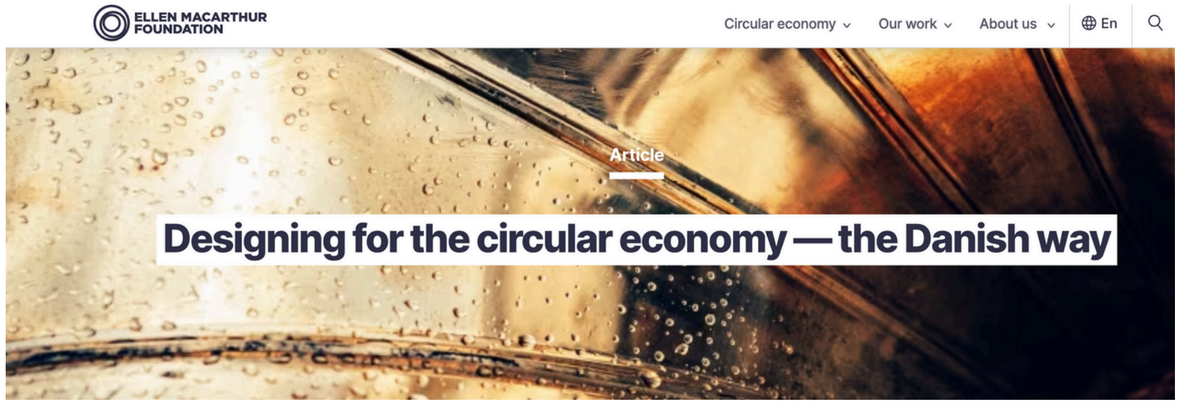
"Using design as a method and mindset, DDC works with private and public companies and organisations to focus their innovation efforts by enabling them to do what designers do best: expand their perspectives and zoom in on the needs of humans, societies, and our planet."



Danish Design Centre: To create impact through a mission oriented project, all three dimensions of setting direction, mobilising ecosystems and building capacity must be considered (DDC, 2022).

The following three key insights obtained from case studies will help guide the design and implementation of mission-oriented innovation initiatives (DDC, 2024):

1. Collaboration Across Sectors: Successful mission-oriented projects require strong partnerships between public, private, and civic sectors.
2. Flexibility and Adaptability: Projects must adapt to changing circumstances and feedback.
3. Clear and Inspiring Goals: A clear, compelling mission helps align stakeholders and mobilise resources effectively.



The method: Mission-oriented innovation

So, how do you create a national, circular mission? Being a design center, we (obviously, one might say) take a design-driven approach to solving this challenge.

A mission-oriented innovation has gained footing as a dominant approach to solving complex challenges in the past years. This is also the case in Denmark with the Danish Government's launch of the four green research missions in 2020.

Mission-oriented innovation is a new and emerging field. In collaboration with great partners such as University College London's Institute for Innovation and Public Purpose and OECD's Observatory of Public Sector Innovation, we have worked to make the approach more accessible and actionable. It's a new way to work and collaborate for the many interested actors (both public and private) everyone has to learn.

Mission-oriented projects provide clear goals and **direction, aligning various stakeholders** and **resources** towards **common objectives and a shared vision**.

They address specific societal challenges and create a focused environment for innovation, making it easier to mobilise support, funding, and collaboration across sectors. This approach helps overcome the fragmentation and inefficiencies often found in broader, less directed innovation systems.

Mazzucato (2018; 2019):
Innovation has not only a rate but also a direction.
It is the lack of direction in national innovation systems that can contribute to the growing popularity of mission-oriented innovation projects.

