المركز الوطني للإحصاء والمعلومات
سلطنة عمان

NATIONAL CENTRE FOR STATISTICS & INFORMATION
SULTANATE OF OMAN

Oman's Experience in Utilizing Mobile Positioning Data for Official Statistics

Ahmed AL Mufarji

About NCSI

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The video originally contained in the presentation has been removed and will be made available separately on the
Global Network of Data Officers and Statisticians at https://www.yammer.com/unstats/ .

The Legal Basis for the Project

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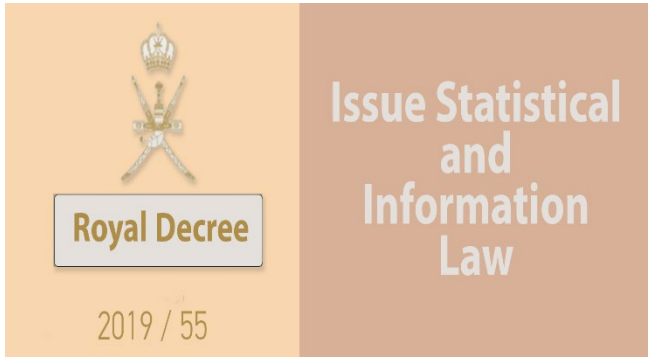
- **A Royal Decree issued in 2014** to regulate the work of the Centre.
  - Granting broad powers to the Centre in collecting and storing official statistics produced by the Centre and other government and non-goverment agencies
- **A Royal Decree issued in 2019** regarding the Statistics and Information Law:
  - Article 19 In order to achieve its objectives, the Center may request whatever data, information and administrative records it deems necessary from individuals, governmental and non-governmental agencies, without fees.
- **Article 32** punishes every non-governmental agency that refuses to provide the data and information required in accordance with the provisions of this law that are required by those in charge of official statistical activities.
- **Memoranda of understanding with telecom companies.**



Introduction about the Telco

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- The Telecommunications Regulatory Authority is the regulator of telecommunications
- Two companies provide telecom service with equal market share of 50% each
- Telecommunications Law in 2002
- Article 8, Clause 10
- Competences of the Authority: laying down controls that ensure the protection of data related to users and ensuring its confidentiality and privacy.

29- عدد الإشتراكات لخدمات الإتصالات حسب النوع
29 - No. Of Telecom Subscription Services By Type

Item	نسبة التغير Changes % فبراير/ فبراير Feb / Feb (21/20)	2021		2020	الجملة حتى نهاية ديسمبر 2020 Total Until End of Dec
		فبراير Feb	يناير Jan	ديسمبر Dec	
		No.			عدد
B- Mobile Phone :-					
1- Post paid mobile	34.0	**1,068,535**	**1,042,652**	**1,020,355**	**1,020,355**
2- Pre paid mobile	-8.3	**5,108,996**	**5,222,992**	**5,256,180**	**5,256,180**
-Operators	-10.7	4,043,996	4,154,829	4,177,070	4,177,070
-Resellers	2.3	1,065,000	1,068,163	1,079,110	1,079,110
Total Mobile Subscriptions (1+2)	**-3.0**	**6,177,531**	**6,265,644**	**6,276,535**	**6,276,535**

Monthly Statistical Bulletin, March 2021, NCSI

Pre-Project

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- Law
- MoUs
- Meeting the stakeholders
- Establish a team consisting all the stakeholders

Project Objectives

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- Investigate the possibilities of use of the MPD in Oman
- Improve the knowledge of society by implementing new data sources for statistics, monitoring, analysis and decision making
- Make the necessary preparations, tests and assessment for full-scale MPD based statistics implementation
- Create a proof-of-concept for the feasibility of MPD
- Showcase that MPD can improve some existing issues with traditional statistical collection methods
- Promote MPD based statistics on Omani example all over the World

Return of Investment

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- Faster processing and production of statistical indicators
- Supplementary and new indicators, and breakdowns which were previously unavailable
- Improved temporal and spatial coverage and accuracy of the data
- No burden on the respondents
- Applicability in a wide range of domains
- Cost-efficiency compared to the existing methods for same magnitude

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Example of Benefits

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NCSI is organizing every year a tourism survey of Salalah visitors during the Khareef Season. The cost of this single survey could be replaced with faster (data is already digital) and higher quality (larger sample) data using mobile positioning data

Oman does not have origin-destination statistics for transportation sector. Starting to use this data, will improve the quality on decisions of large infrastructure project running in Oman

The Project - Deliverables

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- Dissemination materials (D6):
- 10 different animations for presentation of specific phenomena based on the mobile data. The specific animations,
- types and focuses will be agreed in the beginning of Phase III. An example of one animation is: everyday commuting
- patterns of a week period for Oman (D6.1);
- 15 different maps, graphs (possible combinations) and infographics to present specific phenomena or the general
- description of the mobile data usage in production of statistics (D6.2);
- A PowerPoint presentation slides of 30 slides for dissemination concerning the results of the pilot project including
- abovementioned dissemination materials (D6.3).
- Dissemination web-page explaining the project objectives and presenting the list of outcomes for viewing, downloading.
- The web-page will be styled after NCSI portal and can be integrated to NCSI main portal (D6.4)
- Centralized Database
- API for the statistical indicators supporting (D7):
- JavaScript Object Notation (JSON) standard format for applications;
- Extensible Markup Language (XML) following SDMX-ML standard format;

Data Flow

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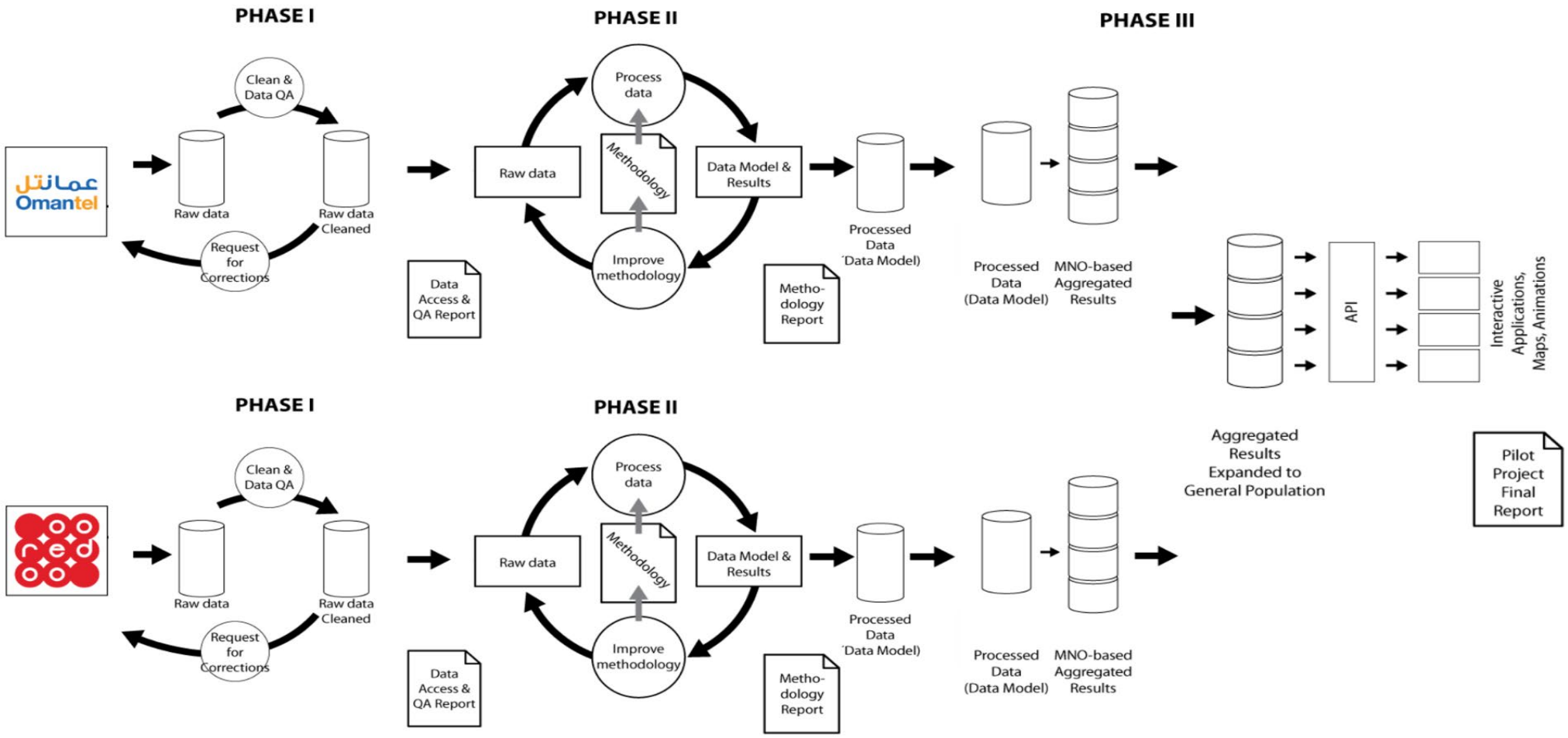

