SPECIAL ISSUE ON FORECASTING GLOBAL MIGRATION

MIGRATION POLICY PRACTICE

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Introduction – Forecasting global migration

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Migration predictions are an indispensable part of any attempt to proactively prepare for future opportunities and challenges, and they feed the heightened interest of decision makers in rendering migration more foreseeable. The policy relevance of forecasts for migration management has been stressed recently in the European Commission's New Pact on Migration and Asylum, which promotes stronger foresight, crisis preparedness and response mechanisms (European Commission, 2020). However, predicting migration trends is an inherently difficult task, and no single approach can capture all relevant aspects of a complex and multidimensional phenomenon such as migration. In fact, most predictive efforts turn out to be wrong.

To shed light on the issue, the 2020 Austrian European Migration Network (EMN)[2] Conference, organized in partnership with the Austrian Ministry of the Interior and IOM's Global Migration Data Analysis Centre (GMDAC), focused on the topic of forecasting global migration.[3] A one-day online conference with prominent academics, policymakers and practitioners provided an overview of existing models, studies and forecasting tools, including their underlying assumptions and key results. Selected conference presenters have agreed to contribute to this special issue on forecasting global migration, and as such, it also serves as the conference outcome document.

The objective of the conference and equally of this special issue is threefold: first, to create awareness of the opportunities and limitations of migration forecasting by presenting key predictive approaches and their usage; second, to contribute to the dialogue on existing and emerging priorities and thus enable the identification of forecasting and policy needs; and lastly, to bridge the gap between scientific forecasting methodologies and policy requirements to facilitate proactive migration management and innovative solutions for policymaking. The conference was conceptualized under two big thematic headings which will also serve as reference frame here.

Addressing uncertainty and the complexity of migration in forecasts and scenarios

The first set of journal contributions addresses uncertainty and the complexity of migration in forecasts and scenarios. They provide an overview of existing migration forecasting models and tools, and analyse potential trade-offs between accuracy, time horizons and policy objectives, discussing innovative approaches and requirements for producing more accurate predictions. Before delving into the depths of the subject matter, Elizabeth Collett in her article entitled "The challenges and value of forecasting" provides us with a brief insight into IOM's prognostic approaches, both as a planning tool for the institution (formalized as IOM's Strategic Vision) and with respect to more concrete forecasting efforts.

In their contribution, "Forecasting migration: A policy guide to common approaches and models", Rhea Ravenna Sohst and Jasper Tjaden provide a comprehensive overview of the main predictive methods, unequivocally concluding that the choice of method depends on the intended policy objective. The four main approaches to anticipate migration as outlined in this paper are: (a) early-warning systems; (b) survey-based forecasts; (c) model-based forecasts; and (d) foresight – listed here in order of their predictive horizon (from short term to long term). The easily accessible descriptions of the different approaches – their data needs, time horizons and the type of migration they can forecast – provide an optimal introduction not only to forecasting per se, but foremost with regard to its policy relevance.

Since migration forecasting is a tool to support decision-making, Sohst and Tjaden rightly pose the question of what we can realistically expect from migration forecasts. They provide a four-part answer: First, there is no universally preferable approach

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2   The EMN is a European Union–wide network providing up-to-date, objective, reliable and comparable information on migration and asylum.

3   Available at www.emn.at/en/national-emn-conference-2020-forecasting-the-future-of-global-migration/.

– the forecasting method needs to match the problem. Second, if certainty is a prerogative, it is preferable to work with short time horizons, as the longer the forecast horizon, the larger its uncertainty. Third, we cannot expect too much of forecasts: they are no crystal ball, no normative judgement, nor do they free policymakers from the burden of having to make difficult decisions. Finally, it is recommended to combine approaches whenever possible as this allows for a cross-validation of results and a diminution of uncertainty.

This leads us to the next contribution in this issue – namely, "Black swans and grey rhinos: Migration policy under uncertainty" by Jakub Bijak and Mathias Czaika, in which the authors creatively reflect on the two most challenging aspects of predicting: complexity and uncertainty. Despite their apparent inherence in migration processes, bringing awareness to both issues could lead to better policy responses. Bijak and Czaika point out that what is often perceived as a "migration crisis" is in fact a migration governance crisis. Relying on metaphors, they outline how black swans (low-probability, high-impact and aleatory events) are linked to prediction failures, while grey rhinos (high impact, more predictable but hiding in sight) are linked to the failure to act on predictions. While creating no illusion that uncertainty or complexity can be easily overcome, they convincingly conclude that the real solution lies in smart governance, which means being prepared to be unprepared for both foreseeable and unforeseeable migration situations.

