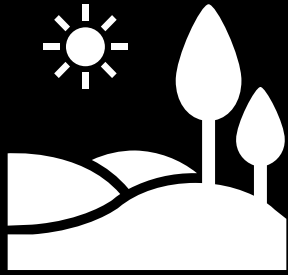# SEVENTEEN

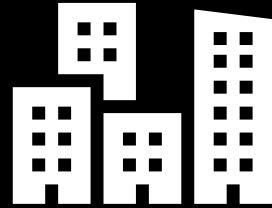**Transition of the Built Environment
in Jordan's Refugee Camps**

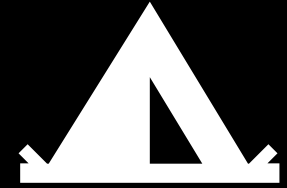**MSc. Arch. Noor Marji**

Prof. Ing. Arch. Michal Kohout

Department of Architecture, Theory and Design (ATT)

An "Ideal Refugee Camp" is not a Refugee Camp

There is no such thing as a "permanent settlement"
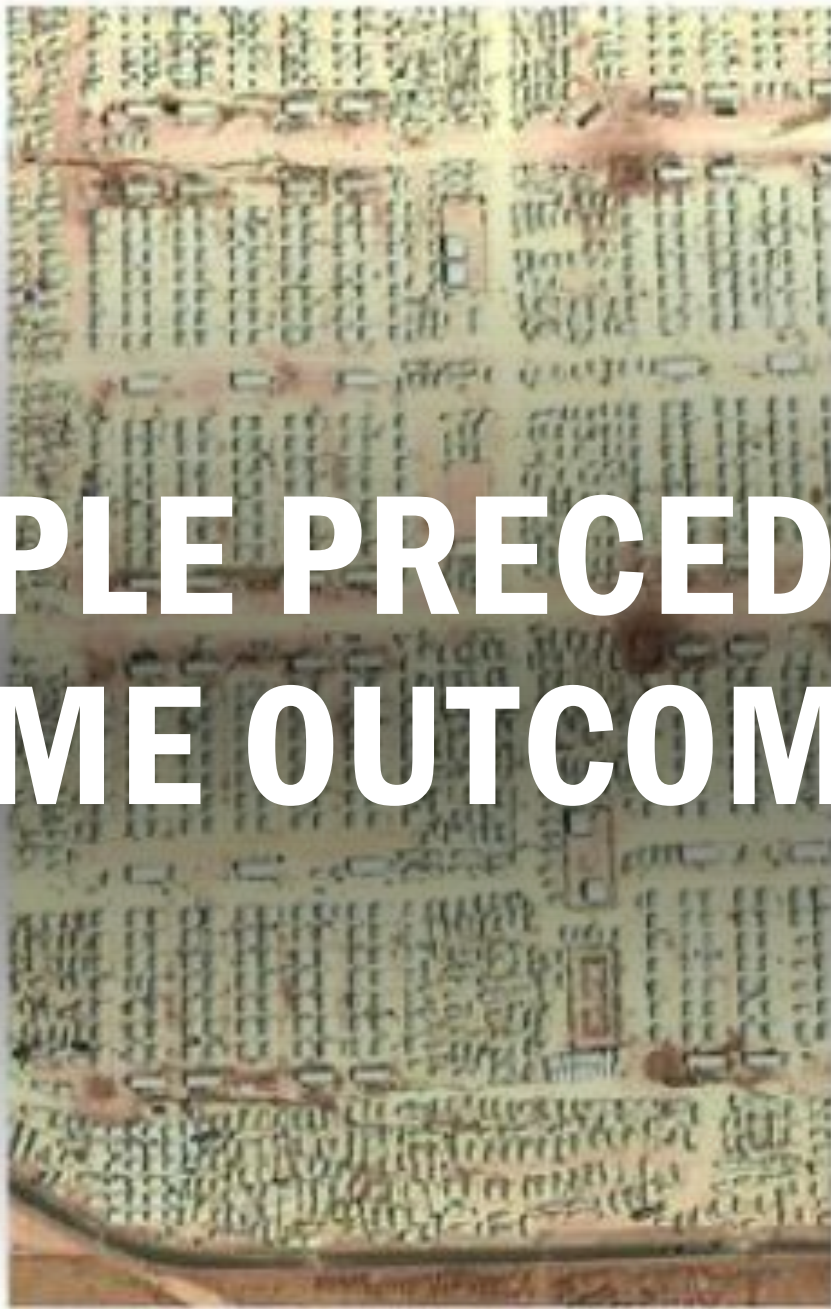
"Slummification" can't be prevented, but it can be guided.

HOW DOES THIS TURN INTO THAT?

January 2013   February 2013   July 2017

MULTIPLE PRECEDENTS, SAME OUTCOME.

PROBLEM STATEMENT

Low standards of living affect human livelihood and wellbeing of refugees

Their needs are evolving the longer they stay, but their shelters aren't

The transition is informal and unregulated, results in slums.

Can we guide the transition towards low-income housing?

REFUGEE CAMPS?

Refugee camps are defined by the United Nations High Commissioner for Refugees (UNHCR) as "temporary facilities built to provide immediate protection and assistance to people who have been forced to flee their homes due to war, persecution or violence" (UNHCR, 2021).

17 Years

Is the average lifespan of a refugee camp (Moore, 2017), after which they organically evolve into permanent towns.

THE WORLD'S TOP 10 REFUGEE HOST COUNTRIES

TURKEY (2.5M+)

IRAN (979,400)

PAKISTAN (1.6M)

LEBANON (1.5M+)

CHAD (369,500)

JORDAN (2.7M+)

ETHIOPIA (736,100)

DRC (383,100)

KENYA (553,900)

UGANDA (477,200)

REFUGEE CAMPS IN JORDAN

Syrian Refugees in Jordan - Governorate Level

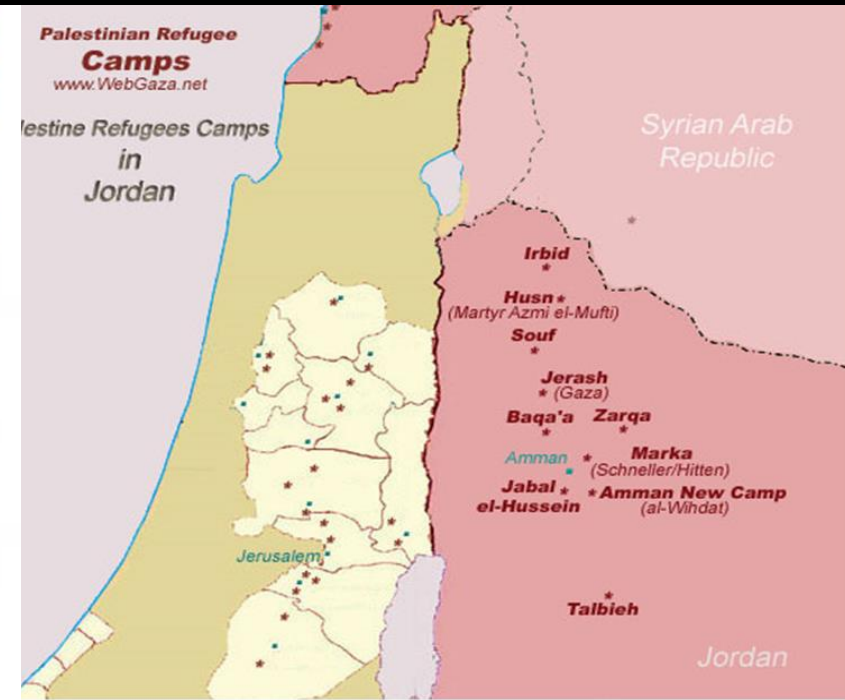Syrain Refugees in Jordan (Total Population) as of 31 December 2016

