Methodology Note

Calculating Postal Development Level (PDL) and the Integrated Index for Postal Development (2IPD)

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I.   Calculating Postal Development Levels (PDL)

A.   Overview

The PDLs **represents a country's stage of postal development**. This classification is derived from the statistical distribution analysis of the Integrated Index for Postal Development (2IPD) scores of all countries.

Leveraging its extensive big data platforms, the UPU has devised a classification system featuring 10 postal development levels as outlined below.

The PDL classification breaks down countries into 10 different categories of postal development. These tiers represent statistically identified clusters of development, as determined through an analysis of the respective 2IPD scores.

Postal development level and economic growth impact	Cohort characteristics from a postal and economic development perspective
10	PDL 10 represents the pinnacle of postal development, comprising top-performing DOs that are most likely to boost their countries' economic growth and social inclusion. Here, we expect that the impact of postal excellence on sustainable economic development and eco-systemic value creation is at its peak.
9	DOs of countries in this group are close to achieving their maximum potential. They positively impact economic development, leveraging their strengths while mitigating the effects of possible remaining weaknesses. Their eco-systemic value proposition could be strengthened.
8	With an additional step towards reaching excellence, DOs of countries at this level typically provide their citizens with a strong value proposition through their postal services portfolio, decisively contributing to higher economic growth. There is potential to achieve greater eco-systemic value creation.
7	DOs of countries at this level have probably achieved new milestones in their postal development journey. They play a prominent role in their respective markets and are likely to do so from a general economic development perspective as well. Eco-systemic value creation should be considered.
6	DOs of countries at PDL 6 are taking steps to accelerate their development. They work intensively on improving performance in critical areas to ensure consistent performance. Their economy will reap the benefits of these investments, achieving higher growth and reducing inequalities.
5	The core requirements for postal success are in play and a brighter postal future seems possible, in turn enabling positive impacts on the country's economic growth and poverty reduction in the coming years, if the current postal development efforts are maintained.
4	DOs of countries in PDLs 4 and 3 are approaching, at different speeds, the conditions that are necessary to better serve their current and potential customers, with PDL 3 signalling some postal difficulties. Their contribution to economic development could become larger if sufficient investments are made.
3	
2	DOs in this group primarily focus on operations and must significantly improve services and business models in order to be better positioned to seize future opportunities. Only then can they begin to contribute to inclusive economic growth and development in their country.
1	PDL 1 country DOs are either just starting out or underachieving in terms of postal development. They urgently need to address critical structural issues for their survival, and quickly update their basic postal infrastructure to aid national development.

Increasing postal maturity and postal development impact on economic growth

PDLs are calculated using the 2IPD scoring method, which quantitatively assesses key postal development components like reliability, reach, relevance and resilience. Ensuring data integrity is crucial; inconsistencies are identified and mitigated to ensure accurate scoring.

B.   Concepts and notations

The 2IPD methodology employs a multifaceted approach to measurement, considering factors such as infrastructure, service reliability, resilience to shocks, and international postal connectivity. Each of these dimensions is potentially crucial for strengthening a country's economy, creating a more comprehensive and nuanced framework for assessing postal services' contribution to economic growth.

Let us denote the 2IPD score for a country as S_{2IPD}. The PDL can be mathematically expressed as a function of S_{2IPD}, such that $PDL = f(S_{2IPD})$.

The exact relationship or mapping between *PDL* and S_{2IPD} is determined through clustering analysis, where countries with similar 2IPD scores are grouped to represent specific stages of postal development.

Let *G* represent the number of groups or classes denoting different postal maturity. The value of *G* is determined by the abovementioned statistical clustering analysis, such that countries with similar attributes are categorized into distinct *G* classes of postal development maturity as shown in the table below.

PDL (G)	1	2	3	4	5	6	7	8	9	10
S_{2IPD}	0.00 – 6.50	6.51 – 16.50	16.51 – 26.50	26.51 – 36.50	36.51 – 46.50	46.51 – 56.50	56.51 – 66.50	66.51 – 76.50	76.51 – 86.50	86.51 – 100

A 2IPD score of 36.5 or higher places countries in categories ranging from PDLs 5 to 10, which are indicative of upper-middle to high levels of postal development. As outlined in the previous table, this means that postal services are highly likely to have a positive impact on overall economic growth.

Conversely, countries with scores below 36.5 fall into PDLs 1 to 4, indicating low to lower-middle performance. Within these levels, PDLs 3, 2, and 1 signal progressively more significant challenges in postal development.