A concrete contribution to better preparedness is provided by the following three articles which use scenario-building, expert opinions, machine learning, as well as early warning and preparedness to predict migration flows. In their article – "Expert opinion on future immigration to the European Union by 2030: Relevant, realistic and reliable?" – Acostamadiedo et al. report the findings of a European Union–funded study in which the authors combine scenarios with expert surveys to provide estimates of future immigration flows to the European Union. By synthesizing four immigration scenarios based on unilateralism versus multilateralism and economic convergence versus divergence, the authors interview 178 migration experts (using a Delphi survey) for their assessment of the implications and likelihood of each scenario. They find that experts expect immigration to increase, particularly for highly skilled labour and total labour migration, while forced and irregular migration is projected to remain at a 2009–2018 annual average. Migration levels as experienced in 2015–2016 are considered an outlier by experts. While presenting these general patterns, the authors also advise that expert opinions should be taken with caution and used to enrich the debate and facilitate long-term strategic thinking, rather than taken as a clear indication of the number of migrants that will be coming to Europe.

Forecasting methods have also made their way to the humanitarian world, as outlined in the contribution of Alexander Kjærum from the Danish Refugee Council (DRC) in his article, "Foresight: Using machine learning to forecast and understand forced displacement". Together with IBM, the DRC created the Mixed Migration foresight platform[4] to inform strategic planning and scenario-building for the prediction of forced displacement from a given country one to three years into the future. The platform is built on open-source data and has been tested for Afghanistan and Myanmar, with preliminary forecasts conducted in several West African countries. While the margin of error is considered relatively low for these countries, the author cautions that there are still a number of limitations in the model as it builds on historical patterns, thus limiting the capacity to predict black swan events. Kjærum outlines five important lessons when using predictive analytics in the humanitarian realm and concludes with a clear message: using predictive analytics to inform humanitarian action should be based on humanitarian ethics and aim to protect people rather than borders.

In "Forecasting asylum-related migration to the European Union, and bridging the gap between evidence and policy", Albertinelli et al. present the advances of the European Asylum Support Office (EASO) which launched its Early warning and Preparedness System (EPS) in 2012 for information exchange on asylum applications. The system has advanced since using three tiers of data to forecast asylum-related migration flows to the European Union: in countries of origin, at the border, and in the European Union plus Norway and Switzerland. The second part of the article highlights the value of evidence-informed policymaking and policy-informed evidence. The importance of creating a favourable political culture towards evidence and the willingness of policymakers to listen leads us to the second thematic focus.

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4   Available at www.mixedmigration.org/wp-content/uploads/2018/07/MM4Sight_1pager.pdf.

Bridging the gap between forecasting and policy needs

The second set of contributions offers insights and possibilities regarding how to bridge the gap between forecasting methodologies and policy needs. They present practical examples of recent predictive methods that inform policymaking at the national as well as European Union levels, along with discussions on how forecasting results can be responsibly merged with proactive migration policies.

In their contribution, "How economic development shapes migration: Facing the emigration life cycle", Michael Clemens and Cassandra Zimmer shed light on the predictive mechanisms of long-term migration flows by looking at the impacts of development on migration. Analysing historical income data, they debunk the idea that development assistance can be directed towards deterring migration. Instead, they present evidence that the richest people are about three times more likely to be preparing for emigration than the poorest. It is neither the poorest people nor the poorest countries which demonstrate the highest number of migrants. As people and countries get richer, the propensity to live abroad increases – a phenomenon also known as the emigration life cycle. Clemens and Zimmer argue that development assistance can shape migration flows from irregular to mutually beneficial regular channels.

Tobias Molander and Manfred Kohler of the Austrian Ministry of the Interior present the Austrian perspective in "Forecasting migration: The way forward for national and European policymaking". Speaking of migration foreign policy, Molander and Kohler describe migration and asylum policymaking as "the art of the possible". With the objective of detecting and forecasting mixed migration flows as early as possible, they underline their commitment to support academia in its efforts to establish functioning and effective predictive tools.

Finally, we close this issue with a look at the New Pact on Migration and Asylum adopted on 23 September 2020, in Zsuzsanna Felkai Janssen's contribution, "Migration monitoring and preparedness at the European Union level: The need for multi-stakeholder cooperation". With the aim of reducing the risk of being caught unprepared and mitigating the inconsistencies and gaps that emerged in 2015, the new Migration Preparedness and Crisis Blueprint issued as part of the new pact revolves around two

core objectives: monitoring and preparedness, and crisis management. Complementarily, the European Commission is conducting a study to assess the feasibility of using artificial intelligence (AI) as a forecasting and early-warning tool for migration, with results to be published in November 2020. Preliminary findings indicate that the most significant output of this tool would be to provide more accurate predictions on the number of irregular arrivals at the European Union external borders, complicated by a lack of collaboration among European Union actors on data sharing and access, data quality gaps and reporting time frames.