UNHCR

Total Number of Syrian Refugees in Jordan as of the end of December 2016 is 655,344 individuals
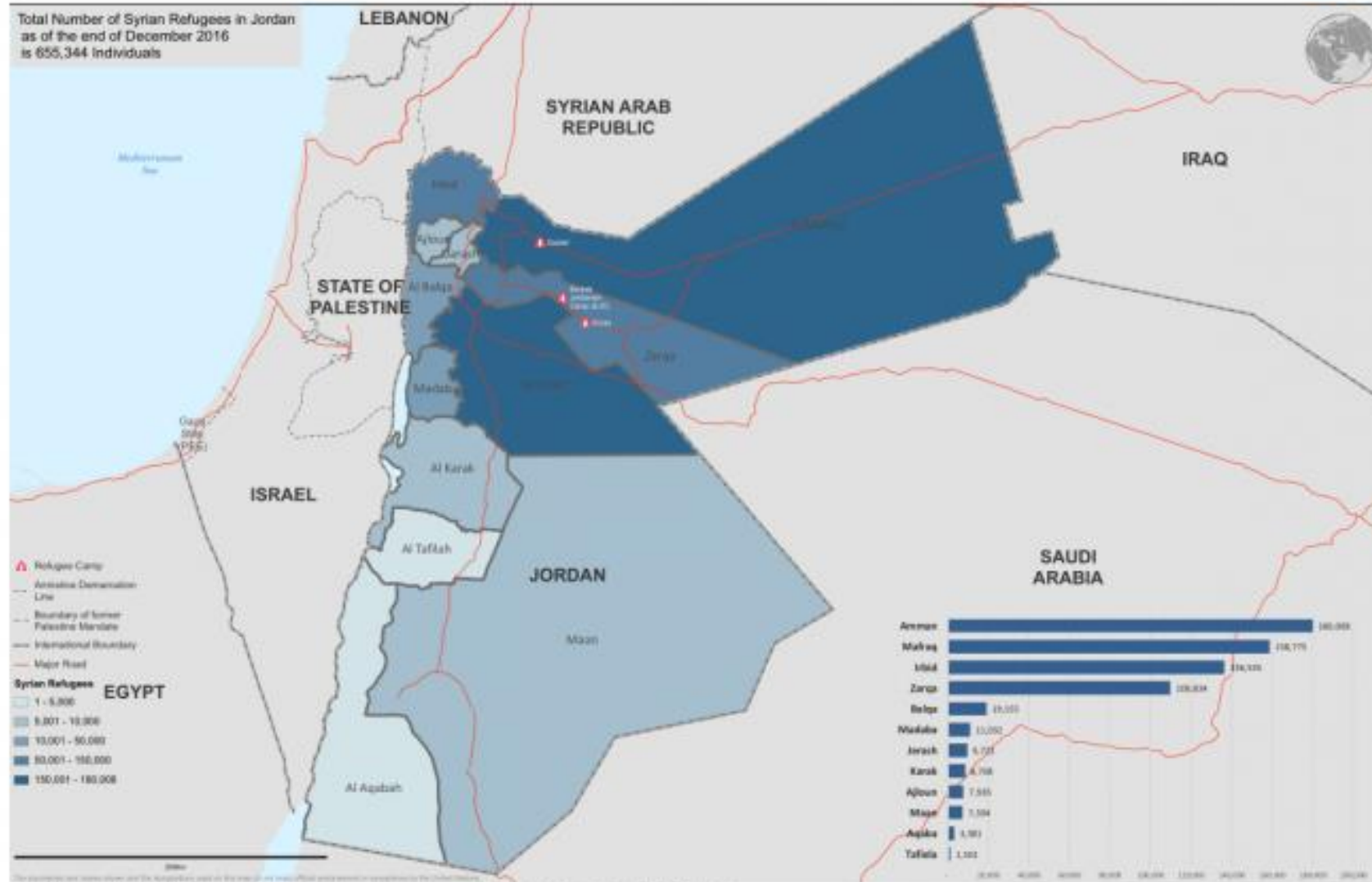
Palestinian Refugee Camps
www.WebGaza.net

Palestine Refugees Camps in Jordan

The refugee camps

The 13 Palestinian refugee camps in Jordan by year of establishment and governorate:

- Hussein (1952) – Amman
- Wihdat (1955) – Amman
- Prince Hassan * (1967) – Amman
- Talibieh (1968) – Amman
- Baqa'a, outside Amman (1968) – Balqa
- Irbid (1950) – Irbid
- Azmi al-Mufti (1968) – Irbid
- Zarqa (1949) – Zarqa
- Hitteen (1968) – Zarqa
- Sukhneh * (1969) – Zarqa
- Souf (1967) – Jerash
- Jerash (1968) – Jerash
- Madaba * (1956) – Madaba