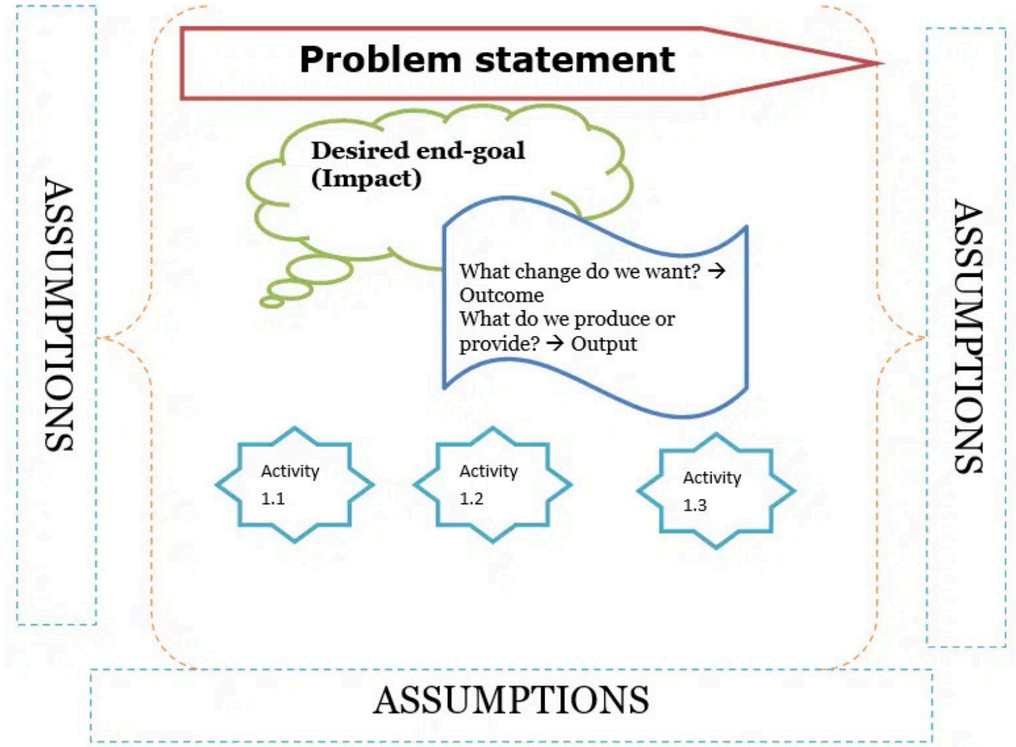
The Approach : Re-framing the Solution & Setting Direction

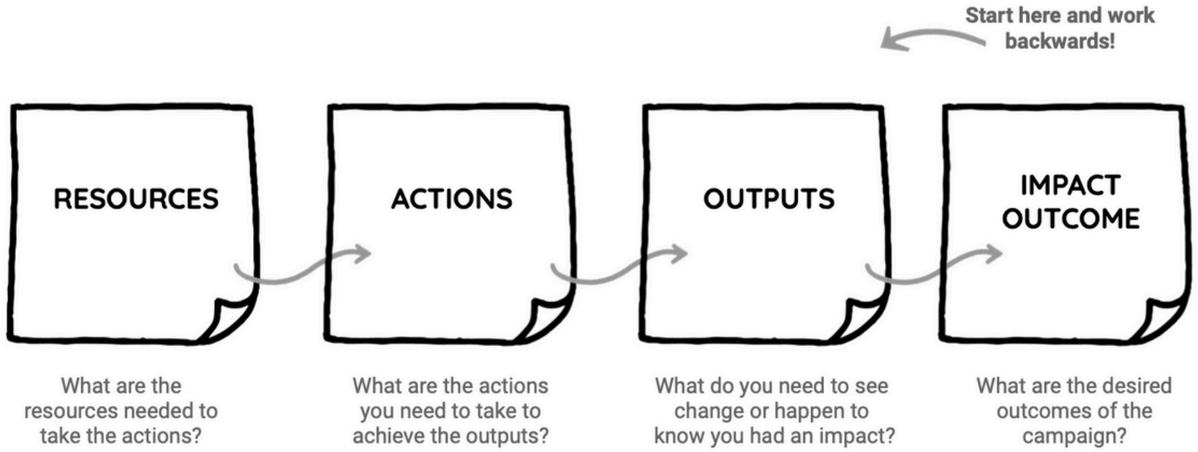
theory of change

METHODOLOGY

We utilised the Theory of Change (ToC) framework to re-frame the challenges faced, and drive action in the eMobility project at UJ. The ToC is a methodology that outlines the causal pathways to achieve specific goals and create desired actions for the challenges faced, and thereby drive action in the eMobility project.

When ToC is integrated into the design thinking process, a structured and more holistic approach to problem-solving or goal-achieving is ensured. Such an integrated methodology enables a team to innovate, collaborate, and create impactful solutions that address complex challenges in various domains.





PROJECT GOALS

THEORY OF CHANGE

This research project aims to identify the role of UJ in mobilising eMobility in the region

STEP 3

Please outline what resources you will need to implement your strategies

RESOURCES

STEP 2

Please outline your proposed strategies towards facilitating this change through your project

ACTIONS

STEP I

(i) Please articulate your vision for the desired transformation in response to the desired outcome

(ii) Define metrics that will measure the impact of your project by:

-Articulate how your project contributes to the teaching and learning outcomes at UJ

-And how does it align with the KPIs at the University

OUTPUTS

What do you need to see happen to know you had an impact?