The Austrian EMN conference offered an incredible opportunity to bring together an array of leading academics, policymakers and practitioners to exchange knowledge on forecasting global migration. The conference and this special issue contribute to bridging the gap between policy and research, between protecting external borders and humanitarian concerns, and between national and European perspectives. They shed light on the advantages and limitations of predictive methods, give advice on how to deal with uncertainty, and provide a perspective on how development aid can shape migration. Backgrounds, approaches, arguments and views may differ, but all came together in diversity to advance one objective: to facilitate safe, orderly and regular migration. ∎

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The challenges and value of forecasting

Elizabeth Collett[1]

The challenges of forecasting on an issue as complex as migration have been brought to the fore by the pandemic that we are experiencing in 2020. But this pandemic has not made forecasting defunct. It has merely allowed us to be more circumspect and thoughtful in how we apply it in our work, while avoiding too much hubris. It has also brought home the importance of constantly assessing, and adjusting, the relevance of particular drivers – as well as the interconnections between those drivers – in order to understand what the next years may bring.

Some commentators have lamented that government efforts to predict the future turn out to be wrong. This may be dangerous if policies are then designed according to a set of internalized and fixed assumptions based on poor projections, but the broader investment in horizon-scanning brings useful skills to policymakers frequently confined to the problems of the moment. More generally, the inherent uncertainty in forecasting means that the process, rather than the outcome, might be more useful for those involved.

IOM has engaged in numerous forecasting efforts in recent years, including the recent joint publication by the Organization's Global Migration Data Analysis Centre (GMDAC) and the Netherlands Interdisciplinary Demographic Institute (NIDI).[2] Some of those efforts have taken a broad approach, considering the implications of a broader range of factors such as political instability, economic turmoil or social unrest for migration (FES et al., 2017). Other analyses are more narrowly focused, bringing together the state of knowledge on a specific issue such as climate change. Much of this work is designed for external consumption, to inform policymakers and the public about issues that affect migration and people on the move.

In recent years, IOM has also invested in foresight in order to develop internal strategic thinking. In October 2018, IOM's incoming Director General proposed the development of a five-year Strategic Vision, setting out a number of areas of priority investment and institutional development based on an assessment of how the world will change over the next decade. The initiative was, in part, a recognition that IOM has grown and transformed over the past decade – including its joining the United Nations family – and that there is a need for a stronger strategic direction. It was also based on the realization that where, and how deeply, IOM chooses to invest over the next five years will impact how well the international community as a whole will be prepared to respond to fast-evolving migration needs. To do this, we needed to understand where IOM had come from and where it hoped to go in the future. We also needed to understand how the landscape of migration might change over the next decade and what implications that might have for IOM's work.

Fortunately, IOM has thousands of migration experts around the world, engaged in different aspects of the Organization's work from different perspectives: some are looking at a specific issue in an operational context, while others are looking at regional and political changes. When brought together, IOM's composite of expertise is indeed difficult to find elsewhere.

Within a span of two months, we asked IOM experts at all levels of the Organization to offer their assessment of how their region or programming area would change over the next decade (which factors would be most important) and what implications this might have on their area of work. At the same time, we convened IOM's Migration Research Leaders' Syndicate – made up of some of the world's leading academics and thinkers – to obtain a complementary external perspective. From this, we drew some broad thoughts about the future and what it might mean for IOM. This activity did not attempt to make predictions, but rather offer a smudged outline of the decade to come. The topics addressed included concerns about the impact of climate change, the changing world of work, the use of technology, and the increasing tension between sending, transit and destination countries.

From the above, we drew some strategic priorities: (a) the need to build resilience into our policy and programming, to help migrants (and would-be migrants) prepare for the future; (b) the need to build agility into our policies for mobility, applying innovative practice that can adapt to fast-paced change; and (c) the need to focus on a wider range of partnerships – beyond the United Nations system and Member States, to include local authorities, regional integration structures and the private sector – and draw on a broader base of data and evidence (gathered within as well as outside IOM), to inform our work.

Of course, the best-laid plans of mice and men often go awry. Weeks after the finalization of the Strategic Vision, the first impacts of the pandemic were felt, gradually leading to an unprecedented slowdown in global mobility, with border closures worldwide. However, this is not as disheartening as it sounds. The conclusions we drew from the internal forecasting discussion still broadly hold, but they can be viewed, and reviewed, through the additional lens of a global health crisis. More importantly, the tools and competences that we used to develop IOM's overall vision are now being used again to assess how the pandemic might shape migration.

Our immediate concerns today have been drastically changed: we are concerned for the 2.75 million stranded migrants that are in need of support and assistance due to the pandemic; we are assessing with renewed vigour the need to health-proof our systems for mobility, to ensure that the movement of people can be facilitated safely; and we are working to ensure migrants are fully included in pandemic response, from global vaccination programmes to economic safety nets. Some of our long-term ambitions are being recalibrated: the likelihood that the world will achieve the Sustainable Development Goals by 2030 in the face of global recession, mass unemployment and millions falling into extreme poverty is becoming ever slimmer.