* not recognized by UNRWA

Source: DPA 2000: 20

Refugee Camp Typologies

Based on Camp Status

Based on Planning and Shelter Types

Traditional (Formal) refugee camps

Informal Settlements

Host Community Integration

Camps with Improved Infrastructure
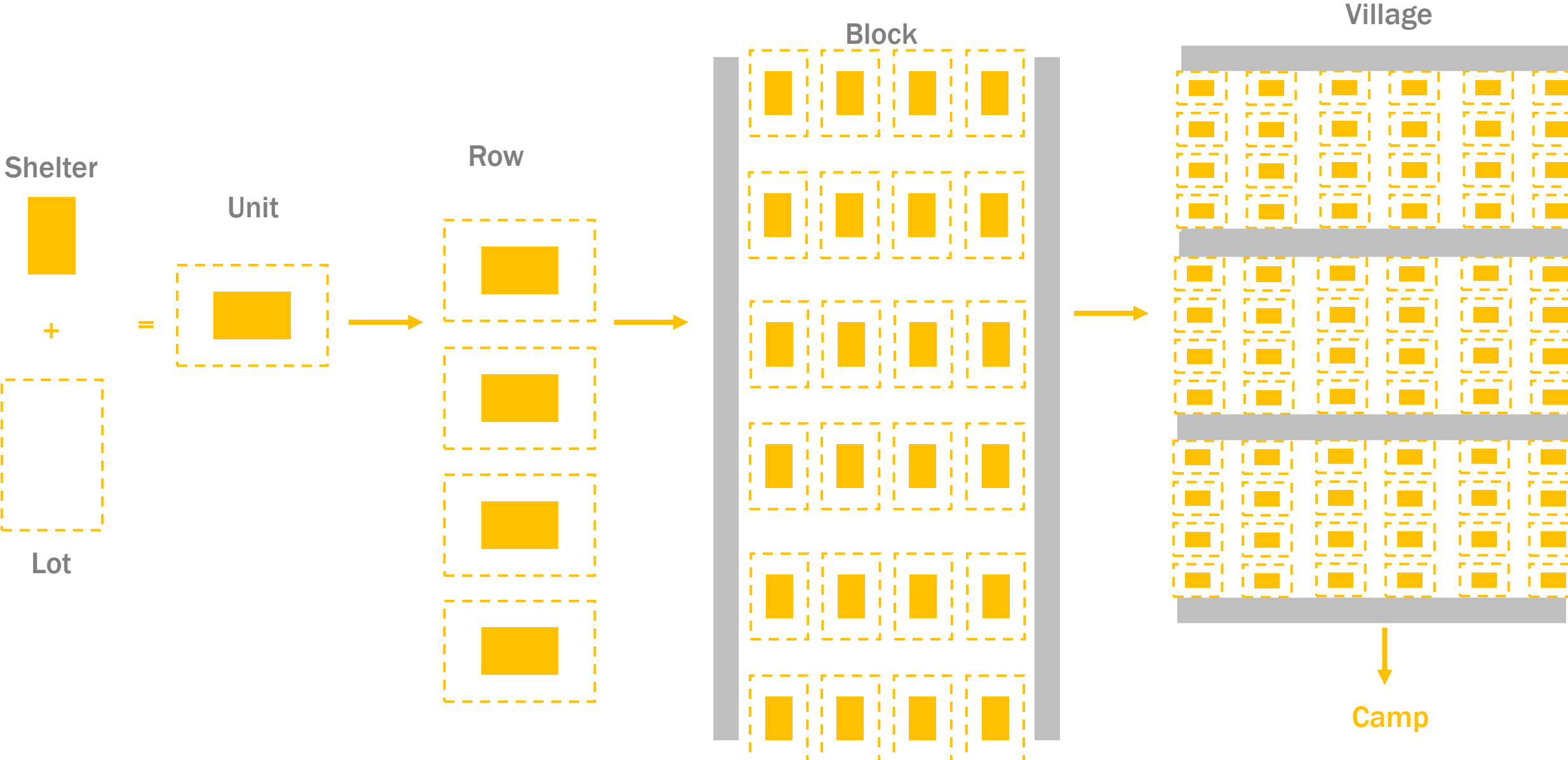
Camps for Specific Groups