Needs to be defined during the first `Action Dialogue

Desired OUTCOME

action dialogue 1

Aims of **Action Dialogue I**:

- **Framing the Problem:** Identify the problems that the E-Mobility project is solving and framing them into context.

- **Stakeholder Engagement:** We identified and engaged with diverse stakeholders from the eMobility project within UJ, including department of Economics, Geography, Technology Transfer Office, and other staff members and researchers, not currently engaged, but who could potentially contribute to the project. Understanding different perspectives helps in creating a comprehensiveTheory of Change.

- **Mapping the Change Process:** We mapped out the steps and interventions required to bring about the desired changes. This involved identifying key resources, and actions needed to achieve the goals.

- **Collaboration and Co-Creation:** We fostered collaboration among diverse departments, and encouraged co-creation with local communities, and other stakeholders of the project. By involving different perspectives and expertise, we enhance the robustness of their Theory of Change.

The following impact statement was articulated at **Action Dialogue I**:

impact statement

Using R&D and Education to Change Perceptions and Culture around E-Mobility

3 PRE-CONDITIONS*: THEORY OF CHANGE

THREE pre-conditions* were defined at Action Dialogue I (2023)

*Pre-conditions are OUTPUTS or what we need to see change or happen to know that we have had an impact.

1

MULTIDISCIPLINARY COLLABORATION

2

FUNDING

3

UJ RESEARCH & POLICY TO ACCOMMODATE, ENCOURAGE AND SUPPORT

The following 8 ACTIONS were further committed to, 3 actions were dropped from the previous dialogue and two new actions were added during Dialogue II (2024) :

Agreed Action #1

COMMUNITY ENGAGEMENT AT BEZ VALLEY, BETRAMS , DOORNFONTEIN & ALEX

Agreed Action #2

INTERNAL UJ COLLABORATION

Agreed Action #3

ACTIVITIES/ PROGRAMS FOR BUSINESS MODELS, START UPS & COMMERCIALISATION

Agreed Action #4

FUND RAISING

Agreed Action #5

E-MOBILITY VALUE CHAIN

Agreed Action #6

CLIMATE CHANGE & ENVIRONMENTAL IMPACT

Agreed Action #7

CIRRICULUM ADAPTATION

Agreed Action #8

EV Perception & User Experience

PROJECT GOAL

DRIVING BEHAVIOURAL CHANGE THROUGH R&D, EDUCATION & SKILLS DEVELOPMENT
TOWARDS ADOPTION AND IMPLEMENTATION OF E-MOBILITY IN GAUTENG PROVINCE/SA

DEPARTMENT OF INDUSTRIAL DESIGN

OUTCOMES

MULTIDISCIPLINARY COLLABORATION

FUNDING RESOURCES

UJ TEACHING & LEARNING TO ACCOMMODATE, ENCOURAGE & SUPPORT

1. COMMUNITY ENGAGEMENT
2. CURRICULUM ADAPTATION
3. INTERNATIONAL COLLABORATION
4. INTERNAL UJ CURRICULUM COLLABORATION (M.Eng & ID)
5. OUTREACH
6. TOWN PLANNING INFLUENCE
7. ACCELERATORS FOR COMMERCIALISATION
8. FUNDING AGREEMENTS /APPLICATIONS
9. E-MOBILITY VALUE CHAIN
10. CLIMATE CHANGE & ENV. IMPACT