II.   The Integrated Index for Postal Development (2IPD)

The 2IPD offers a standardized method for assessing postal development in individual countries. The primary objective of the 2IPD methodology is **to help assess the postal development level for each country that consistently contributes the required data to the UPU's statistical and big data systems**.

In 2021 and 2022, 172 countries were covered by this 2IPD performance measurement exercise.

It provides a valuable metric for research into the postal sector's contribution to overall economic growth. More particularly, this composite index is especially useful for evaluating how postal services have bolstered countries' economic resilience.

Each new data point added to the UPU's systems enhances our collective understanding of global postal development, particularly benefiting less-developed postal services. The information collected serves as an invaluable asset for advancing the sector worldwide.

The index effectively highlights the key drivers of postal development that are crucial for achieving sustainable economic growth.

Furthermore, the 2IPD's multi-faceted approach is vital for adapting to the differing economic realities between countries. For instance, in developed economies, where digital services may be more prevalent, the postal service's role in facilitating e-commerce might be a significant contributor to economic health. On the other hand, in developing nations, the postal network could serve as a crucial channel for basic communication and financial services, affecting economic well-being at a different but equally important level. The PDL framework allows for this level of differentiated understanding, helping policymakers tailor their strategies accordingly.

Finally, the 2IPD methodology's standardized approach provides a common language for international comparison. In a globalized world, understanding how one country's postal services compare to another's can offer valuable insights into competitive advantages or areas for improvement. This global benchmarking is essential for driving data-based policy decisions aimed at optimizing the postal sector's contribution to economic development.

This framework provides nations with a valuable benchmarking tool, allowing policymakers to set targeted goals for postal development. By doing so, they will increase the likelihood of making a positive impact on their own economic growth and population welfare.

However, limited data availability in some cases is a challenge, warranting caution in interpreting associated 2IPD results. **The completeness of data made available to the UPU and accurate measurement is vital for understanding how postal services contribute to economic growth**. It helps identify areas for improvement, informs policy decisions, and allows for international benchmarking, ultimately driving more effective and inclusive economic development.

A.   The 2IPD scoring system

The 2IPD scoring system itself is built around the four key dimensions of postal development: postal reliability; reach; relevance; and resilience, also referred to as the "four Rs" of postal development, as outlined in the table below.

Each component has a scoring range from 0 to 100, based on relative performance in any given year.

Integrated Index for Postal Development score =	Reliability (R1)	+ Reach (R2)	+ Relevance (R3)	+ Resilience (R4)
	Assesses the development of quality of service from a speed and predictability perspective	Evaluates the level of postal connectivity of the country with the rest of the world from an outbound perspective	Measures the relative success of different postal business models and activities from a demand perspective	Estimates the postal capacity to overcome economic, social, technology and environmental shocks in a sustainable way

These scores serve as indicators for areas requiring improvement or showcasing success, thereby influencing policy decisions that contribute to sustainable economic growth. Countries are grouped with similar-performing peers and then categorized into one of these 10 development tiers based on their 2IPD scores.

After consistency treatments on UPU big data and computing via a number of robust algorithms, a country's final 2IPD score is obtained by aggregating the four R component scores. Equal weight is given to each of the four Rs, and finally scores are normalized with the highest value rescaled to 100 and the lowest to 0.

B.   Concepts and notations

2IPD measures the comparative performance of countries in terms of postal development. As a composite index, the individual final scores are based on several components, called sub-variables. These sub-variables are (conceptually) grouped into four pillars: reach, reliability, relevance and resilience.

Sub-scores are computed for each of these pillars and then consolidated into the final score, which takes a value between 0 and 100.

The scores are constructed sequentially and hierarchically in the following manner:
•   A sub-variable is rescaled between 0 and 100, i.e. the minimum (or the maximum) value;
•   The rescaled sub-variables are weighted and added together in a given sequence;
•   The above-mentioned sum is rescaled again between 0 and 100.

In the description of the 2IPD methodology presented henceforth, a vector notation will be used, with vectors and matrices expressed in bold print. Let a_i be the value of a sub-variable *a* for the country *i*. In order to denote a collection of values of *a* for countries *i = 1…k* the individual values a_i are grouped into a vector: $\boldsymbol{a} = (a_1, …, a_k)^\mathrm{T}$.

The rescaling of the vector **a** is done by multiplying it by a diagonal matrix **S** with typical elements defined as:

$$\boldsymbol{S}[i,i] = 100\,\frac{\min_k \boldsymbol{a} - \boldsymbol{a}[i]}{\min_k \boldsymbol{a} - \max_k \boldsymbol{a}},$$

$$\boldsymbol{S}[i,j] = 0 \; for \; i \neq j \qquad\qquad (1.1)$$

Thus, the vector **Sa** contains the scores for the sub-variable normalized between 0 and 100.