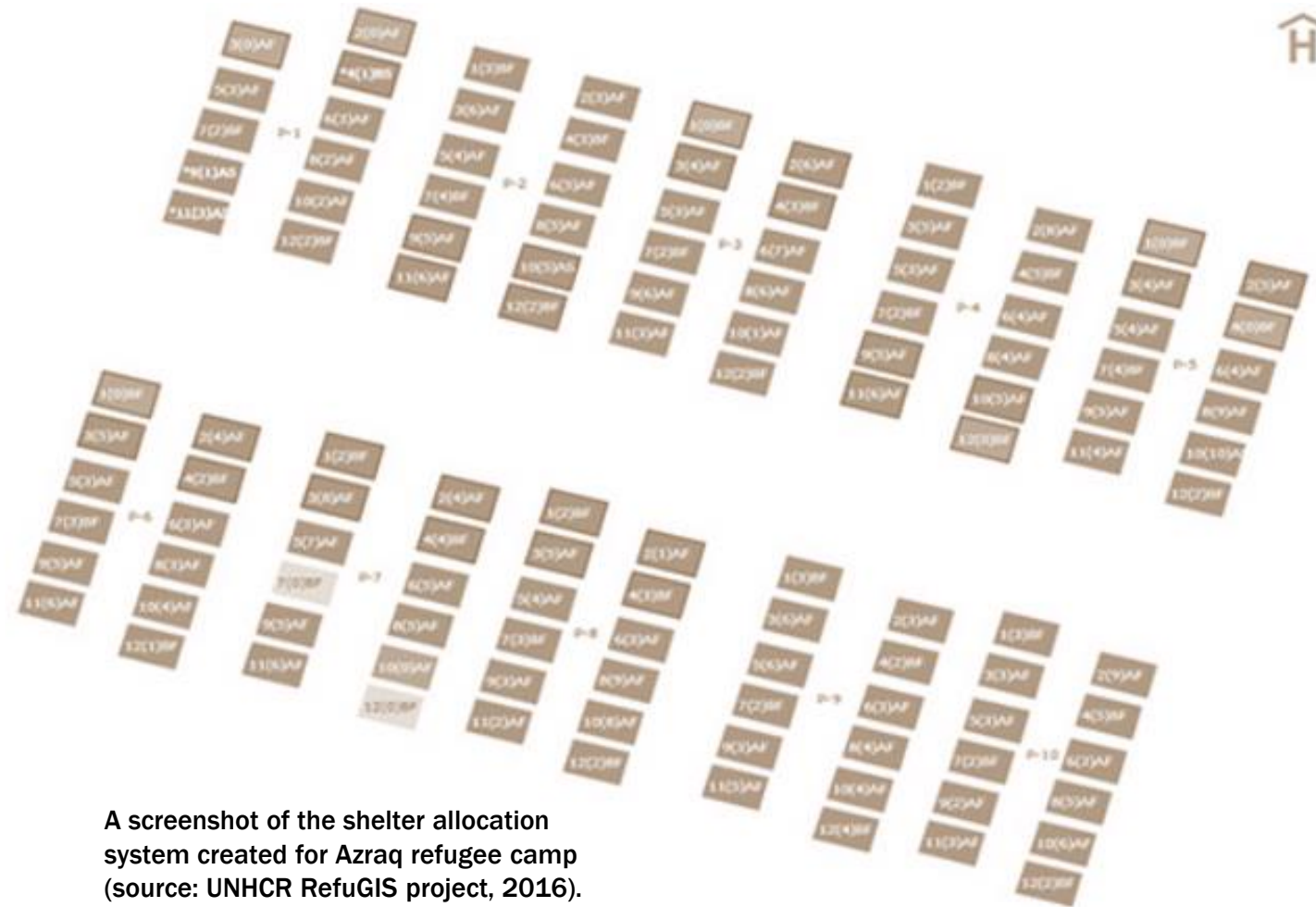Tented (traditional) refugee camps

Container or prefabricated shelter camps

Upgraded refugee camps

Slums

Based on UNHCR settlement planning handbook

THE ALPHABET OF THE CAMP

Shelter

+

Lot

= Unit

Row

Block

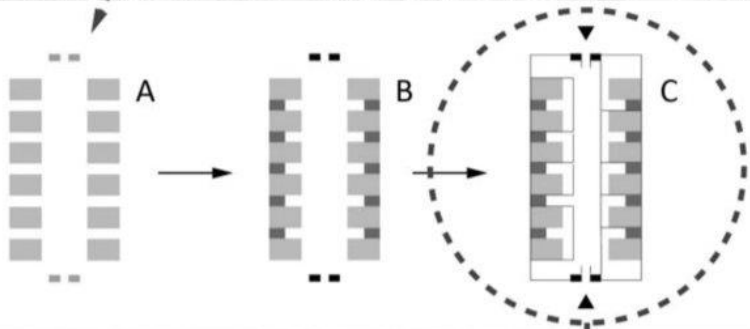Village

Camp

A screenshot of the shelter allocation system created for Azraq refugee camp (source: UNHCR RefuGIS project, 2016).
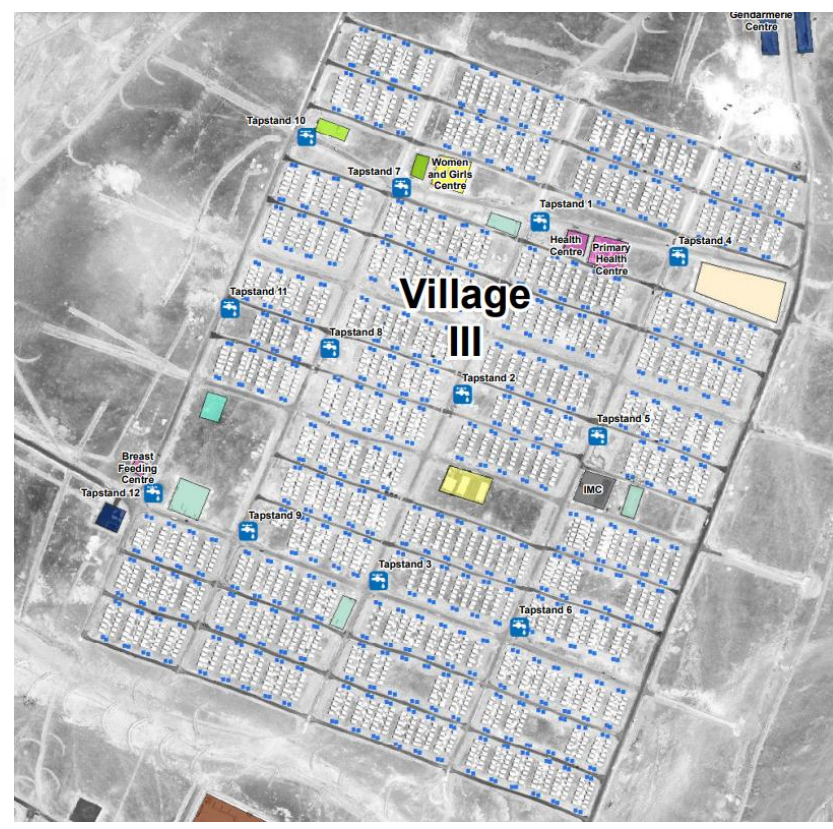
Satellite image of a village in Al Azraq Camp (Source: UNICEF, 2014)

REFUGEES ADAPT THE UNITS TO SUIT THEIR NEEDS
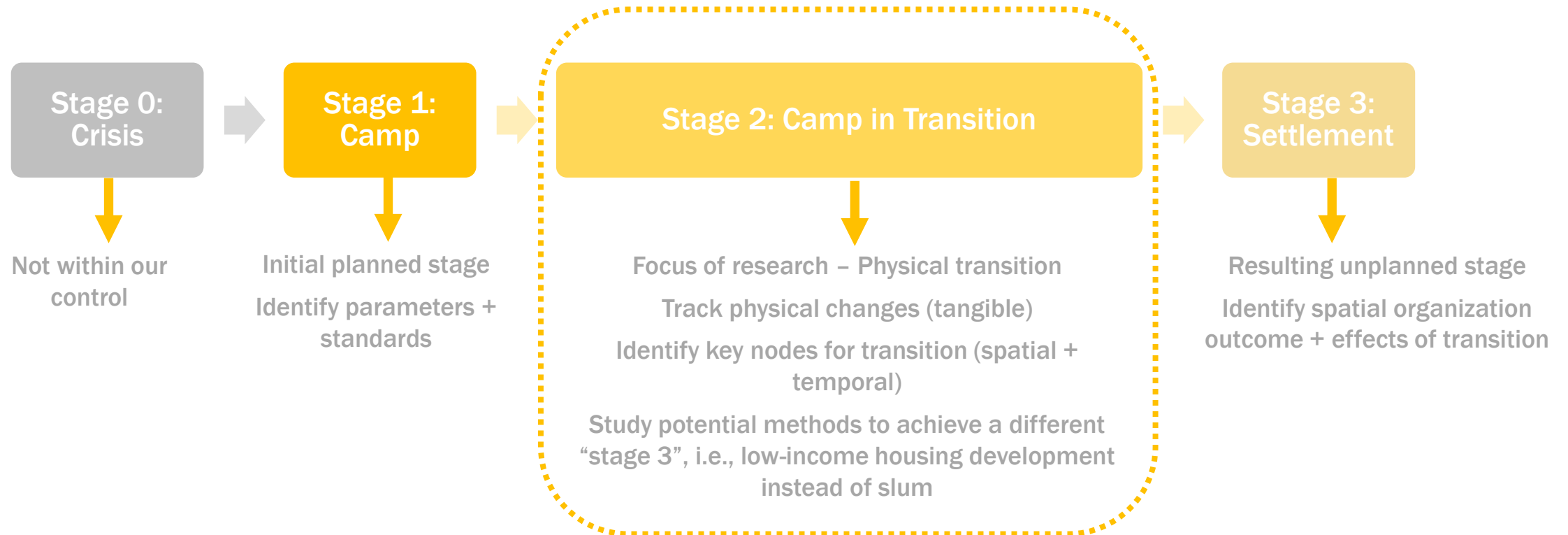
Source: Nasr Chamma, 2022