PRECONDITION 1

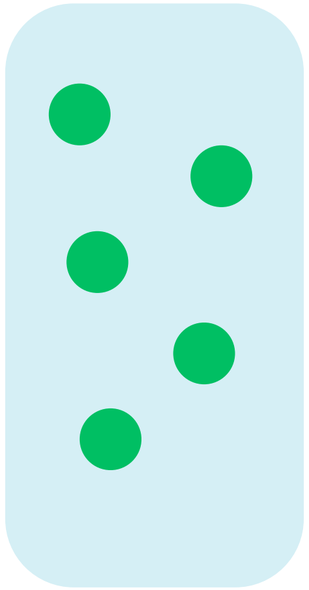
AGREED ACTIONS

PRECONDITION 2

FURTHER ACTIONS TO TAKE | MAY - AUGUST 2024

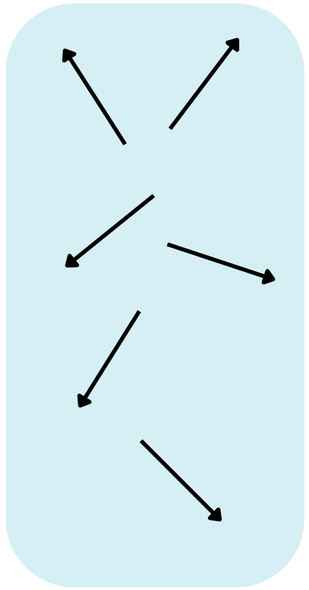
E-MOBILITY INNOVATION PROJECT **BEFORE** THE ACTION DIALOGUES

Previous Frame



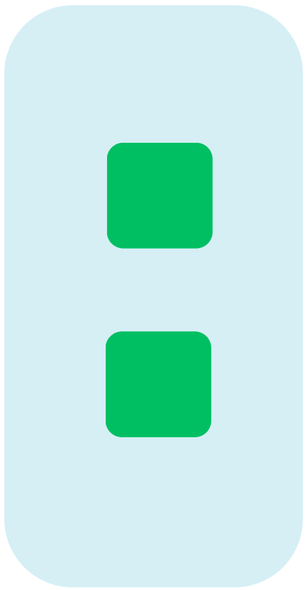
Internal stakeholders at the University of Johannesburg, with ideas, innovations and solutions, worked in isolation when there was no shared goal or vision.

Previous Project Direction



When there is a lack of common direction, researchers, teaching staff and departments work in different directions.

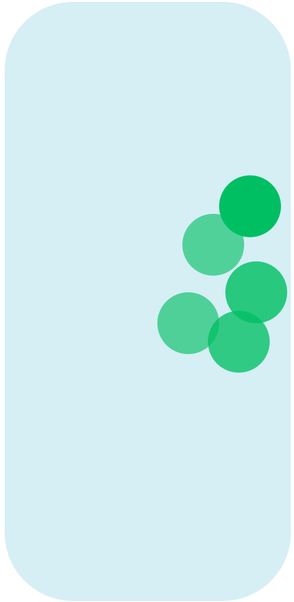
System Conditions Remain



System conditions remain as they are when there are no collaborative efforts and actions undertaken between internal stakeholders.

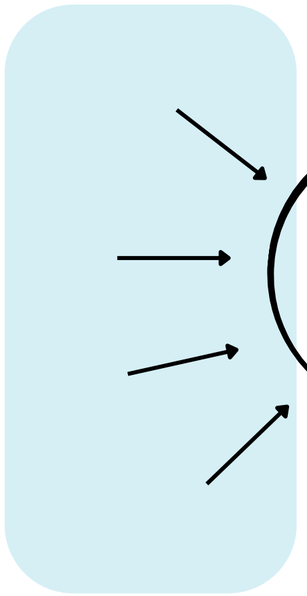
E-MOBILITY INNOVATION PROJECT **AFTER** THE ACTION DIALOGUES

New Frame: Shared Vision



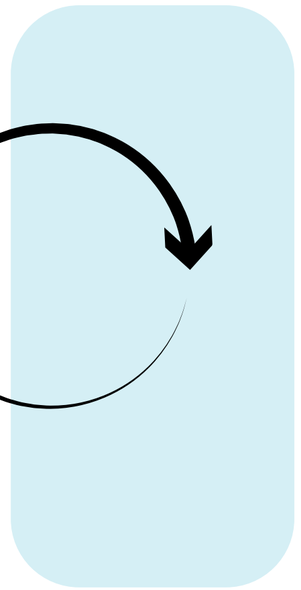
Missions allow stakeholders to align themselves towards a common goal, shared by all

New Frame: Set Direction



Defining direction (where to go) is a crucial part of the innovation process.