The Statistical Indicators

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As a result of the pilot project, statistics have been generated for country, governorate and wilayat levels (LAU 0, 1, 2, grid) for five domains of statistics for the period of January-June 2020:

Population

Anchor points

- Number of homes
- Number of work-places
- Number of second homes

Temporary population and mobility

De facto population

Commuting

- OD matrices between home-work
- Classification of the visitor (local resident, worker, regular visitor, foreign / domestic tourists, transit)
- Temporal aggregation (day-time, night-time, day)

Tourism

Inbound tourism

Domestic tourism

- Temporal aggregation (day, week, month)
- Spatial aggregation (national, governorates, provinces, grid)
- By country of origin/COR
- By type of stay (overnight, same-day)
- By duration of stay
- By destination type (main, secondary, transit)
- Number of visits
- Number of unique visitors
- Number of arrived/present/departed visitors
- Number of nights spent
- Average duration of visits (in hours)

Project Phases

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Phase I — Initiation and access to the data from MNOs and data quality assurance

Phase II — Development of the methodology for generating statistics from MPD

Phase III — Final processing of the pilot data and presentation of the results

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Phase 1

Initiation and access to the data from MNOs and data quality assurance

Phase 1

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- Consultations with TRA
- Consultations with MNOs
- Validating samples before data extraction
- Preparing the data

Data Requirements

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MPD

- Domestic data
- Inbound roaming data
- Outbound roaming data
- Geographic data (Cell references)
- Socio demographics

Reference Data

- Geographical administrative
- Official grid-network of Oman
- Road network data
- Land cover data
- Building data
- Population census data
- Commuting stats from census
- Population demographics
- Population registry data

- Domestic tourism statistics
- Inbound tourism statistics
- Outbound tourism statistics
- Traffic loop counters
- Commuting and migration data
- POI data
- Mobile Phone data – market share
- Official Country List

Phase 1

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- The objective of this quality analysis report is to assess the quality of the mobile positioning data (MPD) of two Omani Mobile Network Operators (MNO) – OmanTel and Ooredoo for the purposes of OmanPos pilot project.
- Assess feasibility for the generation of such statistics
- Both of them got the data requirement checklist and there were special meetings in order to explain the technicalities of the checklist.
- Quality indicators :
  - Subscriber
  - Time
  - Location
  - Country of origin

Quality Assurance Framework

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	Input	Throughput	Output
Source	Privacy and security		Confidentiality
Metadata	Log files Metadata Consistency …	System independence Quality gates Steady states	Accessibility and clarity Relevance
Data	Consistency Validity …		Coherence Consistency Validity …

Based on: A Suggested Framework for the Quality of Big Data - UNECE

Quality Gate 1 – Raw Data

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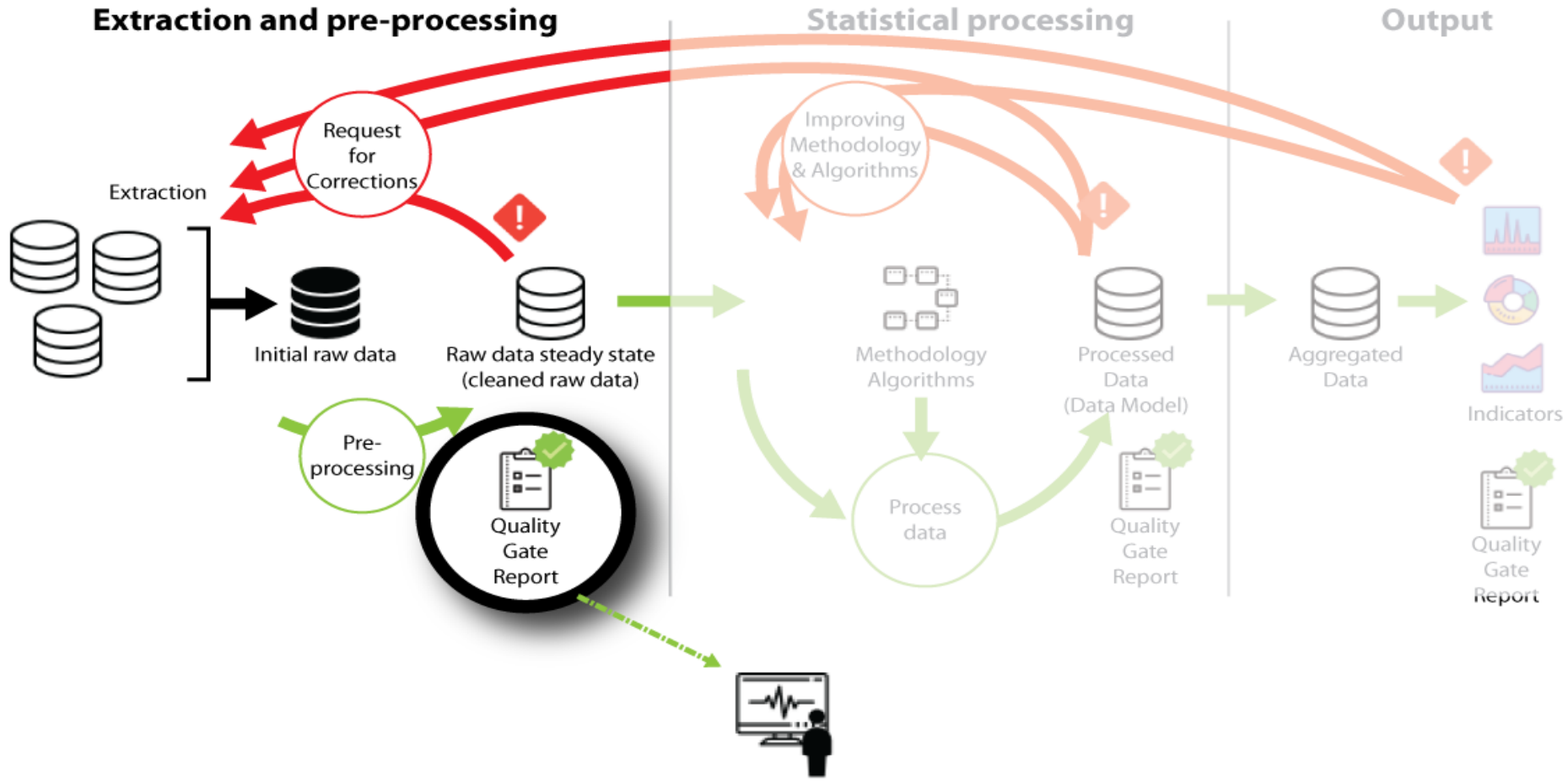