But many of our overarching concerns – the impact of climate change and environmental degradation, the importance of legal identity, and the need to redouble efforts to reduce the vulnerabilities of those caught up in trafficking in persons – remain. Indeed, the objectives of the Global Compact for Safe, Orderly and Regular Migration have all remained as relevant in the pandemic as they were during negotiation in 2018, and some even more so. Access to health care

and other services, the need for consular protection and visa support, and the need to reduce the use of detention – the successful implementation of these objectives is all the more important in light of the COVID-19 pandemic.

Thus, continued investment in forecasting and scenario development is so important: exact predictions are impossible, and further, dependence on rigid modelling can lead us to ignore growing trends that fall outside the models. Instead, the value of forecasting is in the skills that it strengthens. Analysing the role that different drivers might play in a situation is invaluable, keeping all of those working in the field of migration – from academics to policymakers and practitioners – attuned to the possibilities and uncertainties of the future.

Few things, if any, are as smug as a fixed assumption. Thus, it is incumbent upon us all to remain alert to a range of future scenarios and new, emergent sources of illuminating data, in order to develop a composite, shifting image of the future that can quickly adapt to reality. ■

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Forecasting migration: A policy guide to common approaches and models

Rhea Ravenna Sohst and Jasper Tjaden[1]

There is growing interest among policymakers in the European Union and beyond to better prepare for future migration. Migration forecasts could help Member States move away from reactive, ad hoc responses to ones based on preparedness and anticipation. Public opinion could be managed proactively. Resources of national and European Union agencies could be allocated more efficiently. Yet to reap the benefits of migration forecasts, policymakers need to know what different approaches can – and cannot – technically do.

Figure 1. Interest in migration forecasts and scenarios is growing
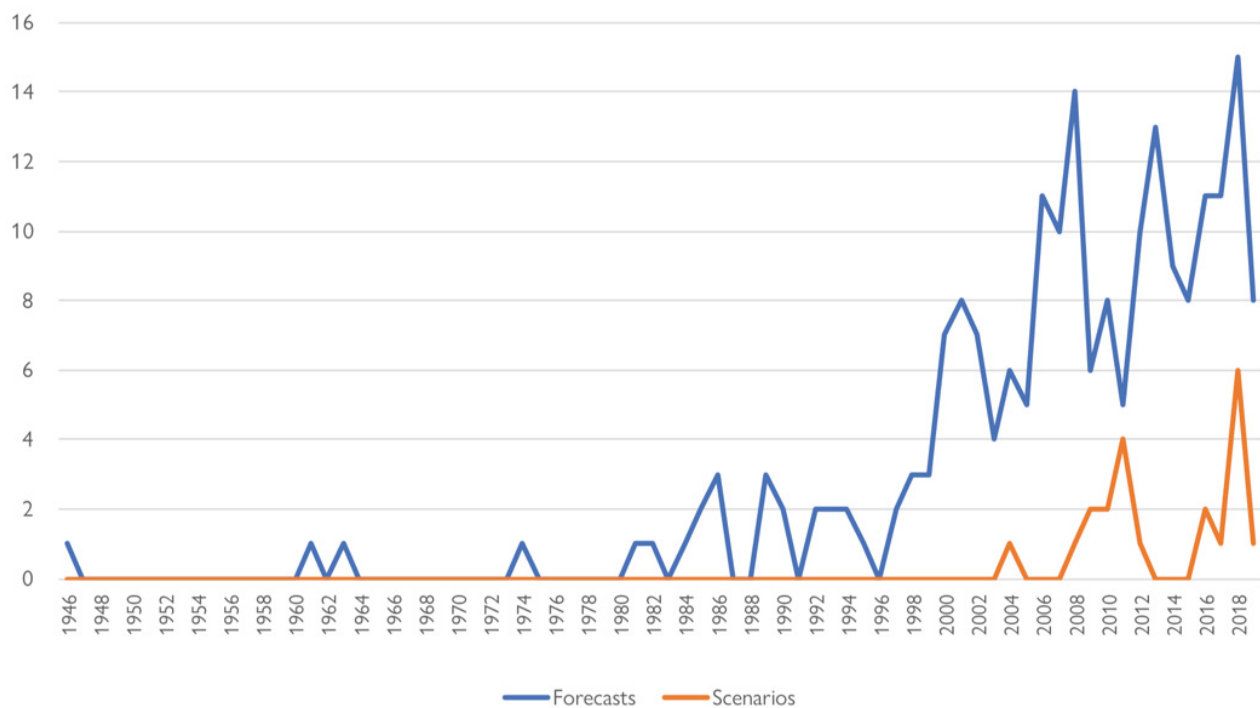
Source: IOM and NIDI, 2020a.
Note: The y-axis represents the number of studies published in a year. Note that the search was completed in August 2019, so the figure for 2019 does not represent the entire calendar year.

