تعداد أبوظبي
ABU DHABI CENSUS

Census Methodology

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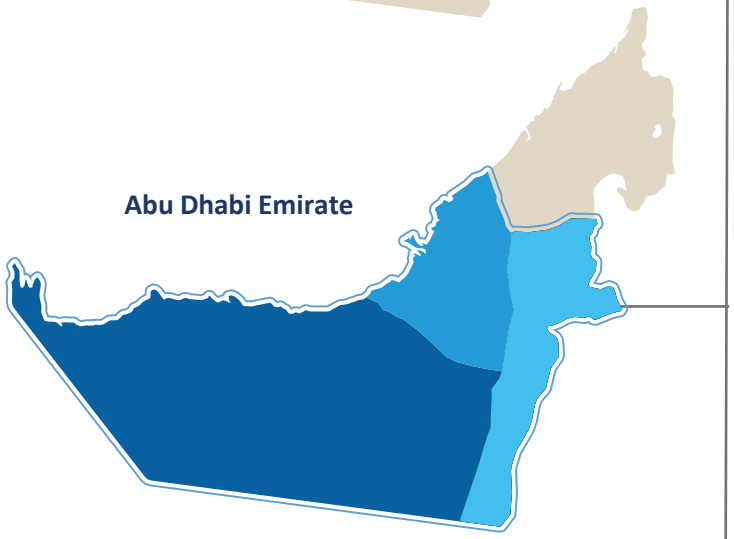
The United Arab Emirates

About the United Arab Emirates…

- The **United Arab Emirates** (UAE) is a federation of seven emirates located on the Arabian Peninsula, known for its rapid economic development and modernization.
- Since its formation in 1971, the UAE has transformed from a region reliant on fishing and pearling into a global hub for trade, finance, tourism, and innovation.
- With a diverse population, the UAE is home to a significant expatriate community, which plays a crucial role in its economy.
- The country is also known for its ambitious vision for the future, including projects like smart cities, renewable energy initiatives, and a focus on becoming a leading knowledge-based economy.
- **Abu Dhabi**, the capital, is rich in cultural heritage and is also a key player in global energy markets, being home to one of the largest sovereign wealth funds.
- The UAE is known for its high standard of living, with residents enjoying world-class infrastructure, healthcare, and education. The country also plays a significant role in international diplomacy, hosting major global events such as Expo 2020 in Dubai, and it is recognized for its efforts in promoting tolerance and multiculturalism.
- Additionally, the UAE's Vision 2021 and subsequent strategic plans aim to position the country as a leader in innovation, sustainability, and the knowledge economy.

Map of the United Arab Emirates

Abu Dhabi Emirate



Abu Dhabi’s Digital Transformation

- Abu Dhabi has made significant strides in digital transformation and smart city initiatives, earning it top positions in global rankings.
- As of 2024, Abu Dhabi is ranked **10th globally** in the IMD Smart City Index, reflecting its leadership in the Middle East and North Africa (MENA) region for smart city development.
- This ranking **marks a three-spot improvement** from the previous year, emphasizing the city's ongoing efforts in integrating advanced technologies, improving the quality of life, and promoting environmental sustainability.
- Key factors contributing to this high ranking include Abu Dhabi's investments in artificial intelligence (AI) for municipal services, smart infrastructure, and **digital services** that enhance governance, mobility, and public participation.
- The city’s approach to smart city development has also focused on sustainability, with initiatives such as green spaces, public transportation improvements, and inclusive governance structures that encourage citizen engagement through digital platforms.
- These efforts position Abu Dhabi as a global leader in smart city development, demonstrating the city's commitment to leveraging technology for economic growth and improving urban living standards.