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Raw Data Quality Assurance

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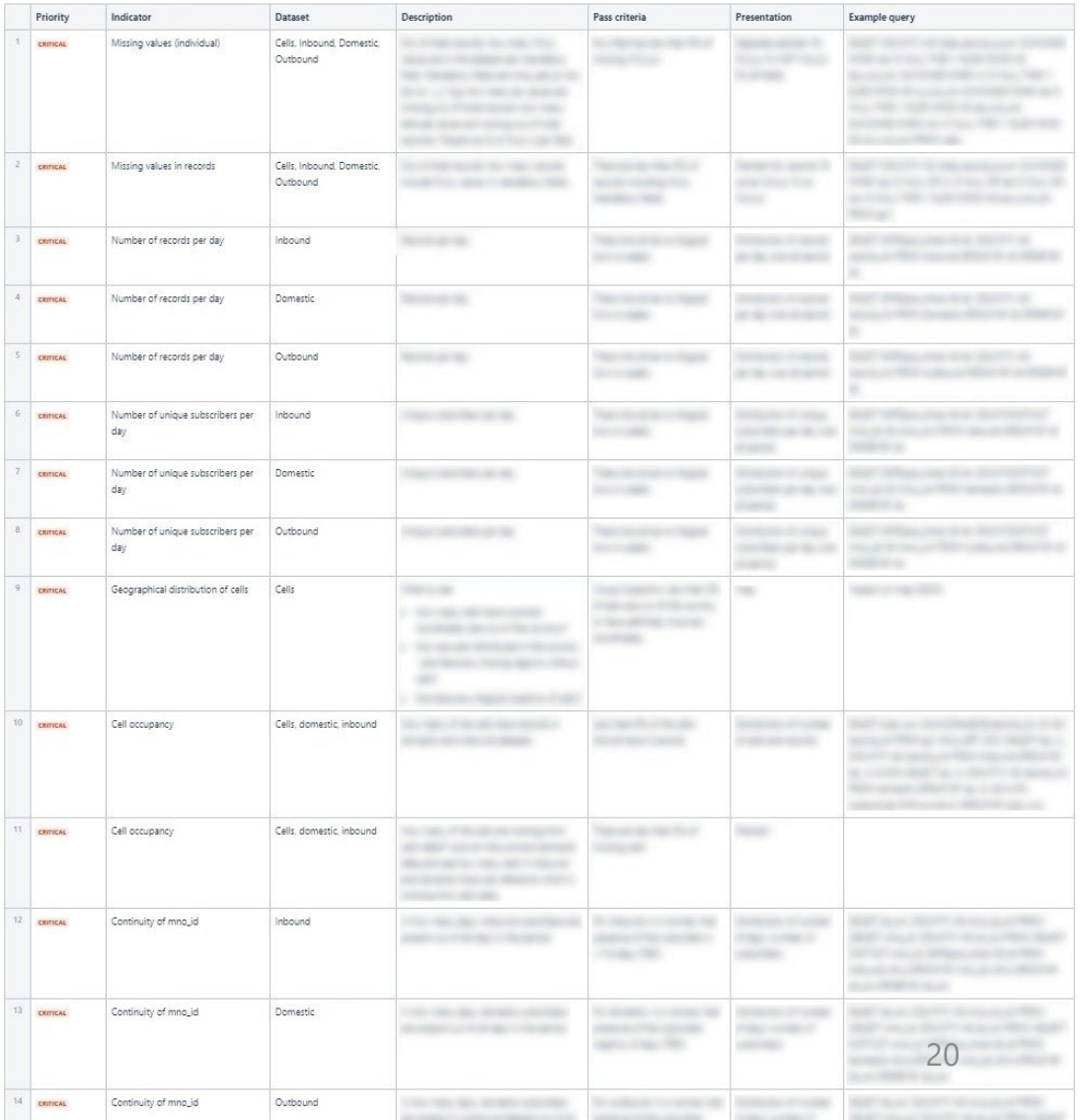
- QA is important: Garbage in – Garbage out (GIGO)
- There are 29 aspects of MPD QA to check before data can be used
- QA indicator categories are:
  - Critical
  - Important
  - Nice to have
- The result of each QA indicator can be:
  - Positive
  - Acceptable with reservations
  - Needs improvements (not acceptable)
- Eurostat QA framework (adjusted to MPD)



	Priority	Indicator	Dataset	Description	Pass criteria	Presentation	Example query
1	CRITICAL	Missing values (individual)	Cells, Inbound, Domestic, Outbound				
2	CRITICAL	Missing values in records	Cells, Inbound, Domestic, Outbound				
3	CRITICAL	Number of records per day	Inbound				
4	CRITICAL	Number of records per day	Domestic				
5	CRITICAL	Number of records per day	Outbound				
6	CRITICAL	Number of unique subscribers per day	Inbound				
7	CRITICAL	Number of unique subscribers per day	Domestic				
8	CRITICAL	Number of unique subscribers per day	Outbound				
9	CRITICAL	Geographical distribution of cells	Cells				
10	CRITICAL	Cell occupancy	Cells, domestic, inbound				
11	CRITICAL	Cell occupancy	Cells, domestic, inbound				
12	CRITICAL	Continuity of mno_id	Inbound				
13	CRITICAL	Continuity of mno_id	Domestic				
14	CRITICAL	Continuity of mno_id	Outbound				

Quality checks

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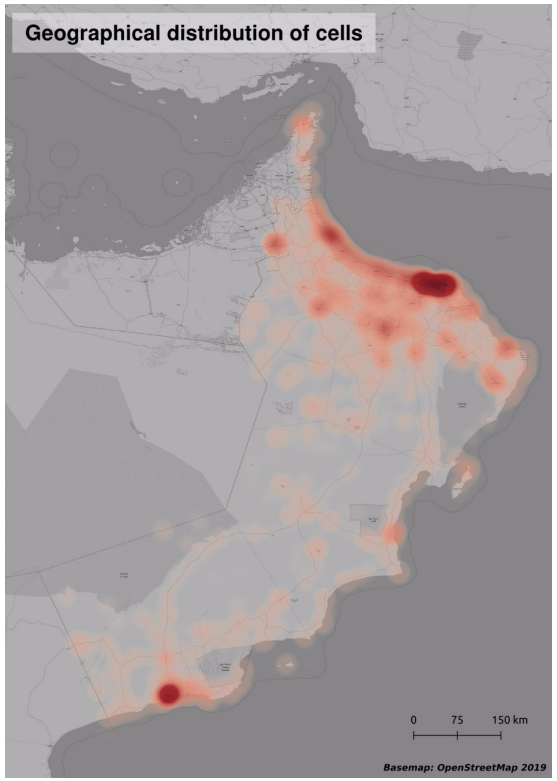
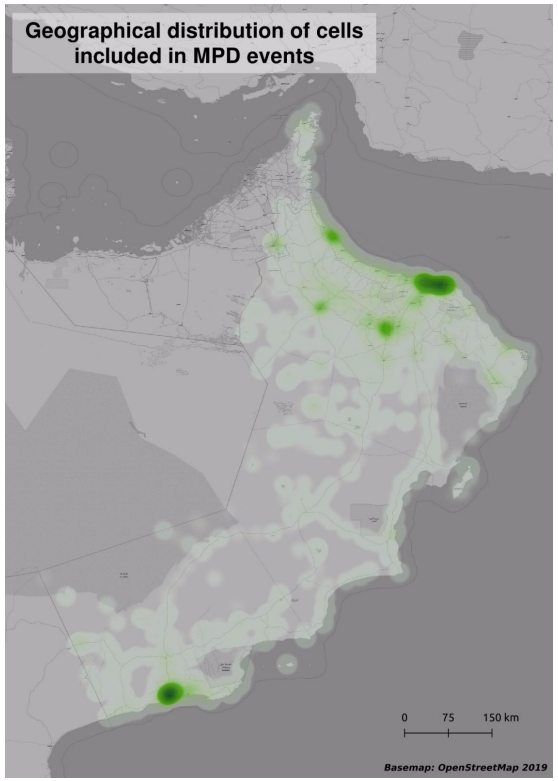
Coverage of all cells MNO provided