Along with the growing number of publications, methods to anticipate migration have multiplied too. In fact, what is commonly referred to as "forecast" now comprises a group of diverse approaches.

Four groups can be distinguished: (a) early-warning systems; (b) model-based forecasts; (c) survey-based forecasts; and (c) foresight. All four are used to anticipate future migration yet differ fundamentally in how they work. In this short article, we present the most common approaches to anticipating migration. Note that the term "forecast" is used colloquially in this paper to refer to all four approaches. The focus is on potential policy uptake, allowing the reader to weigh and compare available options.

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How to select the "best" approach

In the context of policy, migration forecasting is, above all, a tool to support decision-making, not an end in itself. Individuals and organizations interested in using forecasts in their work must therefore first gain a clear understanding of the purpose of forecasting – how it would be used in practice and which tasks it is going to support – rather than start by thinking about potential methods. The following are guide questions that can help determine which approach is most useful:

- How far into the future are migration trends to be foreseen?
- Which types of migration need to be forecasted?
- Who is in charge of reviewing and implementing the recommendations that come from the forecast?
- Who is going to use the forecast results?
- Which tasks are going to benefit from the forecast?
- How certain does the forecast need to be?
- Is the forecast embedded in a wider policy framework?

Approaches differ in the type of migration they can forecast, the data they require and the way they communicate uncertainty. Yet among their most decisive features are their predictive horizons. Broadly speaking, early-warning systems offer the shortest time horizons (up to one year), model- and survey-based forecasts offer medium-term horizons (years to decades), and foresight offers the longest horizons (up to several decades). In the remaining sections of this article, we will present each of the approaches in more detail, using the questions above to guide the descriptions.

Figure 2. The four main approaches to anticipating migration
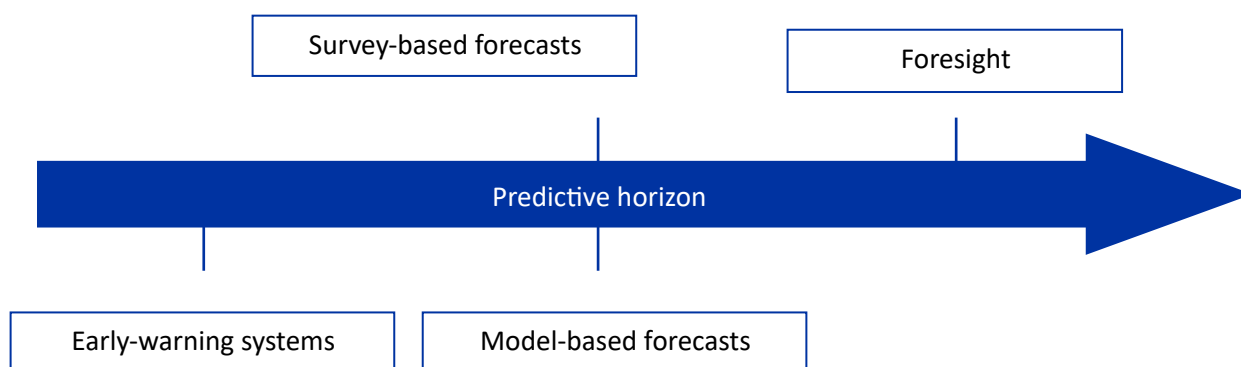
Early-warning systems

Early-warning systems focus on the short term, usually set up to identify imminent movements weeks to months in advance. As such, they can improve the operational preparedness of receiving countries and help with the allocation of resources. To provide timely warnings, they draw on a constant supply of information about migration trends and potential drivers of migration. As such, early-warning systems can also be understood as monitoring or "now-casting" migration flows, particularly in terms of humanitarian flows (Böhme et al., 2020). The information they draw on can be qualitative or quantitative, or a mix of both. For example, IOM's

Displacement Tracking Matrix[2] relies on its network of local workers to provide reports about the location, size and movement of migrant populations. Other early-warning systems rely on quantitative data, such as satellite imagery to identify dwellings and estimate population sizes (HUMAN+, 2020), or use Google Trends data to anticipate migration intentions (Böhme et al., 2020). Early-warning systems can also monitor factors that are known to be correlated with surges in migratory movements, such as what has been recently done by the Danish Refugee Council and the

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[2]   Available at https://displacement.iom.int/content/displacement-tracking-matrix-educational-materials.

European Asylum Support Office (EASO) (Peteranderl, 2020; EASO, 2017; see also the article by Albertinelli et al. in this issue). When critical thresholds of these migration triggers are crossed, the system emits a warning.

Various methods, from interviews to econometric models and machine learning, can thus be used in early-warning systems. Yet paramount to the choice of data is the given that they can be collected and evaluated in a timely fashion. Compared to other approaches, early-warning systems operate with a relatively high accuracy and therefore convey a sense of control over crises. Yet even in an ideal scenario, early-warning systems only detect crises; they do not prevent them. Early-warning systems also impose important requirements on data availability and processing. Lastly, while early-warning systems have started to become widely employed across the European Union (EASO, 2017), comprehensive evaluations are still lacking, and it remains to be seen how they perform in operation.