C.   Calculating individual R scores

The 2IPD scoring components and their calculation methodologies are outlined below.

1   Postal reliability (R1)

The reliability score is based on the performance of a given country in terms of speed and predictability of delivery of incoming items, as measured by the tracking events recorded in EMS item events (EMSEVT) EDI messages, collected by the UPU through the Postal Technology Centre (PTC).

Derived from an extensive analysis of track-and-trace data points related to international postal shipments, this score evaluates the speed and consistency of inbound postal deliveries, serving as a reliable proxy for the quality of domestic delivery service and the customer experience.

A relatively high score in this category (above 70) signifies excellent service reliability and also fosters consumer trust. By reducing transaction costs, it aids in the expansion of e-commerce and facilitates the broader digital economy

The underlying assumption for measuring quality of service this way is that performance should not be assessed according to delivery standards, which are more arbitrary and may vary considerably from one country to another. Instead, the assumption is that high performing Posts are those that can deliver mail within an acceptable average time, with a reasonable amount of variability from this average. The total score of the pillar is based on two main sub-variables, speed of delivery and predictability of delivery.

Notations

The following notation applies:

T_{cij} is the time elapsed between scanning of the event HI and event D, in country i, for item j belonging to the category of mail c (c ∈ {"letters", "parcels", "express"})

avT_{ci} is the average time T_{ci} for mail class c and country *i*. In other terms:

$$avT_{ci} = \frac{1}{N_{ci}} \sum_{j=1}^{N_{ci}} T_{cij}, \tag{2.1}$$

    where N_{ci} is the number of valid observations (scanned items) for mail category c in country i

sdT_{ci} is the standard deviation of observations T_{cij} from mean avT_{ci}.

$$sdT_{ci} = \sqrt{\frac{\sum_{j=1}^{N_{ci}}(T_{cij}-avT_{ci})^2}{N_{ci}-1}}, \tag{2.2}$$

    where N_{ci} is the number of valid observations (scanned items) for mail category c in country i.

Sub-variables

There are two main sub-variables that have to be computed. First, the speed of delivery, defined as:

$$rspeed_i =: \frac{1}{N_i} \sum_{c=1}^{N_i} avT_{ci}, \tag{2.3}$$

The speed of delivery, $rspeed_i$, is the average across mail classes of avT_{ci} for country *i*. N_i represents the number of different mail classes (letters, parcels, express) in country *i*.

The second sub-variable is the predictability of delivery, defined as:

$$rpredi_i =: \frac{1}{N_i} \sum_{c=1}^{N_i} sdT_{ci} \tag{2.4}$$

Once again, this is the simple average of sdT_{ci} over valid mail classes for country *i*. Here too, N_i is the number of valid avT_{ci} times for the country *i*.

Calculation of reliability scores

The last step for the reliability pillar consists in applying transformation (1.1) to the two sub-variables and standardizing the average between the two between 0 and 100.

Notice that in the case of both $rspeed_i$ and $predi_i$, the lower the value, the better the performance. Therefore, the standardization needed, using the vector notation, is:

$$\boldsymbol{Srspeed = S(-rspeed)} \tag{2.5}$$
$$\boldsymbol{Srpredi = S(-rpredi)} \tag{2.6}$$

The final reliability scores are obtained by rescaling the sum between the two:

$$\boldsymbol{reliability =: S(Srspeed + Srpredi)} \tag{2.7}$$

This leads to the final reliability scores.[1]

2   Postal reach (R2)

The reach score is based on the degree of (international) connectivity of the postal network. The connectivity is measured by the number of outbound partners and the number of outbound items for each mail segment (letters, parcels and express). The higher the number of partners and the volume expressed in items, the higher the reach score.

Using electronic messages about international postal dispatches, this metric assesses the extent and effectiveness of a country's international postal network in connecting to the rest of the world. A relatively high score (above 50) indicates robust global postal connectivity that is vital for cross-border e-commerce and to support international trade development for micro, small and medium-sized enterprises.

The data needed to compute the reach scores are contained in the pre-advice of dispatch (PREDES) EDI messages gathered by the UPU.

Notation

The notation is as follows:

K is the number of countries for which scores are computed

A is the set of sending (origin) countries.

B is the set of destination countries

$A \times B$ is the set of all possible country-to-country flows

$O_i D$ is the multiset of all country-to-country registrations for the origin country i in the PREDES file. Each country-to-country flow in this multiset belongs to $A \times B$ but some flows may appear many times (it may occur that $|O_i D| > |A \times B|$).

n_{ijdc} is the number of items dispatched from country *i* to country *j* on date *d* for mail class *c* (c ϵ {"letters", "parcels", "express"}).