Coverage of the cells included in the event data provided by MNO



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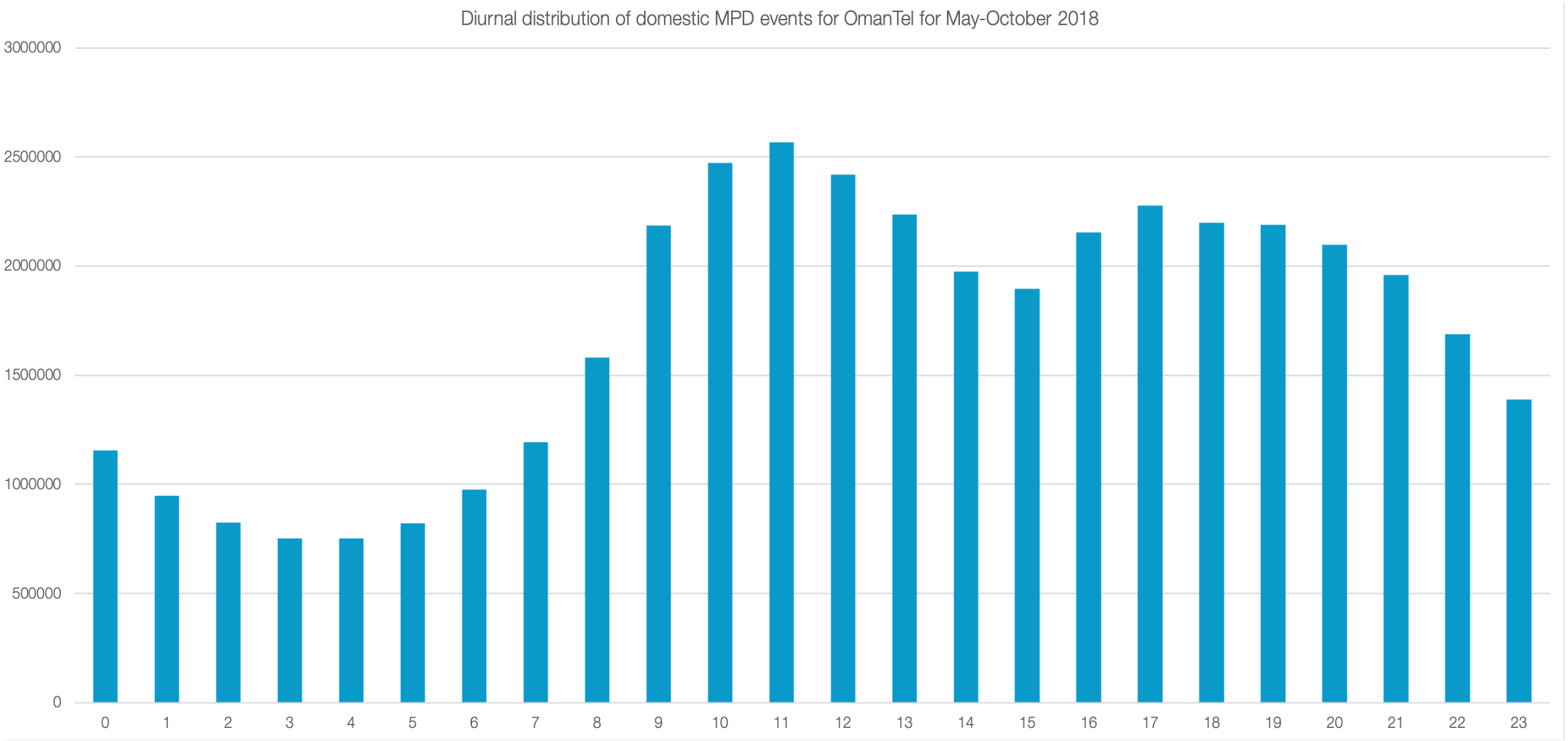

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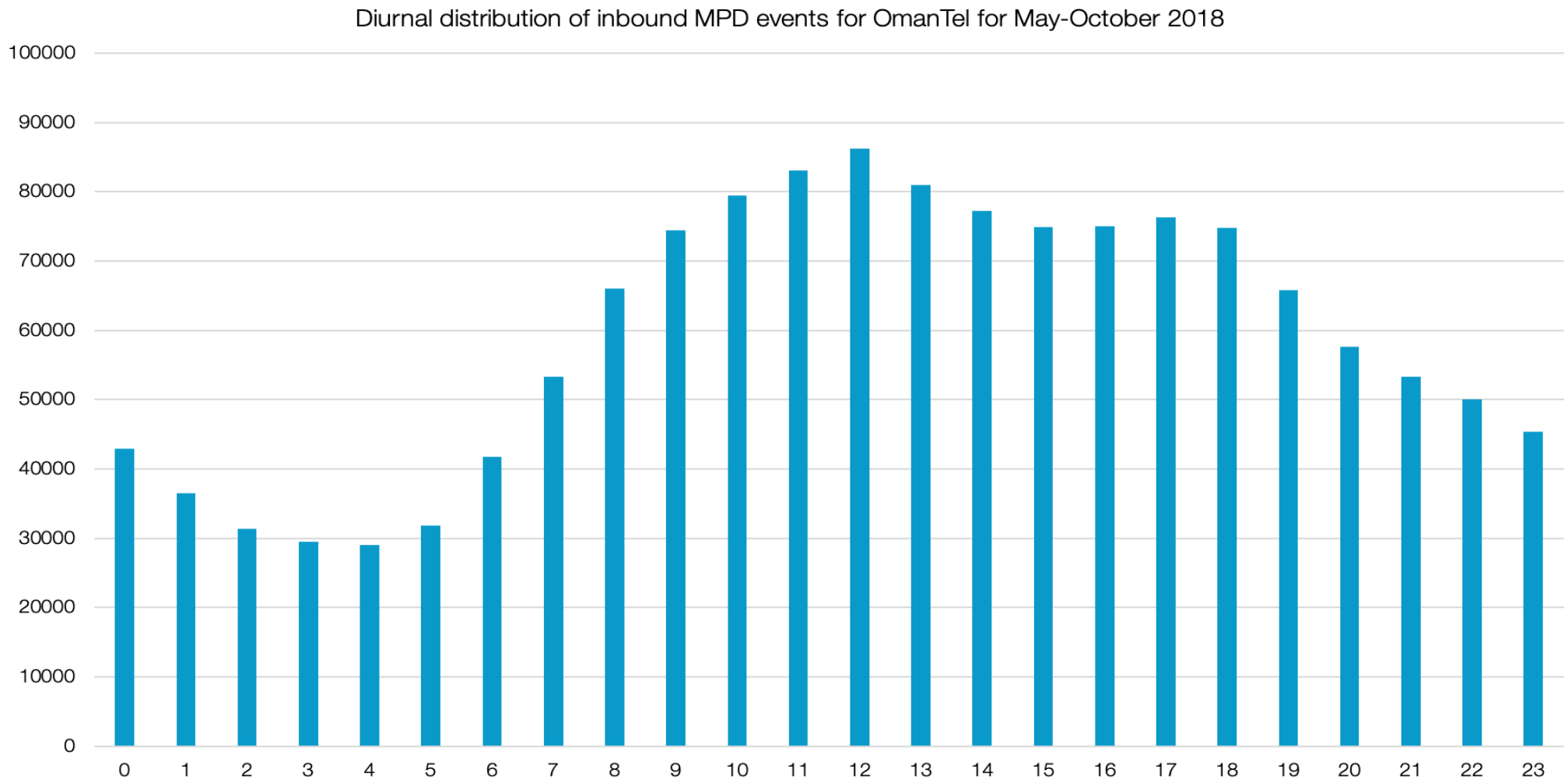

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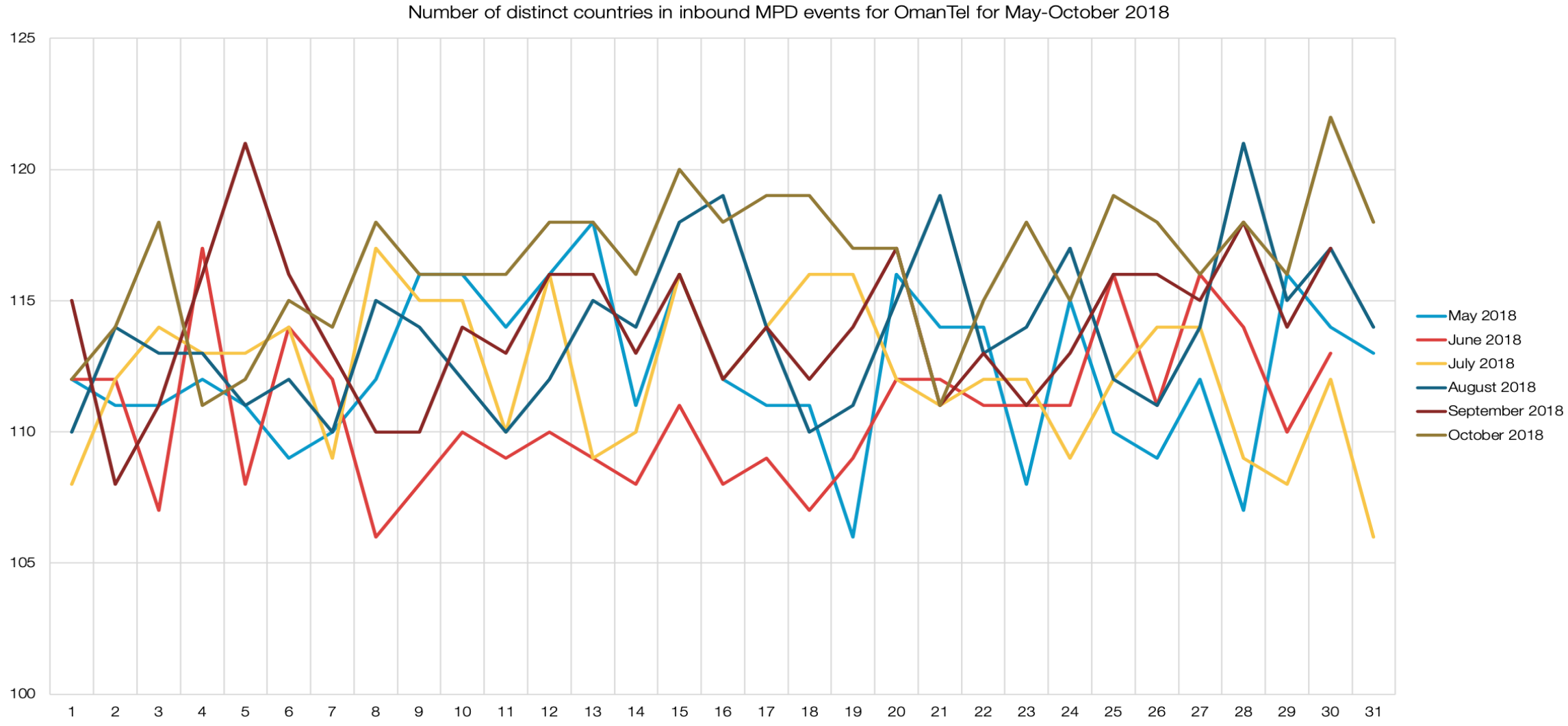