Model-based forecasts

Model-based forecasts are statistical approaches that model the future as a function of the past. Their applications are widely found in demographic and economic studies of migration. Model-based forecasts can provide concrete numbers and point estimates of migration up to decades into the future. Yet forecasts of more than 10 years have been described as carrying an overpowering degree of uncertainty (Bijak and Czaika, 2020). Model-based forecasts can be either probabilistic or deterministic – i.e. communicating a sense of uncertainty attached to the forecast or not.

Time-series extrapolations

Time-series extrapolations work by identifying patterns in historical data and carrying them forward into the future. Time-series extrapolations rely exclusively on past migration data and do not require additional "explanatory" factors. According to Disney et al. (2015), at least 20 observations (e.g. 20 years of annual data) are necessary to produce valid results. The most common models, such as the autoregressive integrated moving average (ARIMA) model and its many variants, are easily implemented and updated using statistical software. Moreover, their strong theoretical foundation allows the construction of prediction intervals, which provide a direct visual indication of forecast uncertainty.

Yet while time-series models are convenient, their sole reliance on past data is also their weakness. Data is often unavailable for a considerable number of years and/or countries. In addition, data sources for migration are still imperfect and likely to introduce bias into the forecasts. Assuming that migration patterns operate under long-term equilibria ignores the aleatory elements in human behaviour (see article by Bijak and Czaika in this issue). Moreover, even if data were available and correct, past trends are regularly upended through systemic shocks that alter the migration context fundamentally, such as changing political realities or sudden-onset disasters.

Econometric modelling

The main difference between econometric models and other methods is their use of "explanatory" factors. Econometric models are (at least implicitly) based on migration theories that presume a causal link between so-called migration drivers and observed migration. Explanatory factors that are frequently used in such models include indicators of a shared language, geographic distance, labour market conditions in both origin and destination countries, and historical ties, among others. The impact of these "push" and "pull" factors can be quantified and then used to forecast migration. Among the econometric models, gravity models have lately gained particular attention because of their consideration for demographic and geographic variables (Beine et al., 2016; Ortega and Peri, 2013).

Despite their popularity, econometric models come with important drawbacks that potentially weaken their forecasting performance. The relationship between migration drivers and observed migration needs to be estimated using historical data or data from "similar" countries before it can be applied to a future situation. Yet it is well known that migration is highly sensitive to a host of contextual factors, making historic or geographic comparisons prone to bias. In addition, the choice of explanatory factors rests on imperfect migration theories that fail to provide comprehensive explanations of the diversity of global migration phenomena.

Survey-based forecasts

Like statistical forecasts, survey-based approaches to anticipate migration operate in the medium term. They use survey responses collected either specifically for the migration forecast at hand or draw on modules of large-scale surveys. As opposed to model-based forecasts, survey-based forecasts usually do not provide assessments of uncertainty.

Migration intention survey

Migration intention surveys collect information from a representative sample about people's intentions to emigrate. In the 1990s, such surveys were conducted to anticipate East–West European migration (Fassmann and Hintermann, 1997) – with mixed results – but recently the Gallup World Poll has offered widely comparable and available data. These two factors, availability and comparability, are a major advantage compared to bilateral migration flow data. Survey questions are usually built to distinguish an abstract desire to emigrate from the concrete and often costly preparations to depart.

The foremost question concerning migration intention surveys is to what extent observed intentions translate into actual behaviour. Recent studies have attempted to identify that relationship and found intentions to be a useful predictor of migration behaviour (van Dalen and Henkens, 2008; Tjaden et al., 2018). The strength of the predictive power of intentions on actual flows varies considerably by region, hinting at the fact that broader structural factors such as geography and policies condition the use of survey-based forecasts (Tjaden et al., 2018). Furthermore, the validity of survey responses depends on the exact wording of questions and the timing of the survey. Even when emigration is correctly predicted, it is difficult to get any information on when, how and through which channel respondents would migrate.

Expert surveys

Expert surveys assemble a select group of experts to systematically collect their opinions about future migration. A common approach is the Delphi survey, which surveys experts in multiple rounds. The method is aimed at reducing individual bias and producing a consensus of opinion. The results of a Delphi survey can be both qualitative (i.e. arguments and reasoning about future trends) or quantitative (i.e. point estimates of future migration). They can be used to complement statistical forecasts such as time-series extrapolations, or used when alternative data is scarce or migration flows are volatile.