Census Approach

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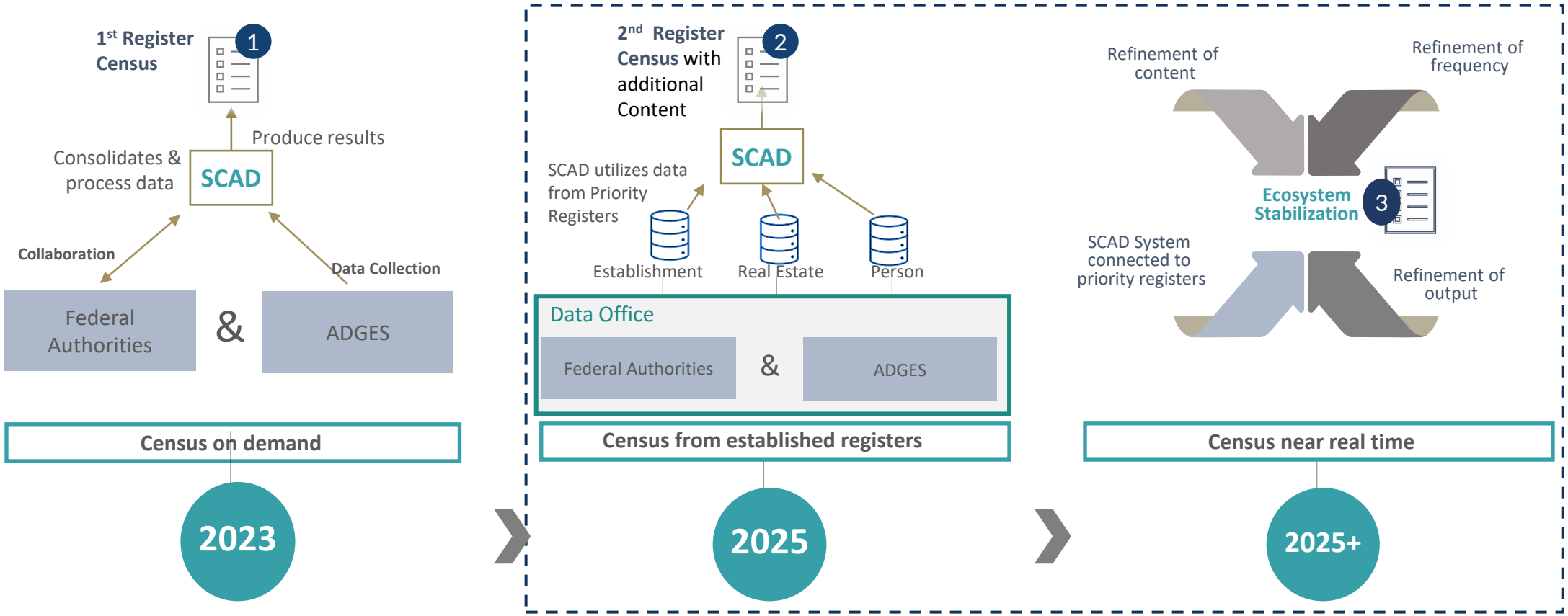
The Register-Based Census approach will provide regular, extensive and near real time statistics.

3 Steps Approach

to a Fully Mature 'Near Real Time' Register Based Census



Readiness of Administrative Registers Across the Government

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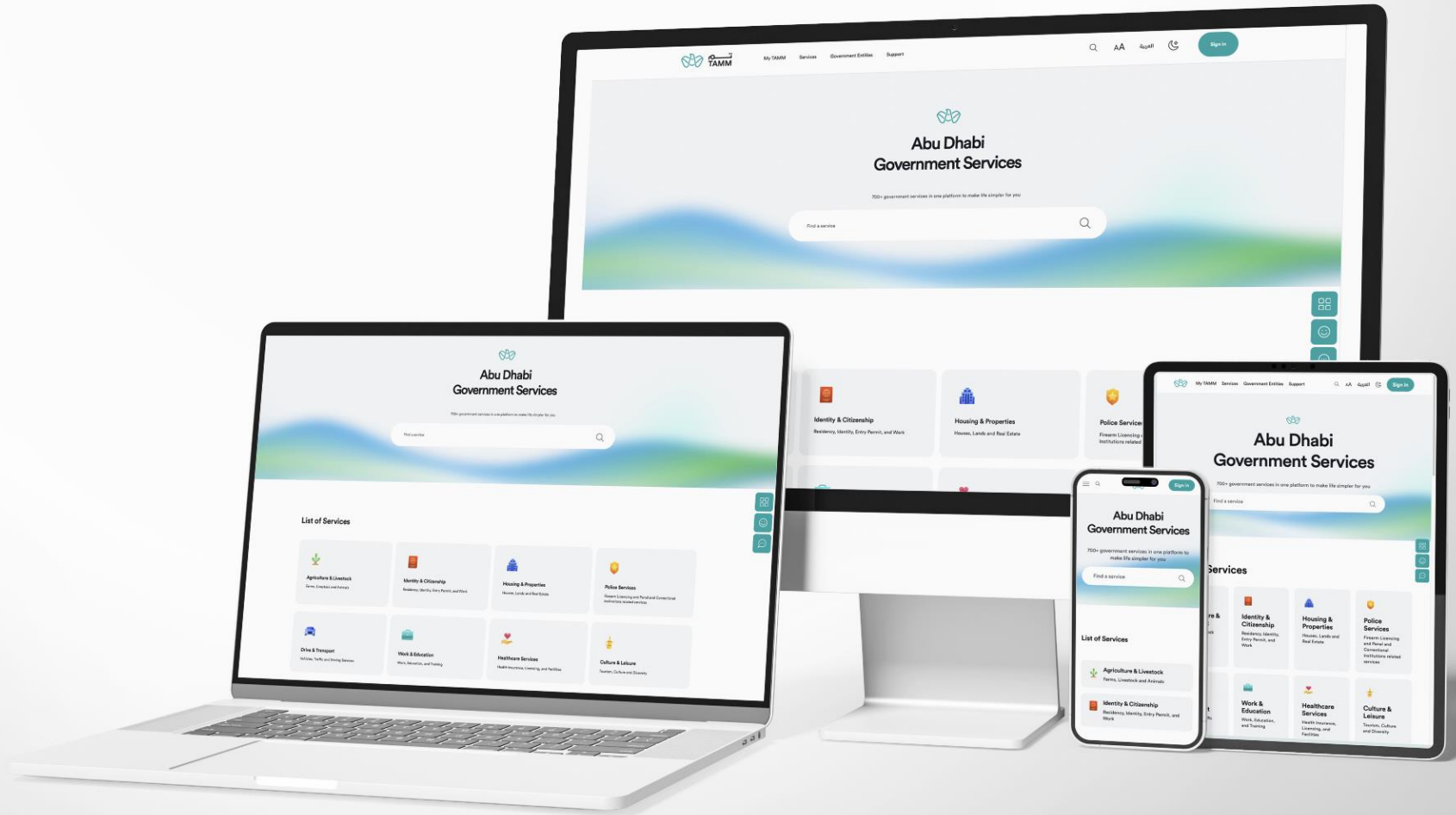