Sub-variables

Two sub-variables take part in the calculation of the reach score. First, the number of partners is the number of distinct (unique) destination partners for the given origin country *i* (the cardinal number of the support of the multiset $O_i D$), which is defined as:

$$rpartners_i =: |supp\ O_i D|, \tag{3.1}$$

Second, the total number of items, in logarithmic scale, dispatched from country *i* regardless of mail class.

$$rvolume_i =: \ln\left(\sum_c \sum_d \sum_j n_{ijdc}\right) \tag{3.2}$$

Calculation of reach score

The last step consists in applying transformation (1.1) to the two sub-variables and standardizing the average between the two between 0 and 100. In vector notation this leads to:

$$\boldsymbol{reach} = :\boldsymbol{S}(\boldsymbol{S}\ \boldsymbol{rpartner} + \boldsymbol{S}\ \boldsymbol{rvolume}) \tag{3.3}$$

The components of the vector reach are the individual reach scores corresponding to each country.

3   Postal relevance (R3)

The relevance score measures the degree of competitiveness of a given operator in its most important business segment (letters, parcels, financial services) as well as the density of its infrastructure. To this end,

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[1] These final scores are compared with reach scores in order to control for countries with very few observations.

the most important business segment is first identified, then compared with the best performing operator for this segment in the world.

This component amalgamates customer demand data across various postal services – from domestic to international deliveries, and financial services – as well as the density of post offices in a country. It identifies strong and weak points in a country's postal business model, assigning scores accordingly. Strong demand for postal services, including counter services, can facilitate economic transactions in a very wide range of sectors and industries, as typically reflected by relevance scores above 20.

The (rescaled) distance from the best performing operator becomes the first sub-variable. The second sub-variable is the rescaled number of permanent postal offices per capita. Contrary to what is done for the previous pillars, the sub-scores of relevance do not receive the same weight in the final calculation.

The data needed to compute the relevance score is derived from the official UPU Postal Statistics and UN statistics (for population data).

<u>Notation</u>

The following notation is used:

k is the number of countries for which scores are computed for the given year

$vpal_i$ is the percentage of revenue generated by the letter post for the given country i. If not available for the given year, the latest value from the last five years is taken.

$vcol_i$ is the percentage of revenue generated by parcel post and logistics. If not available for the given year, the latest value from the last five years is taken.

$vsfp_i$ is the percentage of revenue generated by the financial postal services. If not available for the given year, the latest value from the last five years is taken.

$palint_i$ is the number of domestic letter-post items in country i.

$palexp_i$ is the number of international exported letter-post items in country i.

$popul_i$ is the population of country i.

$bseden_i$ is the value of permanent post offices (including outsourced ones) in country i

<u>Sub-variables</u>

Before identifying the most important transaction segment it is necessary to define a certain number of variables.

$tpal_i$ is the number of letter post transactions per capita in country i

$$tpal_i =: \frac{palint_i + palexp_i}{popul_i},$$ (4.1)

$tcol_i$ is the number of postal transactions attributed to parcel post, but expressed in "letter post units"

$$tcol_i =: \begin{cases} \frac{vcol_i}{vpal_i} tpal_i, & vpal_i \neq 0 \text{ and available} \\ 0, & \text{otherwise} \end{cases}$$ (4.2)

$tsfp_i$ is the number of postal transactions attributed to postal financial services, expressed in "letter post units".

$$tsfp_i =: \begin{cases} \frac{vsfp_i}{vpal_i} tpal_i, & vpal_i \neq 0 \\ 0 \text{ otherwise} \end{cases}$$ (4.3)

$infra_i$ is the number of permanent post offices per capita in country i.

$$infra_i := \frac{bseden_i}{popul_i},\qquad(4.4)$$

Identification of top-performing segments

The observations $tpal_i, tcol_i, tsfp_i, infra_i$ are stacked up for all countries into vectors **tpal**, **tcol**, **tsfp**, **infra**, which in turn are rescaled according to (1.1).

This yields four vectors: **Stpal**, **Stcol**, **Stsfp**, **Sinfra**. At this point it is necessary to identify, for each country, its most important segment, S$trans_i$, which is defined as:

$$Strans_i =: \max\{Stpal_i, Stcol_i, Stsfp_i\}\qquad(4.5)$$

Calculation of relevance scores

The relevance scores are the following linear combination of **Strans** and **Sinfra**:

$$\mathbf{relevance} =: \mathbf{S}(0.75 * \mathbf{Strans} + 0.25 * \mathbf{Sinfra}).\qquad(4.6)$$

4   Postal resilience (R4)

The resilience score relies on a number of factors, which determine a postal operator's adaptability to economic, social, technological and environmental shocks.