Naturally, experts are subject to their own cognitive biases and moral frameworks that affect their estimates. The selection of participants and the way their opinions are elicited further influence the results. While the Delphi method attempts to reduce these biases and promote consensus among experts, results from past studies suggest significant levels of disagreement and uncertainty in expert judgement (IOM and NIDI, 2020b). Furthermore, conducting a multi-round survey is time and resource intensive, and the questionnaire cannot be easily updated.

Foresight

Foresight methods have the longest term and are the most strategic of all approaches. They are especially well qualified to examine lasting, macro-level trends and their impact on migration, such as climate change or digitalization. While various methods exist, including trends analysis and horizon-scanning, scenario-building has been the most frequently applied in the context of migration. In contrast to the previous approaches, scenario-building aims to identify a field of possible futures – not just one. By presenting alternative realities, it highlights the complexity and uncertainty involved in any attempt to anticipate migration. The output are narrative storylines in the form of what-if scenarios that elaborate the interplay of a set of factors.

While past scenario studies have been shown to have distinct educational and mind-broadening effects on the participants, their results are difficult to communicate and translate into policy decisions (IOM and NIDI, 2020b). In addition, scenario studies refer to time horizons that go beyond usual election cycles, making them more difficult to implement.

Conclusions: What can (realistically) be expected from migration forecasts?

Forecasting migration is no crystal ball. In fact, most forecasts turn out to be wrong (Keilman and Pham, 2004; Wilson, 2017; Shaw, 2007; Keilman, 2008). Yet even with their mixed track record, migration forecasts can offer distinct added value when they are designed and applied adequately. Table 1 below

summarizes the characteristics of the four discussed approaches. Furthermore, here are four concluding remarks about what can be realistically expected from migration forecasts:

(a) First, there is no universally preferable approach. No one method is intrinsically superior to all other methods. Instead, choosing the right approach clearly depends on the context. The forecast method needs to match the problem. Therefore, it is imperative that the problem be defined before the solution.

(b) Second, forecasts need to be understood within their methodological limits. As a general rule, the longer the forecast horizon, the greater its uncertainty. If certainty is of key concern, then short-term forecasts should be given priority, and probabilistic forecasts should be preferred over deterministic ones.

(c) Third, forecasts cannot provide value judgements. Knowledge about the future is always going to be tentative, and it is therefore crucial to navigate it with a sense of direction. Early-warning systems, for example, can be used to either reinforce border protection or more effectively target humanitarian aid and rescue. Forecasts don't strip policymakers of the burden of making hard decisions.

(d) Fourth, whenever possible, it is recommended to use various approaches together. Comparing the output of different tools allows policymakers to cross-validate results, reduce uncertainty and reveal which approaches may be most applicable to the particular challenge at hand. This approach is already taken by some European Union agencies and organizations, including Frontex and EASO.

Table 1. Summary of approaches to anticipate migration

	Time horizon	Migrant flow	Policy use	Output
Early-warning systems	Short term	Humanitarian	Operational	Qualitative or quantitative
Statistical forecasts	Medium term	Regular	Planning	Quantitative
Survey-based forecasts	Medium term	All types	Planning	Qualitative or quantitative
Foresight	Long term	All types	Strategic	Qualitative

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Black swans and grey rhinos: Migration policy under uncertainty

Jakub Bijak and Mathias Czaika[1]

Uncertain migration and the crisis of governance

Migration processes are uncertain and volatile, eluding precise conceptualization, definition and measurement. Their reliance on complex driver environments, coupled with high-level human agency owing to the different actors involved in migration decisions – prospective migrants, intermediaries or policymakers – hampers both prediction and efficient policy responses (Castles, 2004; Anderson, 2017). This creates challenges related to managing migration both in the short and long terms. In this essay, we reflect on the uncertainty and complexity inherent in migration processes, and on the ways in which awareness of their presence could lead to better policy responses.

Migration uncertainty can be broadly categorized into epistemic (related to imperfect knowledge) and aleatory (linked to the intrinsic randomness of the world). Epistemic examples include the conceptualization, measurement, and description of migration and its drivers, along with human decisions, at least in aggregate. Aleatory uncertainty includes unpredictable shocks to migration and its complex driver environments, unforeseen advancements in data or analytical methods, and last but not least unpredictable aspects of human behaviour, human interactions and human agency in the face of the unknown (Bijak and Czaika, 2020). While epistemic uncertainty can be reduced with new knowledge advances, aleatory features are unknowable and irreducible and need to be managed accordingly.

In discussing uncertainty and how it can shape future migration flows and policy responses, it helps to rely on popular animal metaphors, which we use in this essay. First, there are swans: from the ubiquitous, predictable and manageable epistemic white swans (regular and orderly migration flows) which do not require special attention, to rare black swans (aleatory, low-probability and high-impact events, the consequences of which can be severe) (Taleb, 2007). An example of the latter is an unforeseen large-scale natural disaster leading to mass displacement. Second, there are grey rhinos – events that are also very consequential in terms of their high impact, but more predictable, yet "hiding in plain sight", leading to neglect and inaction (Wucker, 2016).