Datasets of services provided for individuals are Signs of Life

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Highlights

- TAMM is the central platform for Abu Dhabi Government services. People within Abu Dhabi access everyday vital services across Healthcare, Housing, Education, Citizenship, Residency and much more.
- Every service provided for individuals is a dataset used for census Signs of Life
- Services provided for business and workspaces are datasets used to trace segments of population who are not active users.
- The index-based methodology of the census gives a different view of the known datasets and allows the multiple sources to be compared.
- As the general indexing principles have been established, a new sign of life can be added depending on new information becoming available in any register.

Count of services

Ecosystem

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Building census using available admin data provides solutions for frame, survey enrichment, and knowledge sharing

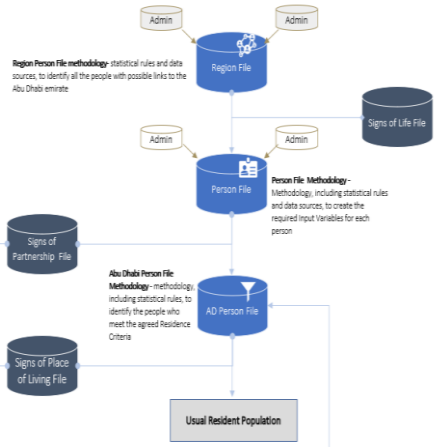
Specify Needs and Design → **Build, Collect and Process** → **Analyze, Disseminate and Evaluate**

1. **Team Members** — Representatives from census, population, social, LF, methodology, data analytics
2. **Datasets** — Education, Employment, Rental, Utilities…
3. **Technology** — Alteryx, BI, Tableau, python, Postgres
4. **Security** — Data ethics course, data access approvals…

5. **Virtual Room**

Census

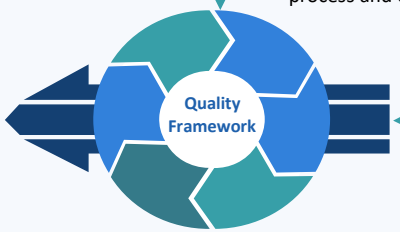
Census covers persons demographic characteristics, social attributes, place of living, and households and families.



Data
Data
Data

Output: Person Register

Quality KPIs are calculated for input, process and output



Innovation and development insights are expected through the learning journey.

Usual Resident Data Cube

- Apply imputation rules
- Apply Disclosure Control
- Derive output tables
- Analyze output quality
- Dissemination Matrix

- **Deliverable**: Census results dashboard on Bayan https://census.scad.gov.ae/

Households Frame

- Extract population frame from person register
- Apply sampling methods on the frame and derive the sample

- **Deliverable**: Administrative Household frame that meets minimum requirements

Knowledge Management Capability

- Build census knowledge capabilities across SCAD competent candidates

- **Outcome: maintain sustainability of census project and achieve optimum independence**