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Phase 2

Development of the methodology for generating statistics from MPD

Methodology of Processing Raw MPD data

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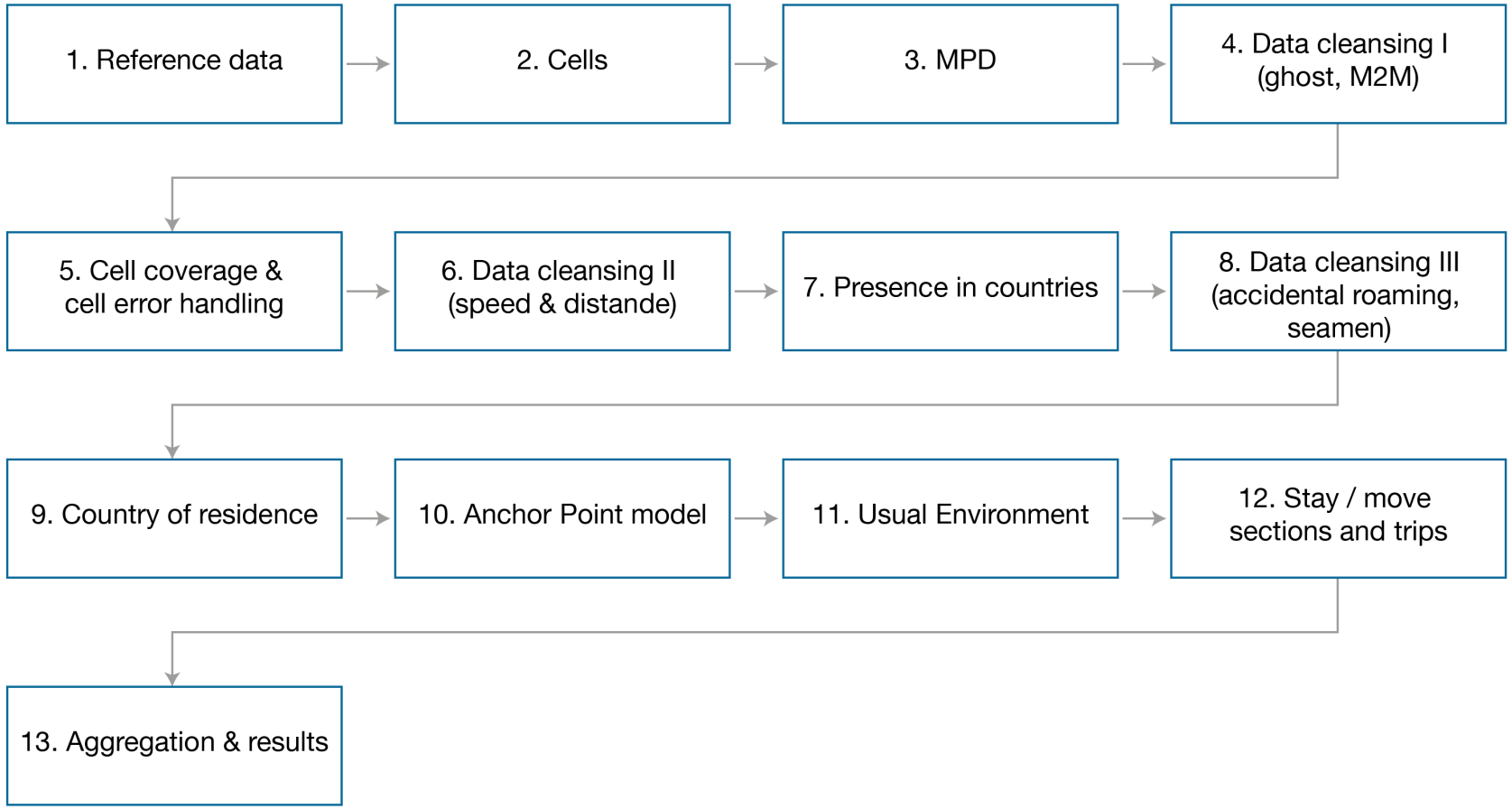

Data Cleansing

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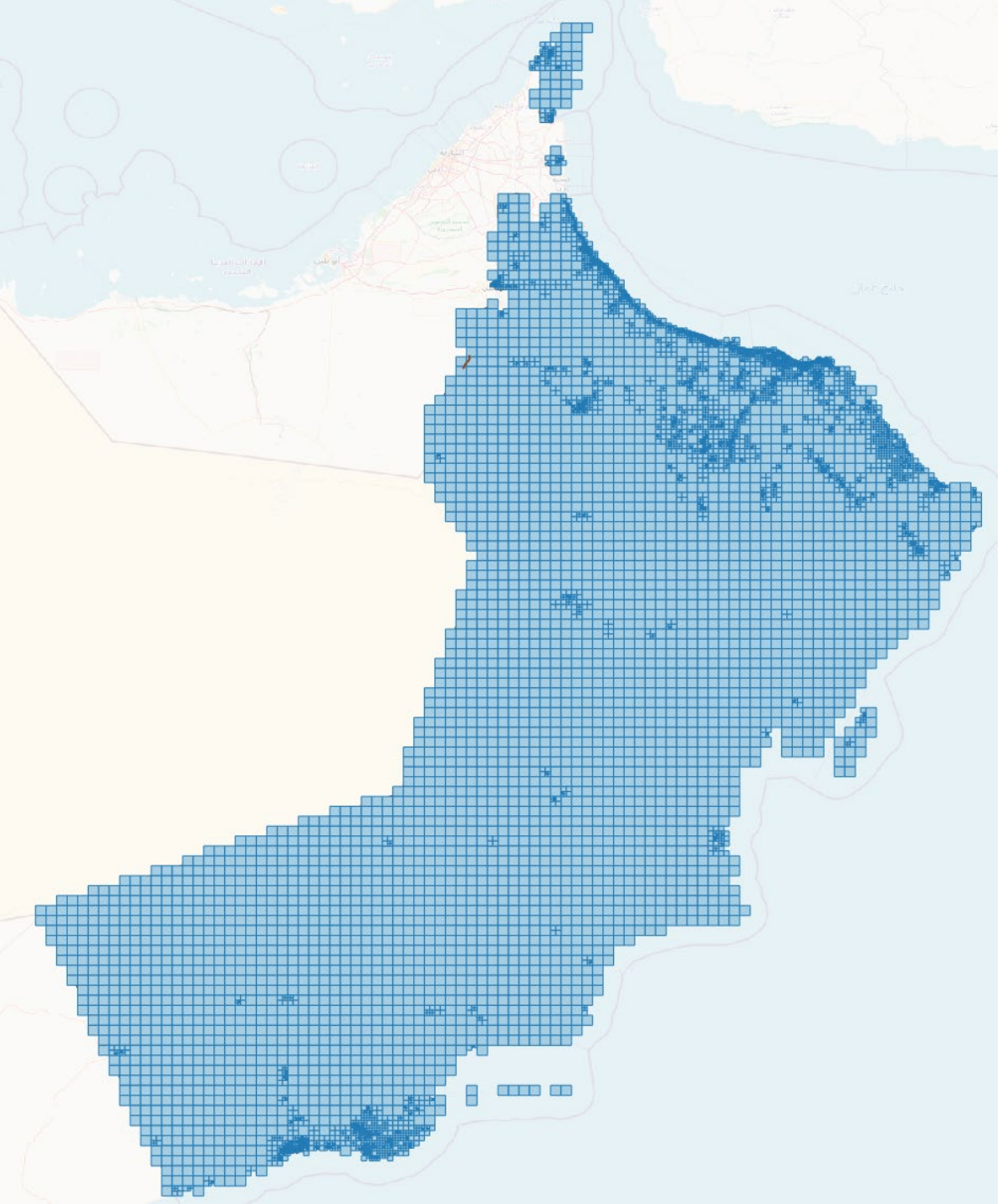
- Machine-to-Machine (M2M) Filter
- Cell cover and cell error prediction
- Speed and Distance Filter
- Presence in Countries
- Accidental Roaming Filter
- Seaman Filter
- Country of Residence