SHELTER VS DWELLING

Temporary	Long-Term
Basic protection	Fulfills deeper needs
Surviving	Living

SCOPE OF RESEARCH

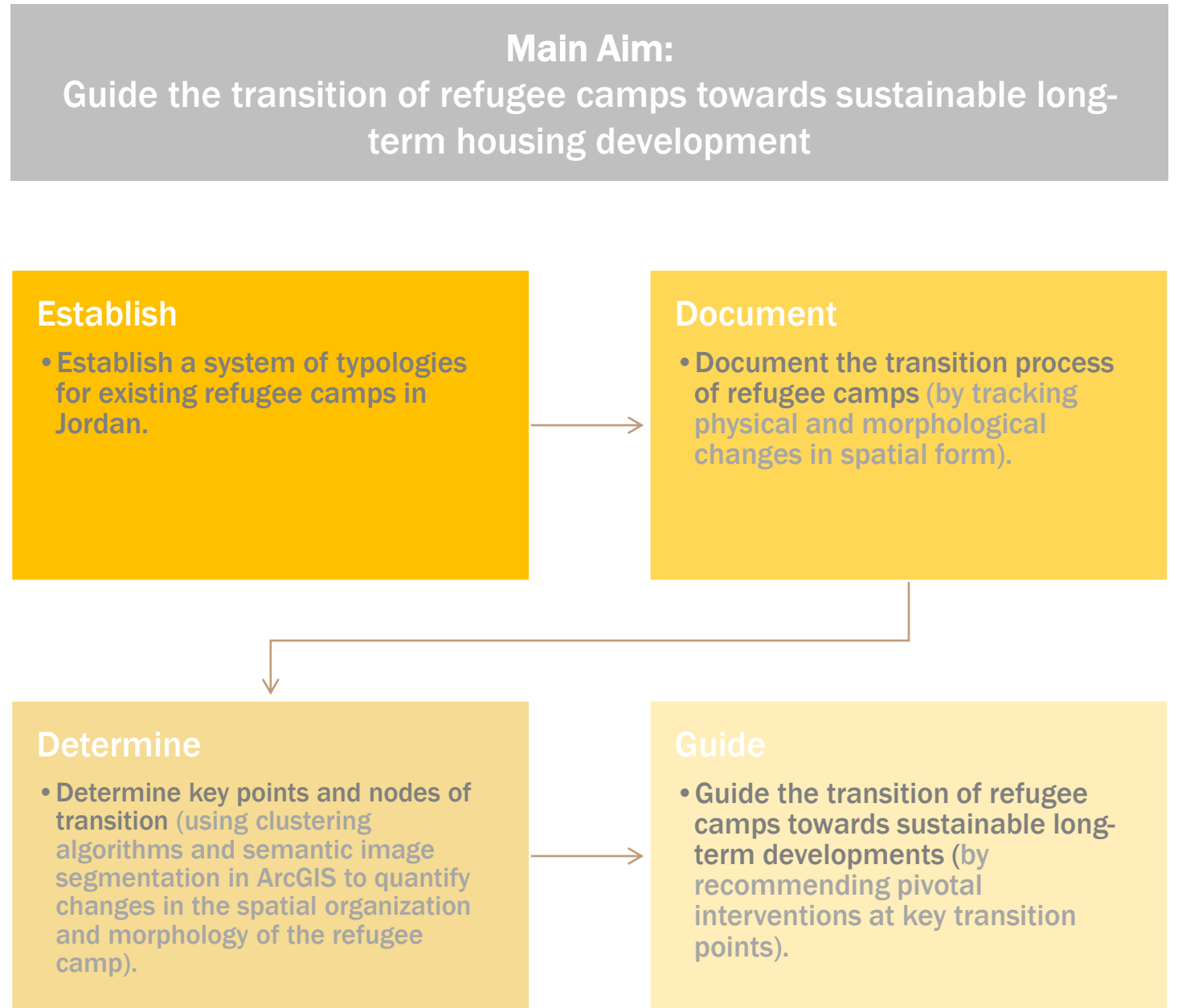| Stage 0: Crisis	Stage 1: Camp	Stage 2: Camp in Transition	Stage 3: Settlement
Not within our control	Initial planned stage Identify parameters + standards	Focus of research – Physical transition Track physical changes (tangible) Identify key nodes for transition (spatial + temporal) Study potential methods to achieve a different "stage 3", i.e., low-income housing development instead of slum	Resulting unplanned stage Identify spatial organization outcome + effects of transition

RESEARCH QUESTIONS

- How can the transition be guided towards a more sustainable outcome (low-income housing development) from the transition phase?

- What is a camp, what is a slum, and what is the "anti-slum"? What physical features characterize these typologies?

- Which quantifiable variables and values can be used to determine whether a specific spatial organization is a formally planned camp vs an informal slum in the context of Jordan?

- At what point in the transition stage does a camp transition into a slum, and can this be pinpointed in physical form and spatial organization?

- Where are the key nodes (spatial and temporal) from which the physical changes occur, and how can they be determined using image segmentation algorithms?

AIMS AND OBJECTIVES

Main Aim:
Guide the transition of refugee camps towards sustainable long-term housing development

Establish
- Establish a system of typologies for existing refugee camps in Jordan.

Document
- Document the transition process of refugee camps (by tracking physical and morphological changes in spatial form).

Determine
- Determine key points and nodes of transition (using clustering algorithms and semantic image segmentation in ArcGIS to quantify changes in the spatial organization and morphology of the refugee camp).

Guide
- Guide the transition of refugee camps towards sustainable long-term developments (by recommending pivotal interventions at key transition points).

METHODOLOGY

Based on:
Literature Review

Theoretical Framework

Secondary Sources

Case Study Selection

(Result of field work + secondary research)

Al-Baqa'a Camp 1969

Al Azraq Camp 2014

Data Collection and Analysis

Qualitative

Quantitative (main focus)

Satellite Image Clustering and Segmentation

Collect Images

Perform ISO clustering Analysis
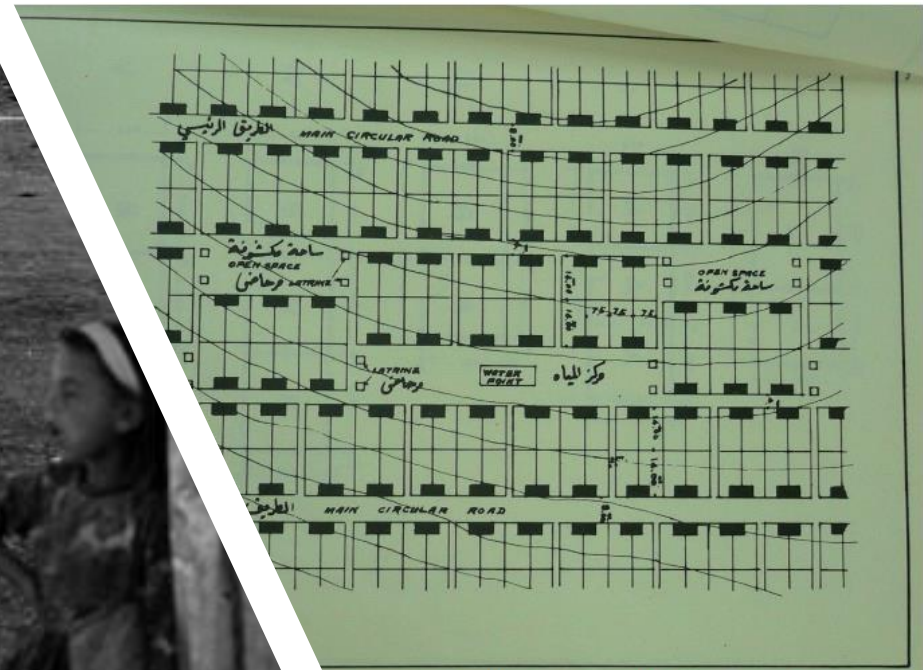
Extract Results

Stakeholder Feedback

Collect insights

Optimization approach

Baqa'a Camp – Jordan – 2022

Baqa'a Camp – Jordan – 1969

permission from UNRWA Central Registry archive.