Dissemination Tools and Accessibility

Data
Data
Data

Personalized User Experience

Designing Logical Workflows

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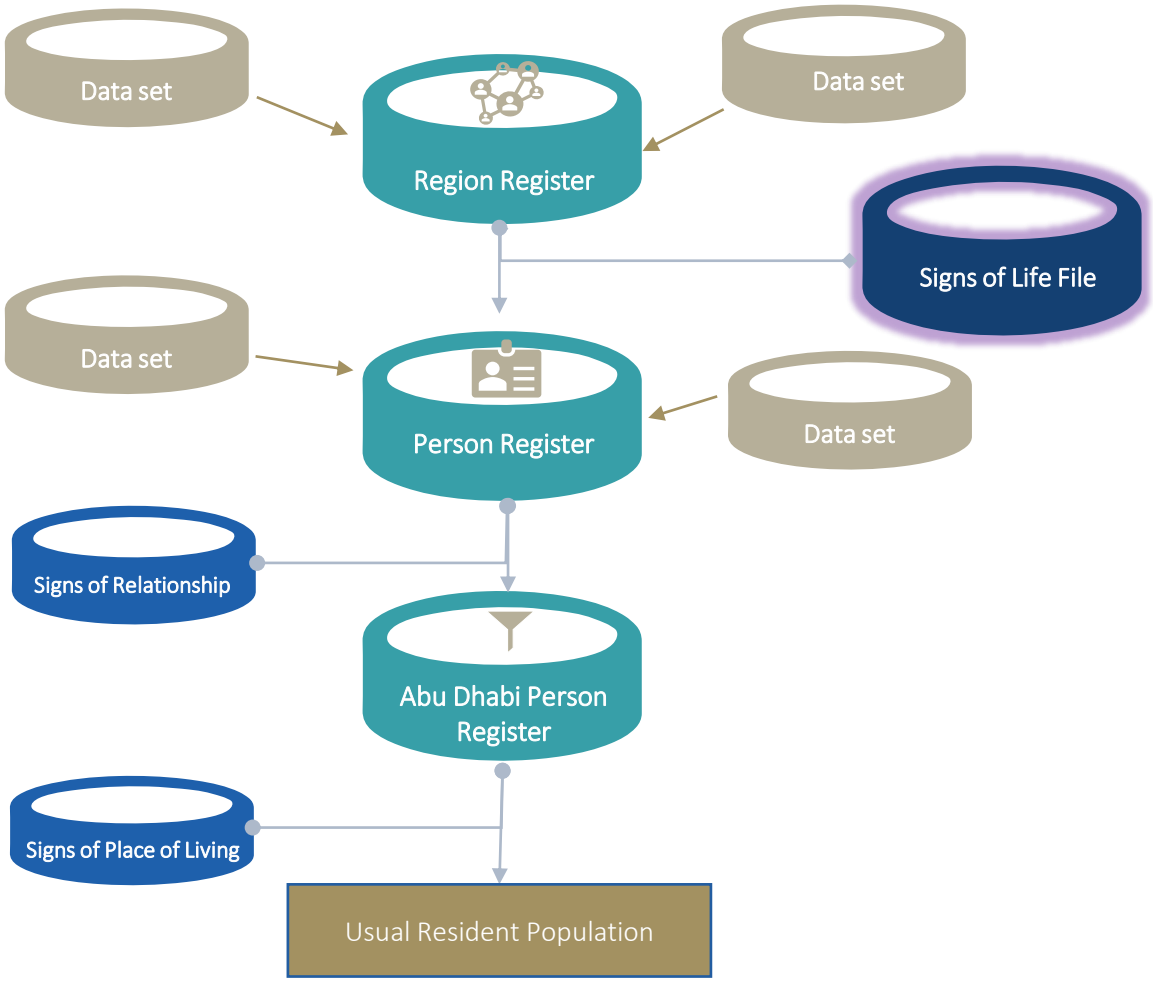
The purpose is to collect population data of internationally comparable quality that allows making decisions and forecasts on the population development.



Census Essential Features

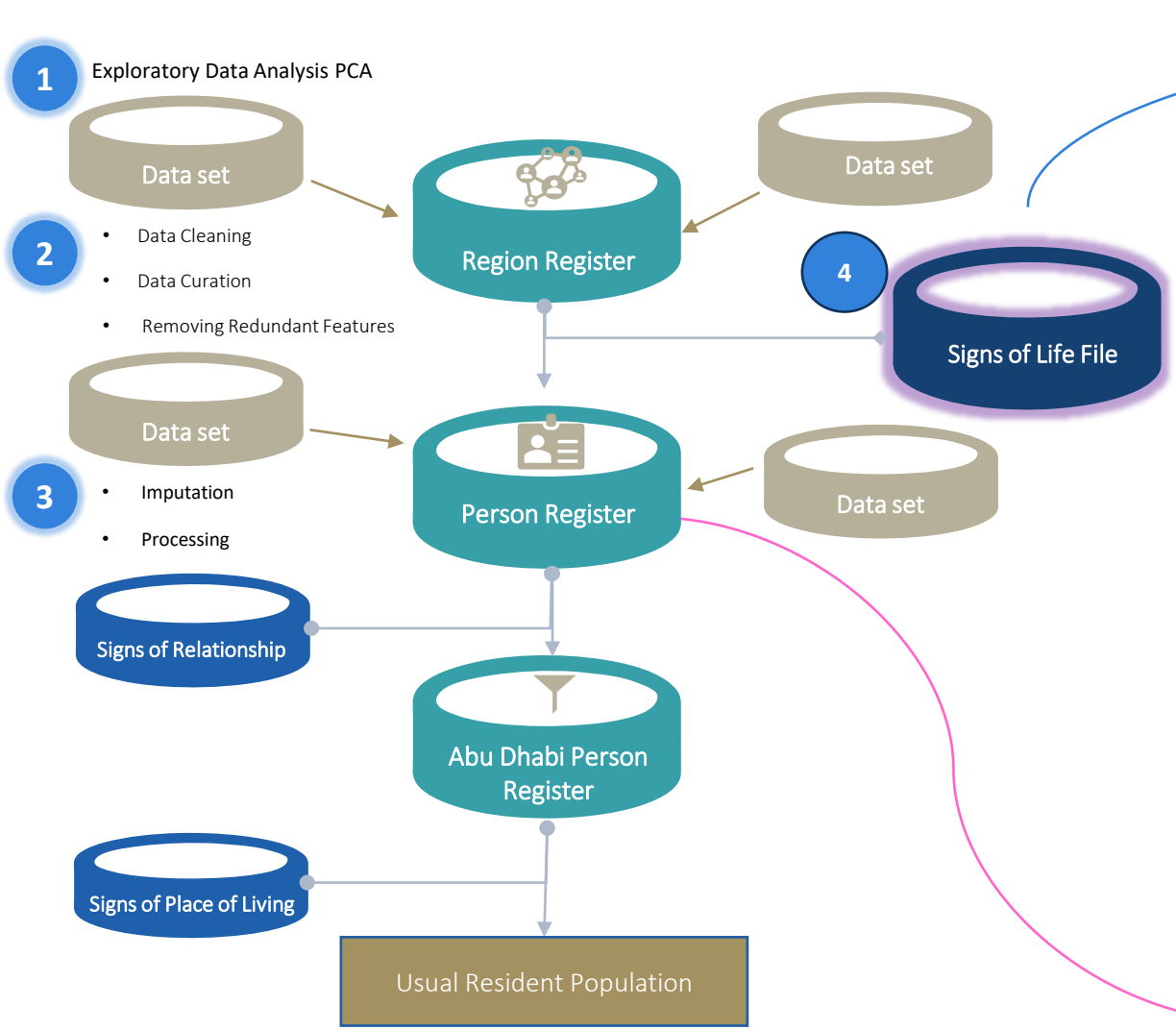
1. **Individual Enumeration** — Ensuring total count of units is covered. This principle relies heavily on Unique Identifiers
2. **Simultaneity** — The fixed census moment. Reference Period is the principle's area of focus.
3. **Universality** — Ensuring the content is exactly the same. This feature corresponds to Conformity.
4. **Small Area Data** — Providing information for small geographic areas and small population sub-groups.
5. **Defined Periodicity** — The period of time between two censuses. The shorter the better.