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- Home: place of residence (POR),
- Secondary home anchor point (SHAP);
- Work: work-time anchor point (WTAP),
- Secondary work-time anchor point (sWTAP);
- Other regular anchors: regular anchor point (RAP).

Quality Gate 2 – Modelled Data

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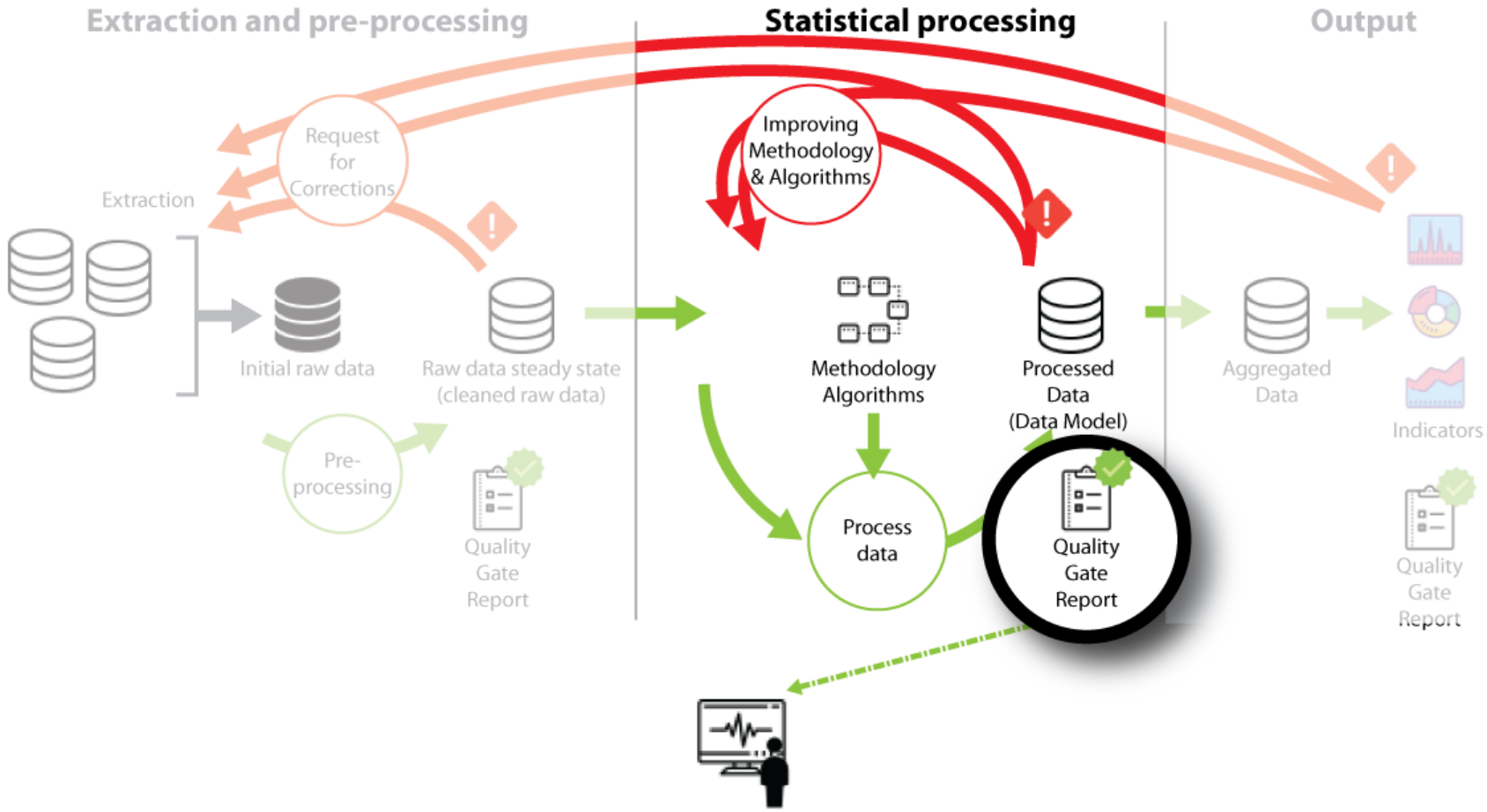

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Phase 3

Final processing of the pilot data and presentation of the results

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Global Network of Data Officers and Statisticians at https://www.yammer.com/unstats/

Big Data Project

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Enhancing Knowledge
SULTANATE OF OMAN

January, 2020

SU	MO	TU	WE	TH	FR	SA
29	30	31	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	1

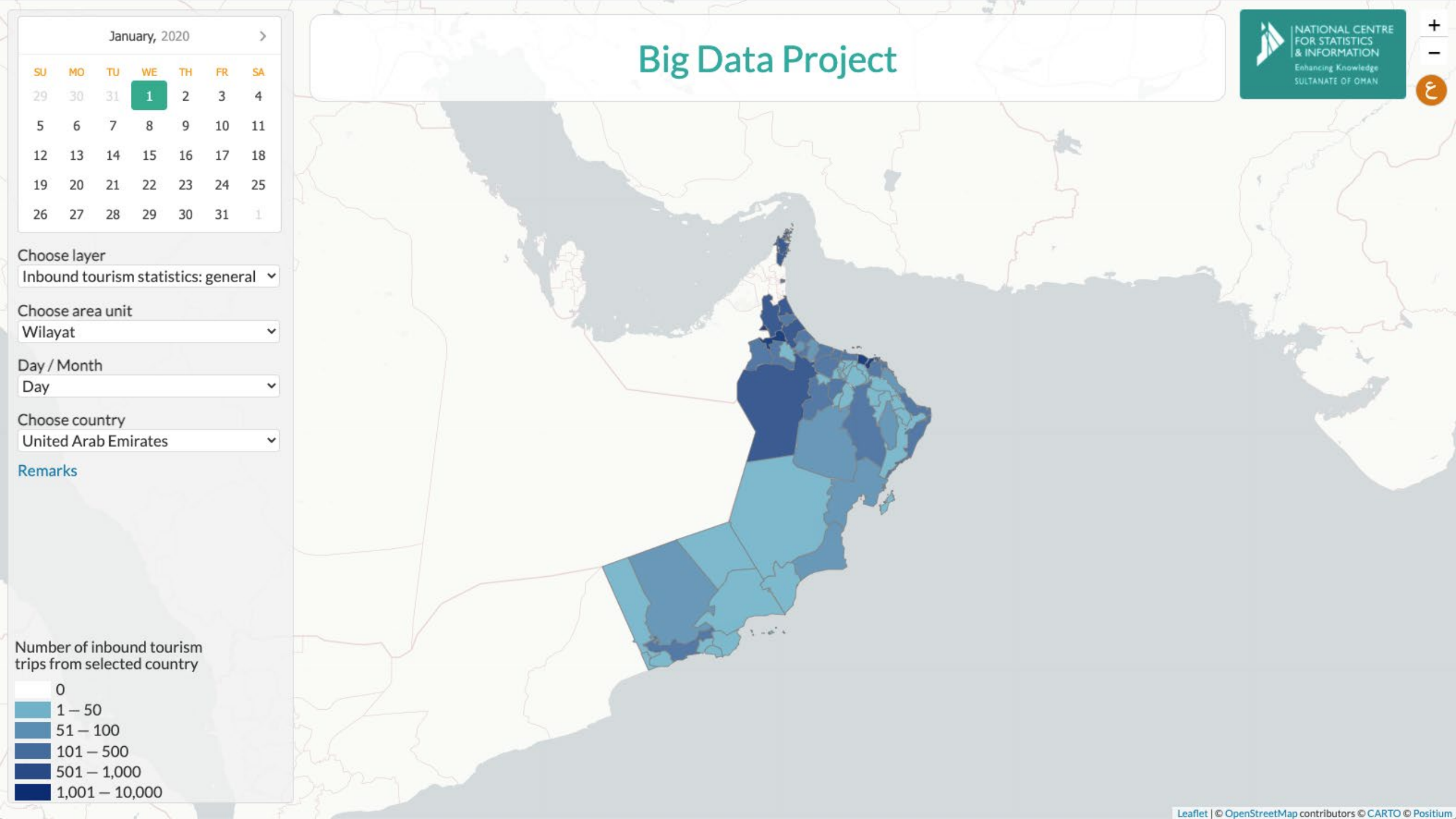
Choose layer
Inbound tourism statistics: general