Azraq Camp – Jordan – 2022

Same emergency handbook still used since 1982, was updated in 2018 without significant change to shelter and site selection recommendations.
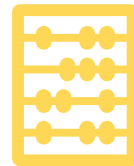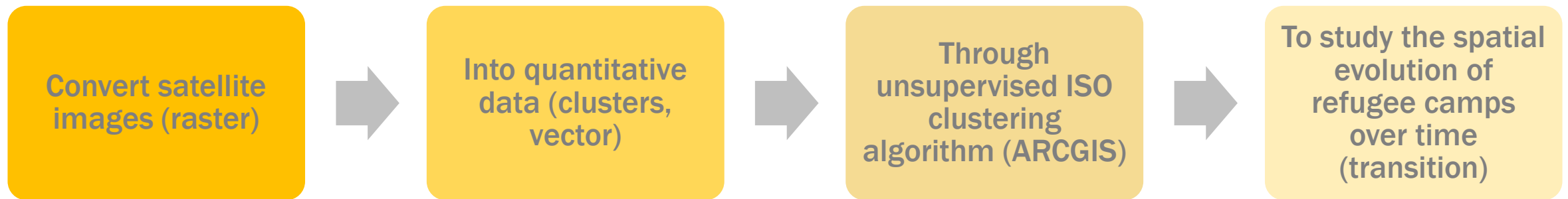
THIS RESEARCH DEALS WITH

Theoretical Part

- Physical morphological transition
- Theoretical framework
- Literature background
- Case study analysis
- Field work, interviews
- No policies – focus on tangible aspects of the built environment

Technical Part

- Remote sensing
- Computer vision
- Image segmentation
- Unsupervised classification
- ISO clustering applied to a time series

BUT HOW?

Convert satellite images (raster)	→	Into quantitative data (clusters, vector)	→	Through unsupervised ISO clustering algorithm (ARCGIS)	→	To study the spatial evolution of refugee camps over time (transition)

- Applying clustering to each image separately, no concatenation of raster data – Clusters are linked temporally and compared in relation to their relative size and position (center) to other clusters in the image.

- The algorithm is unsupervised – doesn't need to be trained, only tuned via hyperparameters.

SCALE OF RESEARCH

Unit

Row

Block

Village

CAMP
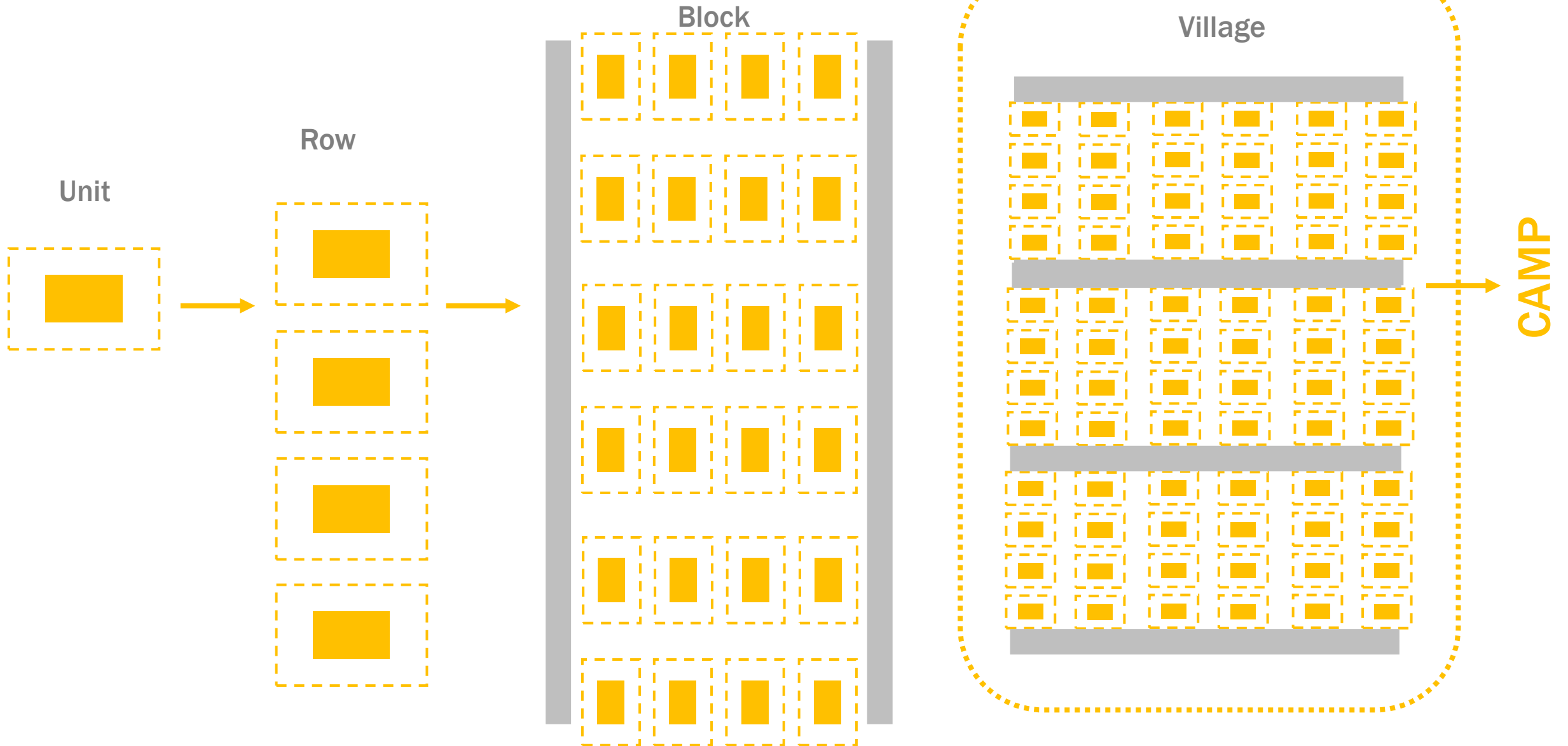
Village II

Village III

Village V

Village VI

CLUSTERING AND SEGMENTATION

Using ISO (Iterative Self Organizing) Clustering classification algorithm in ArcGIS. Satellite images were sourced from ESRI Landviewer and are opensource.

Satellite image of Azraq refugee camp from April 2014 when it was first opened (left) and clustering algorithm result separating built structures from valley and mountainous terrain (right).