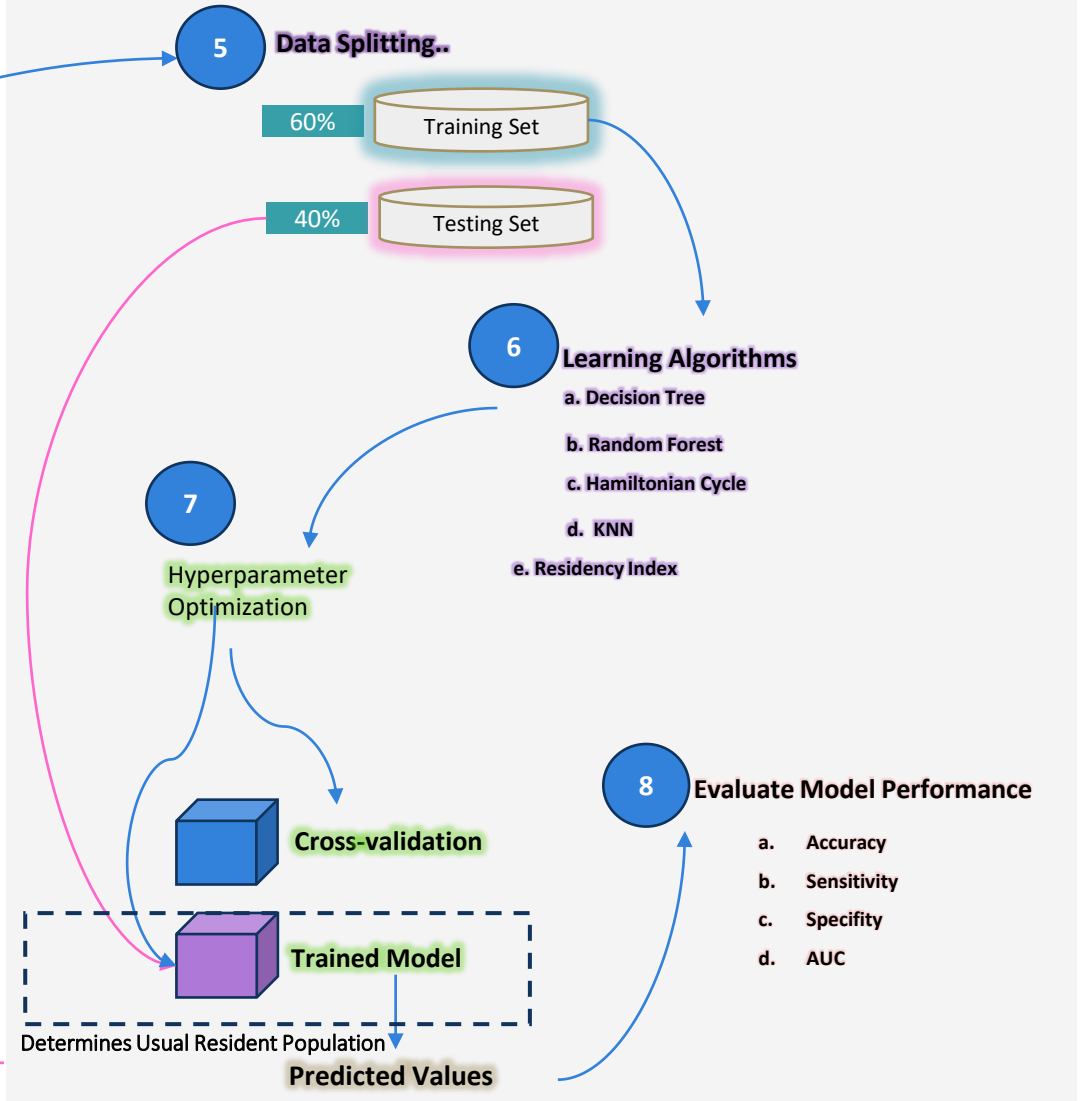
Determines Usual Resident Population

Source: Statistics Center Abu Dhabi

Building Machine Learning Model

The use of survey data to train the model and evaluate its performance was run in multiple iterations





Source: Statistics Center Abu Dhabi

Towards Register- Based Census innovatively

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challenge

Coverage

Traditional: Under coverage of total population

Register: Over coverage of total population

Linking Person to Person

Traditional: Identifies relationship for persons who live in the same place only.

Register: Not all relationships captured.

Linking Person to Dwelling

Traditional: Identifies place of usual residence, however, remains outdated till next census.

Register: Can not identify place of usual residence

Linking Persons to Households

Traditional: Constructs households only

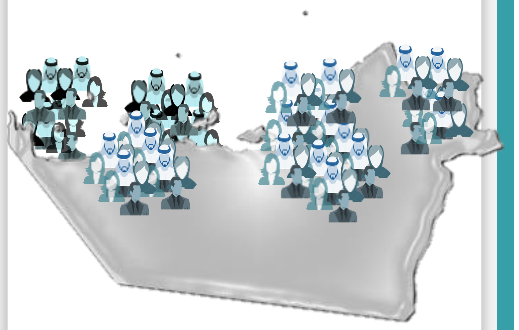
Register: Constructs Families only

solution

A Signs of Life

- The basis of the methodology is that **over time**, a person living in Abu Dhabi inevitably leaves **certain traces** or markers of administrative activity in the form of records in different databases.
- This means it is possible to verify the person's residence in the emirate.

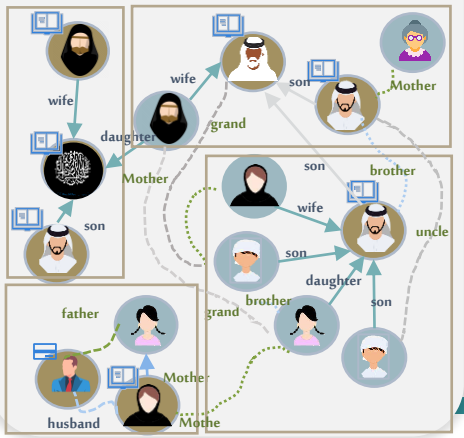
Tracing person(s) activities across respective registers



B Signs of Relationship

- Tracing **persons links to other persons** existing in admin records and verifying the type of linkage

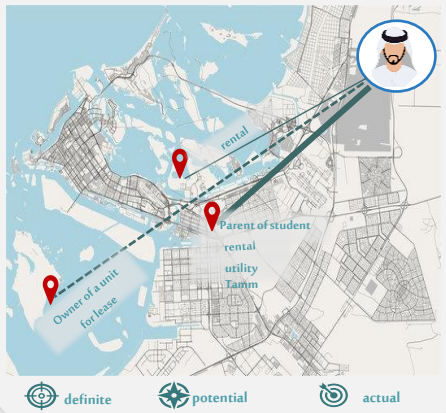
Linking persons and building relationship trees



C Signs of Place of Living

- Capturing persons **links to residential units** in the respective registers and use deep learning to predict actual place of living

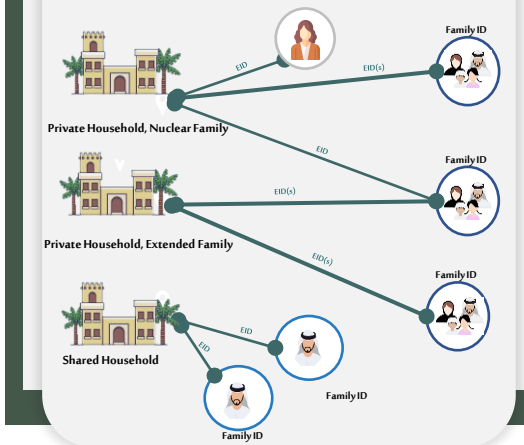
Linking person to dwelling is captured



D Social Aggregation

- Using both signs of relationship and signs of place of living, census is able to identify households and families by their citizenship and type: nuclear, extended, or family of one