Choose area unit
Wilayat

Day / Month
Day

Choose country
United Arab Emirates

Remarks



Quality Gate 3 – Output Data

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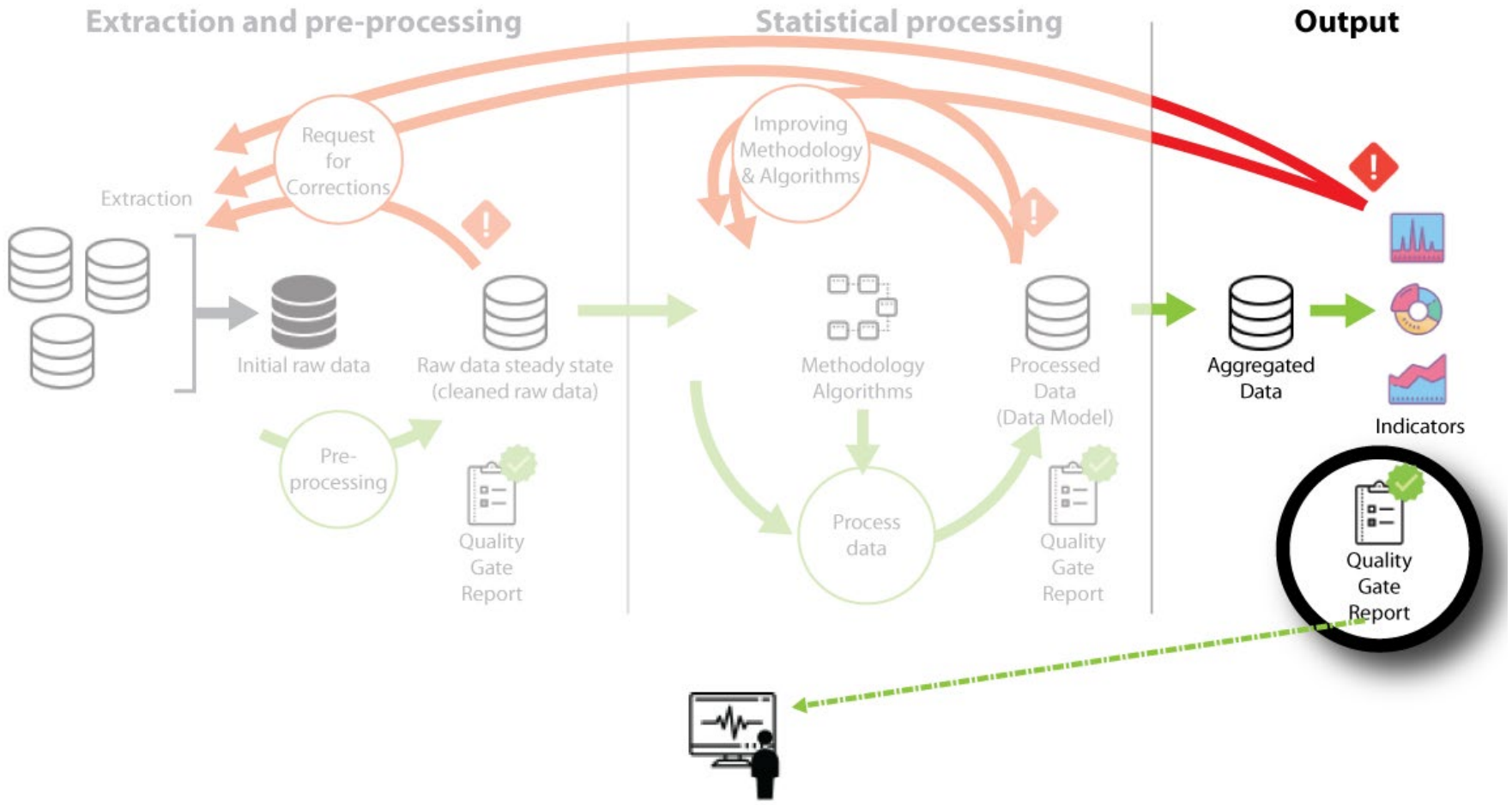


3

Comparison of population numbers from 3 different sources for 3 different governorates

- MPD – Mobile Positioning Data
- Admin – Based on registered address
- eCensus – Omani eCensus result Dec 2020

Muscat:

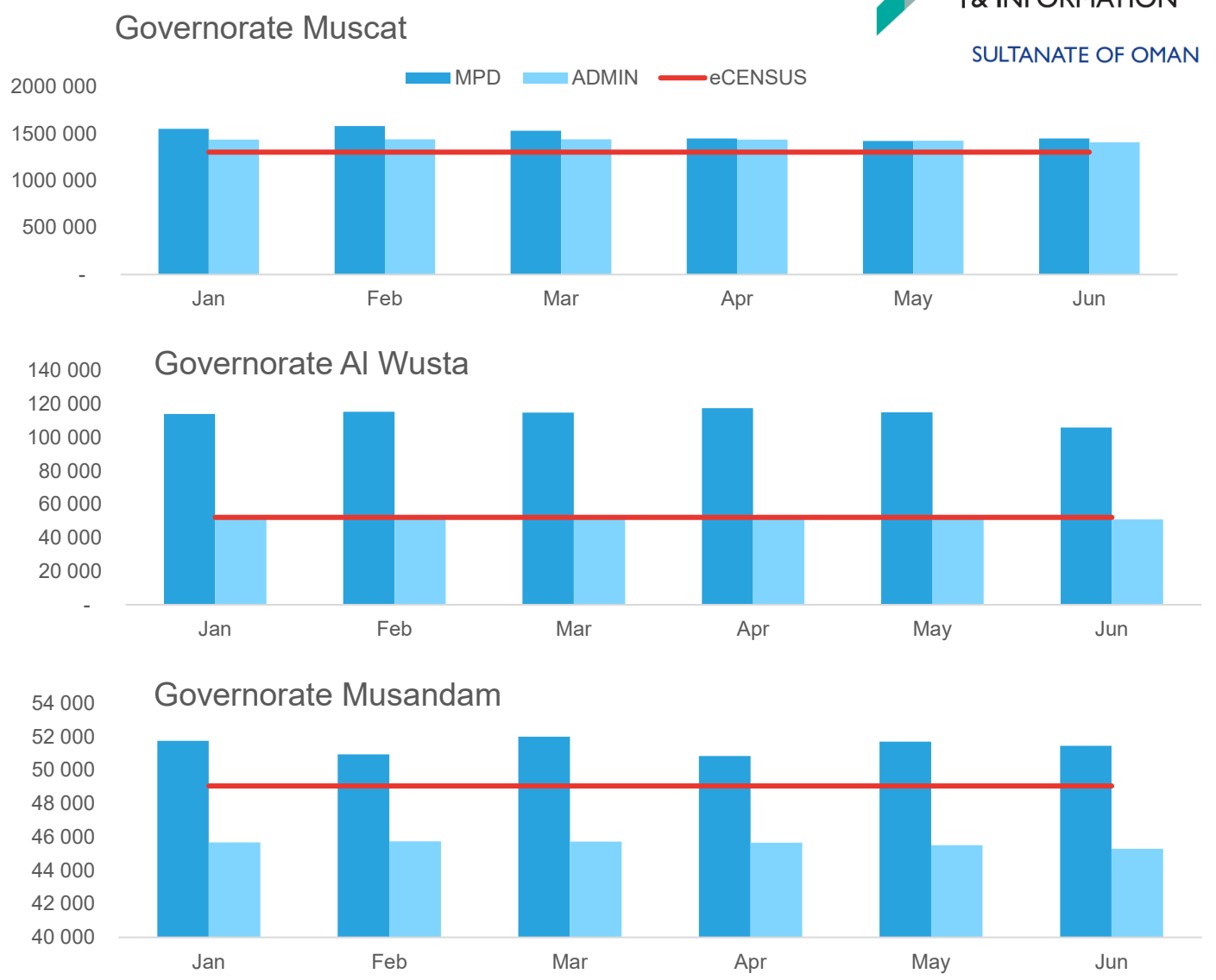
- Drop in April 2020 due to lockdown

Al Wusta:

- Special Economic Zone with many workers without a permanent address

Musandam:

- …



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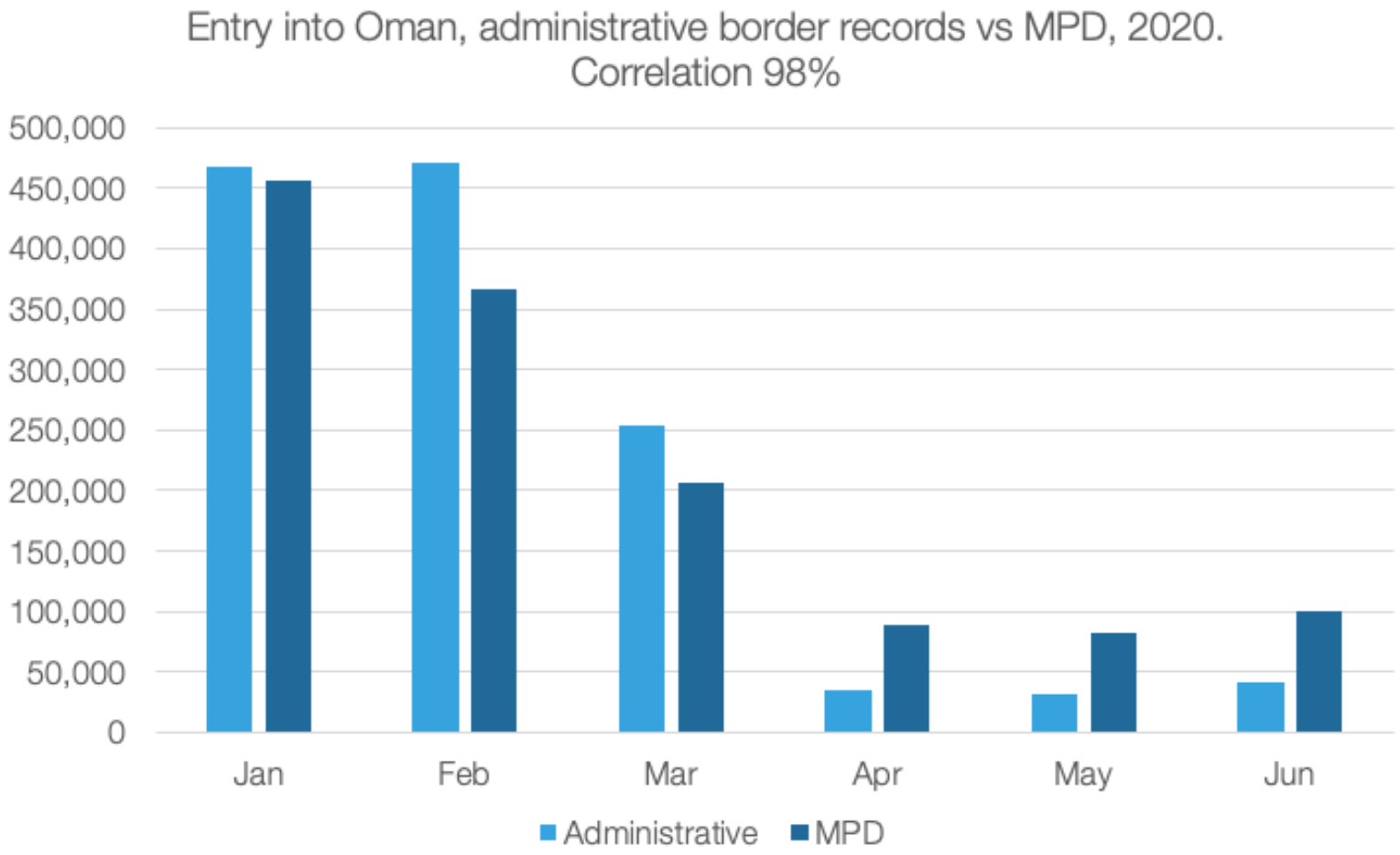

Month	Administrative	MPD	Difference
Jan	467,914	455,657	12,257
Feb	471,150	367,042	104,108
Mar	253,510	205,831	47,679
Apr	34,296	88,793	-54,497
May	31,929	82,243	-50,314
Jun	42,022	100,676	-58,654

Correlation	98%

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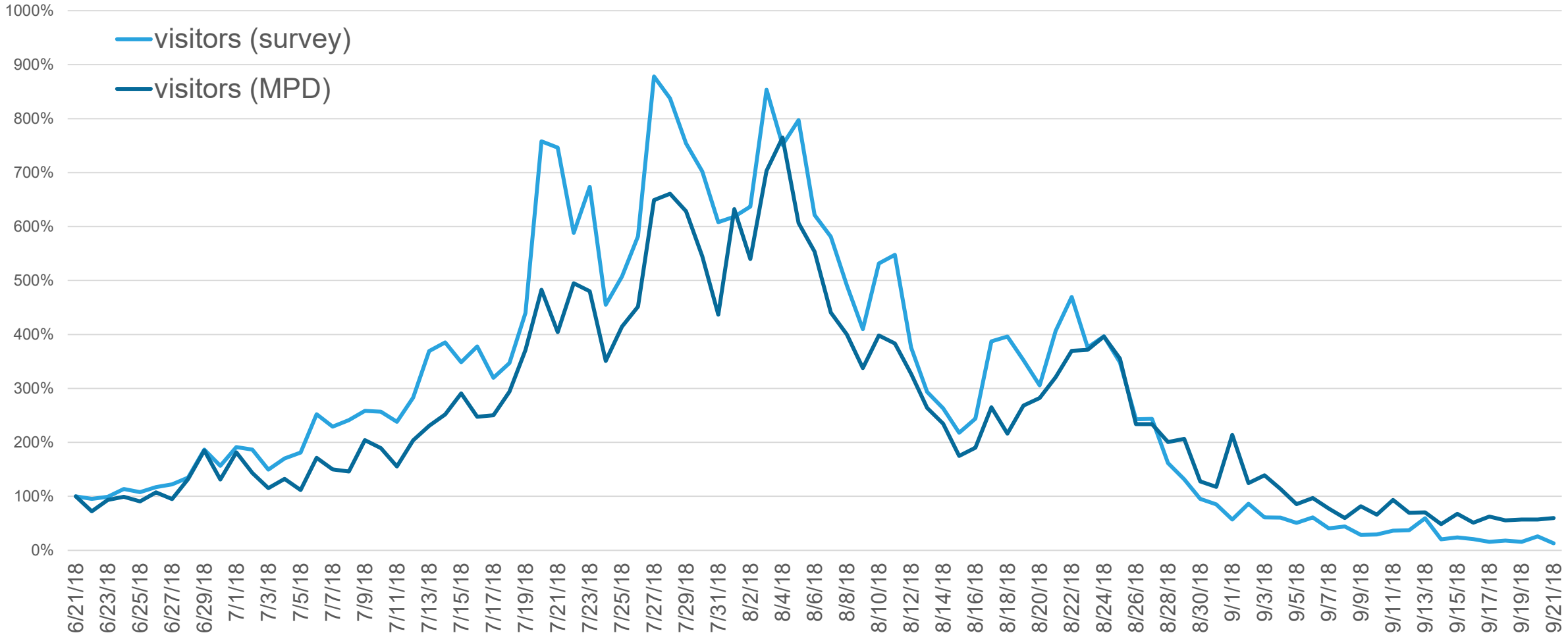
Salalah area visitors comparison (survey and MPD), 21 June 2018 = 100, correlation 96.2%



The Way Forward

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- Training for statisticians
- Training for IT technicians
- Validating the results and adjusting the methodologies
- Adding metadata to the published indicators
- Introduce new domains

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Thank you