Satellite image of Azraq refugee camp from April 2017, three years after opening (left) and clustering algorithm result separating built structures from valley and mountainous terrain (right). The clustering result displays an increase in the built (shelter and infrastructure)

Satellite image of Azraq refugee camp from January 2023 (left) and clustering algorithm result separating built structures from valley and mountainous terrain (right). The clustering result displays an increase in the built (shelter and infrastructure)
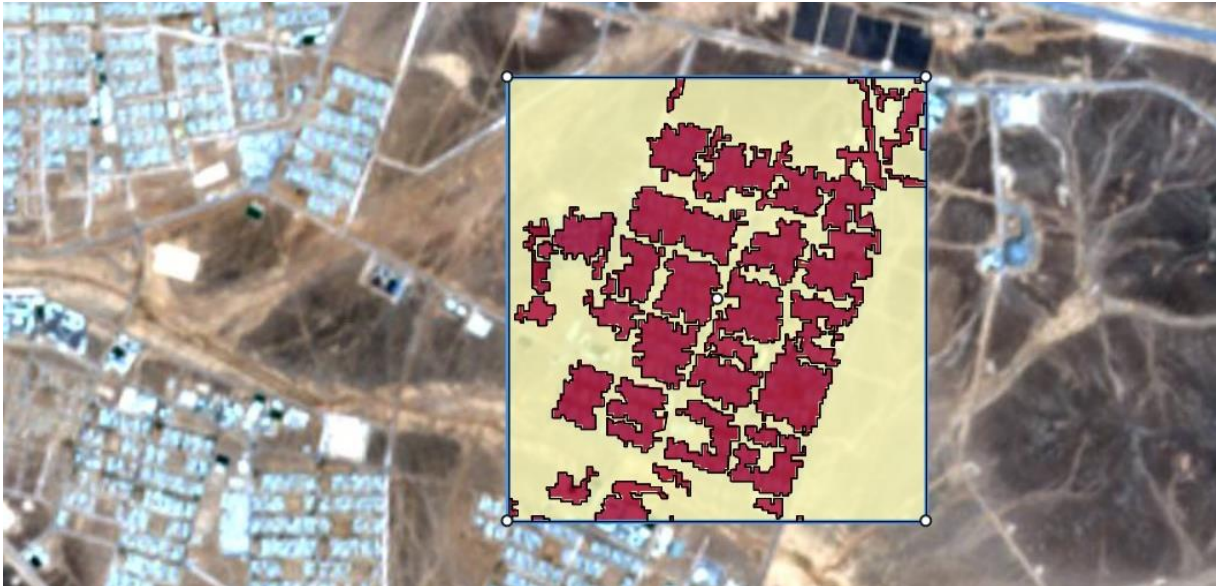
Satellite image of Village III in Azraq refugee camp from July 2014 and clustering algorithm result separating built structures from valley and mountainous terrain.

Satellite image of Village III in Azraq refugee camp from August 2022 and clustering algorithm result separating built structures from valley and mountainous terrain.

VILLAGE SCALE
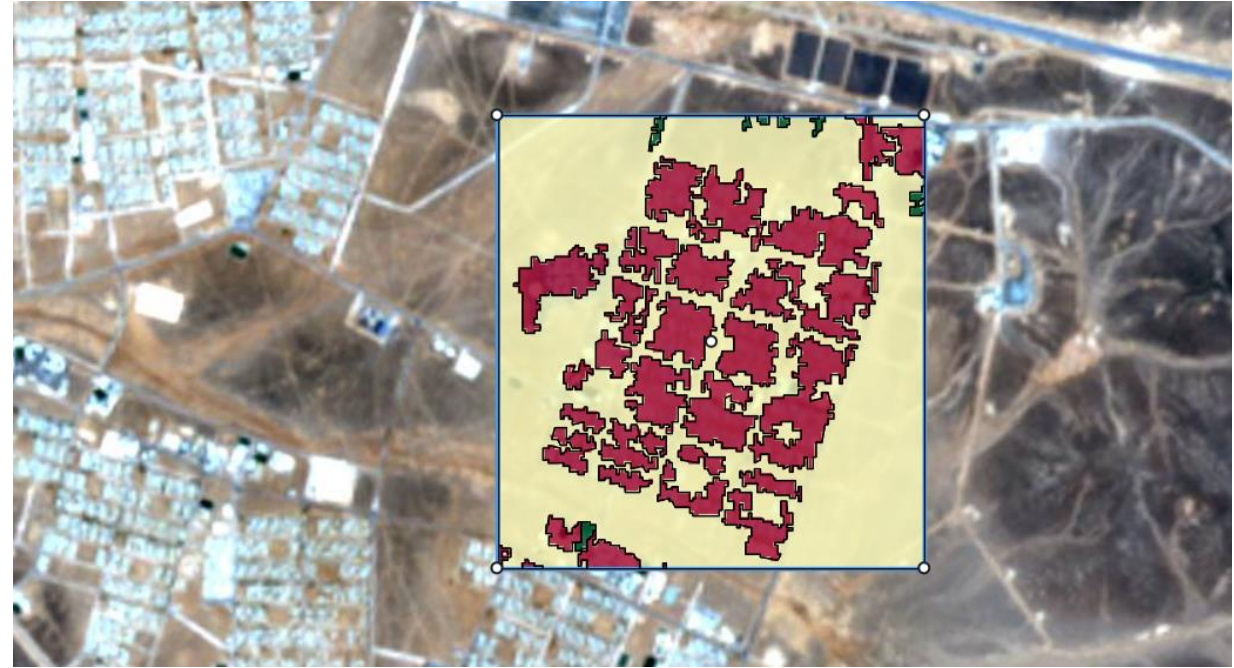
Satellite image of Village III in Azraq refugee camp from August 2023 and clustering algorithm result separating built structures from valley and mountainous terrain.

Satellite image of Village III in Azraq refugee camp from July 2018 and clustering algorithm result separating built structures from valley and mountainous terrain.

Collected 10 years of satellite images of Azraq Camp – 2013-2023 (around 90 useable high-resolution images) from ESRI Landviewer to perform analysis

As well as 10 years of satellite images of Village III in Azraq Camp – 2013-2023 (around 80 useable high-resolution images) from ESRI Landviewer.
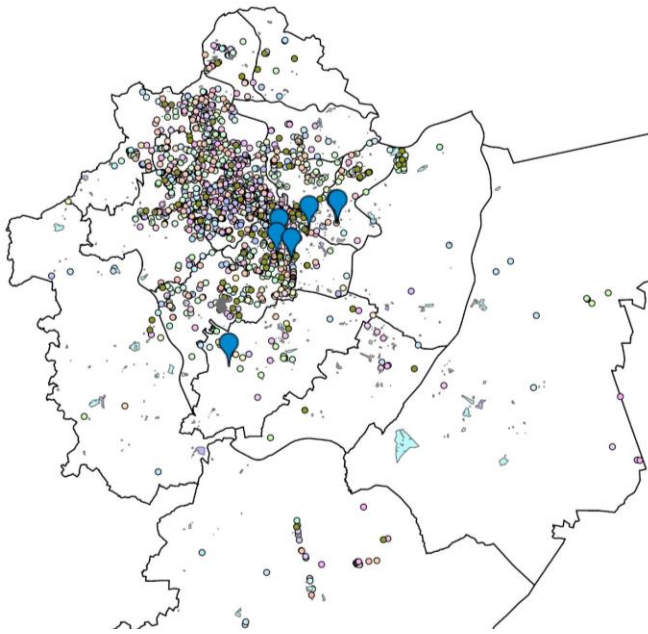
Same for Baqa'a Camp – 2004-2023 (around 80 useable high-resolution images) + older data will be provided in collaboration with researchers from Jordan