This facet evaluates the postal system's ability to adapt to economic and technological disruptions, while also highlighting its role in advancing a country's social inclusion initiatives. For scores above 60, it underscores the broader societal advantages of sustaining a resilient postal network.

Firstly, a combination of factors such as the mail volumes decline rate, the level of economies of scale achieved by the postal mail delivery network or the degree of diversification in terms of postal revenues measures the level of economic strength of a given postal business model in response to both macroeconomic and technological shocks.

Secondly, the potential for delivering financial inclusion through the postal network constitutes a measure of the level of social resilience provided by postal operators in order to mitigate economic and social inequalities within any given country.

The data needed to compute the resilience score is sourced from the official UPU Postal Statistics, as well as the UPU's Global Panorama on Financial Inclusion.

In most cases, the key variables are transformed into scores which are functions of critical value thresholds.

Notation

Let us denote by:

k	is the number of countries for which scores are computed for the given year.
$vpal_i$	is the proportion of revenue generated by letter post for the given country i.
$vcol_i$	is the proportion of revenue generated by parcel post and logistics.
$vsfp_i$	is the percentage of revenue generated by financial postal services.
$vaut_i$	is the percentage of revenue generated by other services.
$palint_i$	is the number of domestic letter-post items in country i for the given year
$palexp_i$	is the number of international exported letter-post items in country i for the given year
$palint\_prev_i$	is the number of domestic letter-post items in country i three years ago
$palexp\_prev_i$	is the number of international exported letter-post items in country i three years ago
$popul_i$	is the population of country i for the given year

Computation of sub-variables

$vdec_i$ is the ratio of decline of letter-post volumes

$$vdec_i = \frac{palint_i + palexp_i}{palint\_prev_i + palexp\_prev_i},$$ (5.1)

$veco_i$ is the number of letter-post items per capita

$$veco_i = \frac{palint_i + palexp_i}{popul_i}$$ (5.2)

$sdec_i$ is the indicator of letter post decline in country i

$$sdec_i = \frac{1}{1 + e^{-10(vdec_i - 0.9)}},$$ (5.3)

> *This function takes values between 0 and 1. If the ratio of decline of letter post is below the threshold of 0.9 the function rapidly tends to zero. Conversely, above the threshold it rapidly tends to 1.*

$seco_i$ is the indicator of economies of scale for country i (threshold = 15).

$$seco_i = \frac{1}{1 + e^{-(veco_i - 15)}},$$ (5.4)

$seor_i$ is the indicator of concentration on other services than postal business

$$seor_i = \frac{1}{1 + e^{(vaut_i - 33.3)}}$$ (5.5)

> *Above the threshold of 33.3% the function tends rapidly to 0, below the threshold to 1.*

$scon_i$ is the indicator of diversification of services in country i

$$scon_i = \sqrt{(1 - vpal_i)(1 - vcol_i)(1 - vsfp_i)},$$ (5.6)

> *The variables $vpal_i, vcol_i, vsfp_i$ are the relevant proportions of revenue generated by the given service, and here they are represented by values between 0 and 1 and not, as in postal statistics, in percentages. The higher the diversification, the greater the function value. If the arguments are missing the function will get the value of 0.*

$fincl_i$ is the individual score of country i in Postal Financial Potential Success Index as found in the UPU's Global Panorama for Financial Inclusion.

Calculation of resilience scores

First, we compute the variable of economic resilience. To this end, for each country *i* we sum together the four variables computed according to (5.3), (5.4), (5.5), (5.6):

$$ecores_i = sdec_i + seco_i + scon_i + seor_i ,$$ (5.7)

Then, the variables *ecores_i,* and *fincl_i,* are assembled into vectors *ecores, fincl,* which in turn are rescaled according to (1.1). This yields two vectors, *Secores, Sfincl.*

The final resilience scores are computed according to the usual formula:

$$\boldsymbol{resilience} =: \boldsymbol{S(Secores + Sfincl)}.$$ (5.8)

D.   Composite 2IPD score

Once all the scores for the four pillars have been computed, the final 2IPD scores can be obtained. For each country, the sum of the four scores is taken and then rescaled according to (1.1).

$$\boldsymbol{S_{2IPD}} =: \boldsymbol{S(reach + reliability + relevance + resilience)}.$$ (6.1)

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Website
https://www.upu.int/en/Universal-Postal-Union/Activities/Research-Publications/Integrated-Index-for-Postal-Development

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