Designing families and households



Use-cases examples

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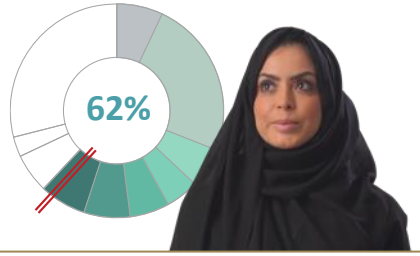
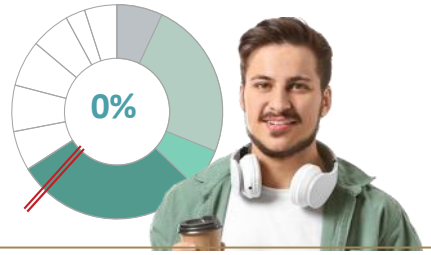
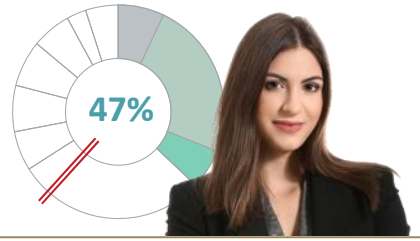
Reality	Monitoring through records			
Mohammed **lives and works in Abu Dhabi** Mohammed works in a government job in the Abu Dhabi region with a university degree. He lives with his wife and children in Al Ain region, in an owned villa. Mohammad's wife is a housewife.		Registered in Abu Dhabi Health Insurance Visiting the hospital Working in Abu Dhabi	Student guardian Owns a House Electricity Bill He lives in Abu Dhabi*	The census proved that Mohammed resides in the emirate
Sheikha **lives in Abu Dhabi and is a student** Sheikha has 4 children, three of whom are in school. She is not working but is completing her graduate studies at Zayed University. She is a renter and lives with her children and a maid.		Registered in Abu Dhabi Health Insurance Visiting the hospital University Student in Abu Dhabi	Student guardian Rents a House Electricity Bill She lives in Abu Dhabi*	The census proved that Sheikha resides in the emirate, even though her identification documents belong to another emirate
Joseph **works in Abu Dhabi and is not a resident there** Joseph has two children, one of whom attends school in Dubai, where they all live. His wife works as a freelancer from home.		Registered in Abu Dhabi Health Insurance Visiting the hospital Working in Abu Dhabi	Student guardian Owns a House Electricity Bill He lives in Abu Dhabi*	Although Joseph has enough evidence to make him an actual resident of the emirate, the individual verified in the central platform he is not residing in the emirate.
Christine **does not work or reside in Abu Dhabi** Christine works in a company that is registered in Abu Dhabi but the branch is located in another emirate, where she resides.		Registered in Abu Dhabi Health Insurance Visiting the hospital Working in Abu Dhabi	Student guardian Owns a House Electricity Bill She lives in Abu Dhabi*	The census showed that Christine outside the emirate, and that she works for a company whose license is issued from Abu Dhabi and is in another emirate.

Verified Possibly true Proved to be incorrect threshold

Signs of Life File

The design of Signs of Life File is flexible and allows adding more data sources and activities as the project move forwards

Source	Region File	Health				Education		Justice		Rental	Utility	…	Total
Activity	EID	Beneficiary	Births	Deaths	Episodes	Enrolled	Parent	Marriage	…	…	…	….	
1	Person a	1	0	0	1	0	1	0					
2	Person b												
3	Person c												
…	….												
	Total												

The creation of the Signs of Life File is apparently relying on a binary system based on person's activity across the respected registers.

Every person is given a value of 1 if an activity sign is shown in the respective data source, and 0 if no activity signs shown.

The use of Signs of Life File is to calculate ***Residency Index*** (explained in Abu Dhabi Person File Chapter) that verifies actual usual resident population.

Highlights

- The index-based methodology of the census gives a different view of the known datasets and allows the multiple sources to be compared. As the general indexing principles have been established, a new sign of life can be added depending on new information becoming available in any register.
- An increase in the number of data sources required is expected over time.

Designing calculations

- The binary variables $E(i,j)$ are specified for:
  - every person $(j = 1, 2, \dots, N)$, and
  - each admin dataset $(i = 1, 2, \dots, M)$ as follows:

$$E(i,j) = \begin{cases} 1\,, & \text{if person } j \text{ is active in dataset } i \\ 0\,, & \text{otherwise} \end{cases}$$

- Variables $E(i,j)$ represent the Signs of Life of persons across the respective data sources.
- In order to differentiate the actual usual residents of Abu Dhabi Emirate from non-usual residents, SOL values are used.

$$X_j = \sum_{i=1}^{m} \mathrm{E}\,(i,j)$$

Assigning weights for Signs of Life

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Survey Sample

Confident Usual Resident

Research Group

Test Group

Confident Non-Usual Resident

Research Group

Test Group

Assigning weights for Signs of Life

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Survey Sample

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1	Person a	1	0	0	1	0	1	0				
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...	....											
	Total											