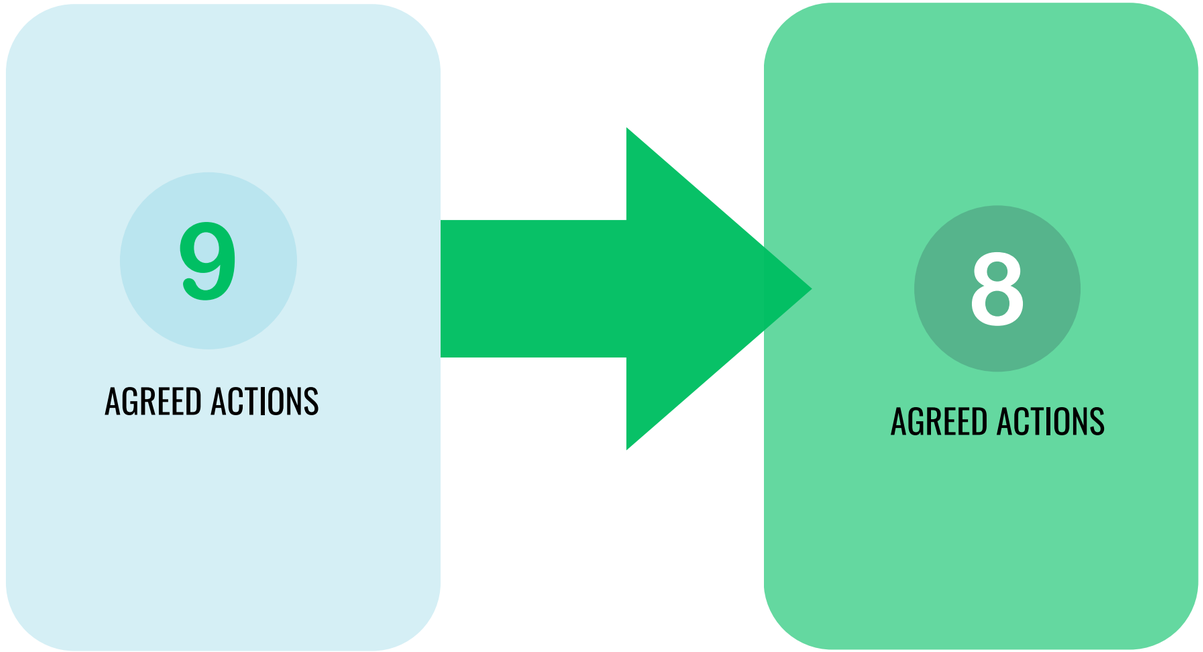
New Frame: Changed System Conditions



System conditions are changed through collaborative efforts and taking actions towards the shared goal or vision.

IMPACT OUTCOME

Using RDI and Education to Change Perceptions and Culture around eMobility in the Region



ACTION DIALOGUE 1
October 2023

ACTION DIALOGUE 2
April 2024

During Action Dialogue 1, participants had collectively framed the eMobility solution. Once the project's direction was set, or 'where to go' was defined, participants agreed on actions they would take in order to achieve the project goal or outcome. As a result, system conditions change, and when system conditions change this implies that a system has been mobilised.

Action Dialogue 1, various stakeholders pledged to undertake nine actions within a 4-6 month timeframe. However, by the time of Action Dialogue 2, the number of agreed-upon actions from the initial dialogue decreased to five but three new actions were added.

CONCLUSION OF THIS RESEARCH

Action Dialogue 3: October 2024 | External stakeholders such as the foreign OEMs, battery manufacturers. Department of Trade and Industry and DSI, CSIR, NMU (uYilo and UCT), etc

Action Dialogue 4: Internal UJ

Link to UJ electric bus video.

Decreasing UJ's carbon footprint

Special Projects advisor Professor Andre Nel explained the process that led to this project coming to fruition. "It started more than 18 months ago, as part of our drive to reduce our carbon footprint at UJ. We've always had a strong focus on sustainability issues. After implementing large numbers of solar panels, one of the next questions was how can we further make UJ sustainable? After some research, the obvious answer was how we were going to cut our carbon emissions in one area, and that area was transport. Transport makes up about four-and-a-half percent of UJ's footprint and reducing that in any way is something we desired".

So what will happen when load shedding strikes and the buses can't be charged? And what about their environmental friendliness, given that they are charged using coal-generated electricity? Dr Mpoti Ralephata, UJ's Chief Operations Officer, was quick to allay such concerns. He said 15% of our energy at UJ comes from solar, which is enough to power the buses. "We will have to have loadshedding for more than five hours a night to affect overnight charging," he said.

4IR in action

FUTURE RESEARCH

Textile Waste | The Circular Economy | July 2024
Comparative Study of Entrepreneurial Start Ups: Netherlands. India and South Africa and their contribution to the National Innovation System