GIS data from previous work – refugee camps in Amman and Salt (Baqa'a) acquired from relevant authorities – administrative boundaries, lots, roads, landuse, landmarks, to use for analysis of Baqaa Camp

BUILDING + CAMP STANDARDS

Currently in contact with authorities of Amman and Salt city planning to acquire building and planning standards (codes) as well as parameters for existing refugee camps (mainly Baqa'a)

Summarizing building standards of UNHCR refugee camp planning handbook into a brief "toolkit"

PUBLICATIONS

Reviewed and currently in Publication (2023):

1. MARJI, N. and M. KOHOUT. **Optimizing the Spatial Organization of Refugee Camps in Jordan through Artificial Intelligence.** In Proceedings: UIA International Congress of Architects in Copenhagen, Denmark. 2023.

2. MARJI, N., M. KOHOUT, L. CHEN, G. EMIR ISIK, A. RAVI KUMAR.
   Refugee Camps in Jordan as Livable Cities. In Proceedings: AMPS New York – Livable Cities: A Conference on Issues Affecting Life in Cities. 2023.

3. RAVI KUMAR, A., N. MARJI, L. CHEN, G. EMIR ISIK, I. FIALOVA.
   Digital Twin and Artificial Intelligence as a public participation tool for reclaiming the postmining built environment in the City of Most. In Proceedings: AMPS New York – Livable Cities: A Conference on Issues Affecting Life in Cities. 2023.

4. CHEN L., N. MARJI, A. RAVI KUMAR, G. EMIR ISIK, V. KOCI, D. TICHY. **Digital Technology Transition in Age-Friendly Communities: A New Approach to Social Innovation**. In Proceedings: AMPS New York – Livable Cities: A Conference on Issues Affecting Life in Cities. 2023.

5. MARJI, N., M. KOHOUT, L. CHEN, G. EMIR ISIK, A. RAVI KUMAR.
   AI-Enabled Transition to Smart European Cities. In Proceedings: The 12th Annual Professional Conference Regional Development Between Theory and Practice on the topic Regional Development as Part of Europe's Sustainable Transformation. Masaryk Institute of Advanced Studies of the Czech Technical University in Prague. 2023.

6. CHEN L., N. MARJI, A. RAVI KUMAR, G. EMIR ISIK, V. KOCI, D. TICHY. **Sustainable Transitions in Age-Friendly Communities in Europe: A Participatory Approach.** In Proceedings: The 12th Annual Professional Conference Regional Development Between Theory and Practice on the topic Regional Development as Part of Europe's Sustainable Transformation. Masaryk Institute of Advanced Studies of the Czech Technical University in Prague. 2023.

7. RAVI KUMAR, A., N. MARJI, L. CHEN, G. EMIR ISIK, I. FIALOVA. **Investigating Urban Relocation of Post-Mining Cities: A Case Study of Most City in the Czech Republic**. In Proceedings: The 12th Annual Professional Conference Regional Development Between Theory and Practice on the topic Regional Development as Part of Europe's Sustainable Transformation. Masaryk Institute of Advanced Studies of the Czech Technical University in Prague. 2023.

PUBLICATIONS

Published (2020-2022):

1. MARJI, N. and M. KOHOUT. **From Temporary Shelter to Permanent Dwelling: Optimizing the Spatial Organization of Refugee Camps in Jordan through Artificial Intelligence**. In: Proceedings of the 25th International Academic Mindtrek Conference. Tampere, 2022. New York: Association for Computing Machinery, 2022. p. 329-333. ISBN 9781450399555. DOI 10.1145/3569219.3569363.

2. MARJI, N., J. SHAWASH, and N. MARJI. **Human-made. Waste as a resource for urban regeneration in Jabal al Jofeh refugee camp**. AGATHÓN – International Journal of Architecture, Art and Design. 2021, 2021(09), 134-145. ISSN 2464-9309. DOI 10.19229/2464-9309/9132021.

3. SHAWASH, J., N. MARJI, and N. MARJI. **A century of Jordanian architecture: narrating the development of the nation**. International Journal of Architectural Research. 2022, 2022 134-145. ISSN 2631-6862. DOI 10.1108/ARCH-07-2021-0205.

4. MARJI, N. **Extended Steel Reinforcement on Amman's Rooftops**. Tafseela: Urban Details. 2020, Tafseela: Urban Details. Arab Urbanism Magazine.

Awards (2023):

1. UltraHack 2023, Metaverse Hackathon.
   Project: **RealityShift: The Future of Work in the Metaverse**. Top 3 Finalist.

2. UltraHack 2023, Location Intelligence for Smart Cities Hackathon.
   Project: **CityPulse**. 3rd Place.

3. Holcim Awards for Sustainable Construction 2022, Next Generation Category. Project: **From Earth: School in the Iraqi Marshes**. 4th Place.

PUBLICATIONS

In Progress (2024):

1. **Transition in the Built Environment, a Systematic Literature Review and Meta Analysis**. N. Marji, M. Kohout, L. Chen, G. Emir Isik, A. Ravi Kumar.

2. **Analyzing the Development of Al-Baqa'a Refugee Camp in Jordan Using Artificial Intelligence Tools.** N. Marji, M. Kohout, R. Aburamadan, V. Cotello.

3. **Systematic Typologies of Refugee Camps in Jordan.** N. Marji, M. Kohout.

NEXT STEPS

Refugee camp typologies:

- Compile typologies of refugee camps based on physical and spatial characteristics to create a systematized database.

- Identify quantifiable parameters of each refugee camp typology and compile the parameters in the database related to physical characteristics.

- Construct definitions, namely what is a slum and anti-slum, based on quantifiable values.

Case study analysis:

- Continue with the data collection and create a database of satellite images for both refugee camps

- Compare the transition over time of both refugee camps and extract information and insights relating to their typologies and physical characteristics

AI integration:

- Continue with the clustering and segmentation analysis for the collected satellite images for both refugee camps

- Extract insights regarding the transition process, to pinpoint key stages of transition both spatial and temporal

- Determine appropriate interventions to mitigate the transition from a temporary refugee camp to a slum

- Suggest recommendations for the transition towards a long-term sustainable development, based on the extracted parameter values in identified key stages of transition.

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THANK YOU !

MSc. Arch. Noor Marji

Prof. Ing. Arch. Michal Kohout

Department of Architecture, Theory and Design (ATT)