Confident Non-Usual Resident

Research Group

Test Group

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3	Person c												
...	....												
	Total												

$$K = j \mid R\,(j,k) = 1$$

Confident Non-Usual Resident

Research Group

Test Group

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Activity	EID	Beneficiary	Births	Deaths	Episodes	Enrolled	Parent	Marriage	...	...	...	....	
1	Person a	1	0	0	1	0	1	0					
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...	....												
	Total												

$$N = j \mid R\,(j,k) = 0$$

Assigning weights for Signs of Life

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Assigning weights for Signs of Life

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3	Person c											
...	....											
	Total											

$$b_i = \left(\frac{nN}{nK}\sum_{j\in K} E_i(j,k)\right) / \sum_{j\in N} E_i(j,k)$$

Assigning weights for Signs of Life

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...	....											
	Total											

$$T = (\sum_{j=1}^{N} \sum_{i=1}^{m} E_i(j,k)) / (\sum_{j=1}^{N} \sum_{i=1}^{m} biE_i(j,k))$$

Assigning weights for Signs of Life

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	Total											

$$q_i = \ln(bi)\,, \qquad qi := Tqi\,, \qquad i = 1,2,3,\dots,m$$

Elevating Data Privacy and Confidentiality Standards

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Highlights

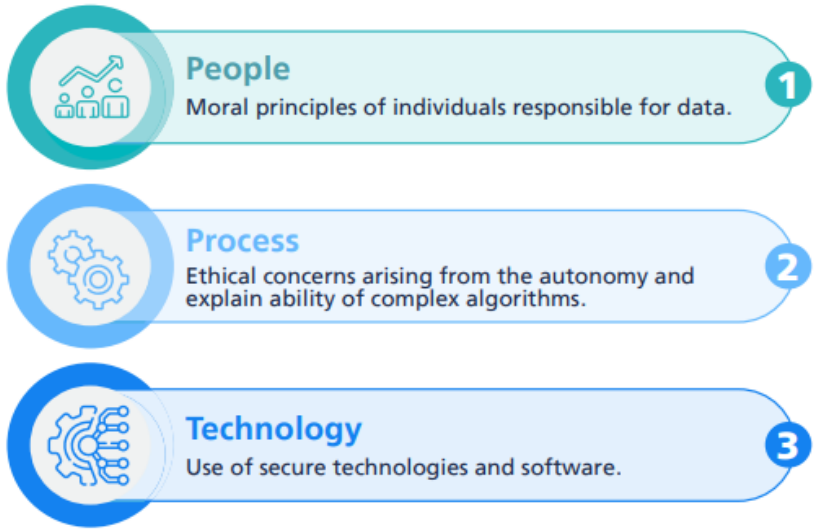
- Advanced technologies were used to ensure the governance and security of information and related data.

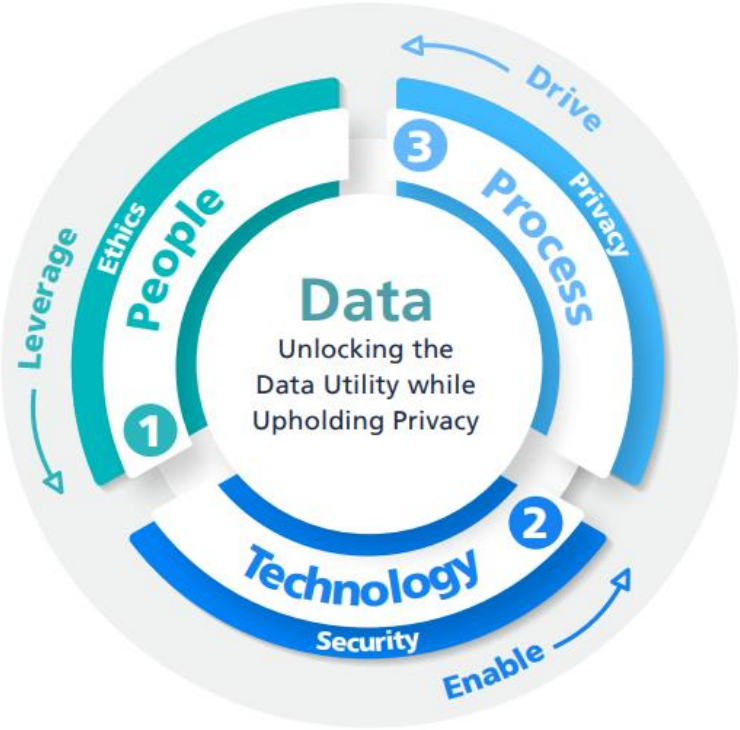
- An intensive ethics program was employed for dealing with data, and secure procedures were adhered to throughout the preparation and implementation phases.

- Data security measures applied while handling data included:
    a. Data was received from partners through direct API integrations and secure file transfer approach, as per best practices, to avoid any data leakage during the transfer.

    b. Periodic security tests have been conducted to comply with all security controls and mitigate any vulnerabilities.

Data Areas Alignment with Privacy Pillars





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THANK YOU