While black swans are linked to the intrinsic failure to predict them, grey rhinos are related to the failure to act upon prediction. Sometimes the character of a process may change: a current example is asylum-related migration, which has moved from the initial surprise of a black swan to the grey rhino territory. Even though its drivers, exact timing and magnitude remain unpredictable, especially after the 2015 "asylum crisis" in Europe, we are now acutely aware that such events happen and have large consequences, and can envisage them happening in the future.

Most of what is often perceived as "migration crisis" is in fact a migration governance crisis. Every time "unwanted" immigration figures rise unexpectedly, governments and parts of host societies feel pressured: migration governance systems are seemingly losing control due to a perceived unpreparedness in managing and coping with a large-scale influx and the incorporation of new arrivals. These times of crisis are often due to deficiencies in migration governance systems, predominantly in the areas of prediction, prevention, protection and public engagement.

The frequent failure in predicting "migration humps" well in advance and within acceptable margins of error – or at least anticipating future migration shocks and trends with some accuracy – is largely caused by limited knowledge and predictive capacity for anticipating the early signs of changing migration driver configurations, as well as the unpredictability of black swan events. Enhancing predictive capacity with better theory, data and models is therefore essential to increase the preparedness level for alternative time horizons.

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Smart migration governance prepares and is prepared for both foreseeable and unforeseeable migration situations and their societal impacts. Migration governance should not become a part of the problem by creating additional uncertainty through erratic or poorly designed policies that send false signals to would-be migrants – for instance, those that may trigger unwanted irregular migration. Migration, if well managed, benefits many stakeholders, but if mismanaged, it can also be harmful for migrants, host societies and migration governance systems alike. Thus, it is essential to prevent migration policy failure and unintended migration outcomes by designing policies based not only on traditional assumptions regarding migrants' decision-making logic (including common sense or cost-benefit thinking), but also on new insights (e.g. from behavioural sciences regarding decision heuristics and "nudging") (Czaika and Reinprecht, 2020; Sunstein, 2013).

Governance systems also often fail to protect both migrants and other groups affected by undesirable migration situations. Smart migration governance is based on a clearly designed actor network with clearly specified responsibilities and systematic and regular communication between actors, who respond in a swift and coordinated way to the early indicators of an upcoming undesirable migration situation. Lastly, smart governance requires State and non-State actors to engage effectively in public discourse by constructing transparent, informative, unbiased and evidence-based narratives on migration as a complex social reality.

Illuminating the uncertainty and complexity

Migration decisions are taken in the context of personal needs, livelihood challenges and opportunities, stress, urgency and uncertainty, based on limited and incomplete information about migration prospects or alternative options. Thus, migration decisions are both situational and contextual – that is, the configuration of complex driver environments is very specific to the time and place in which migration aspirations are formed and decisions taken. More often there is no single reason or "root cause", but rather a complex combination of economic, political, and social factors and other developments and events that may dynamically influence migration opportunities as well as the willingness and ability to migrate. The intertemporal accumulation of triggering factors leads to certain "tipping point" situations, where large-scale population movements are suddenly set

in motion. For instance, many Syrians stayed in their hometowns years into the civil war and only fled to neighbouring countries once their economic basis of subsistence eroded – and was further degrading through environmental stress to the extent that staying was no longer a viable option.

Migration forecasting must deal with different types of epistemic and aleatory uncertainty that are intrinsic to the dynamic, and sometimes erratic, development of complex driver environments. Any reliable analysis of future migration has to identify: (a) the relevant migration drivers; (b) the complex ways and extent to which those drivers intersect and interact; and (c) the intensity with which driver configurations impact the migration aspirations and abilities of would-be migrants.

Existing methods for acknowledging and dealing with migration uncertainty vary across a range of time horizons. The short-term early-warning systems, mid-range predictions (ideally probabilistic) and long-term scenarios offer a way to shed some light on the uncertainty (see Figure 1; see also: IOM, 2016). The predictability of these approaches inevitably decreases with the time horizon. Despite migration not being predictable in a strict sense, different methods can offer at least some approximate insights into the possible futures. They also map closely on to the different levels of migration management, with early warnings potentially aiding operational responses (e.g. humanitarian relief and border operations) in the short run, forecasts supporting tactical and planning-related policies in the medium term, and scenarios helping with long-range strategic decisions. In all cases, the aim is to increase preparedness and shift the response from reactive to proactive.

The probabilistic treatment of early warnings, predictions and scenarios additionally enables a formal decision analysis of user-specific responses, by allowing loss (cost) functions that describe the real-life implications of predictions and various migration outcomes. Figure 2 presents stylized examples, with decisions depending on the interplay of the costs of over- and underprediction. Notably, the same prediction can lead to different decisions in different contexts and for various users (Bijak, 2010). For black swan events, the probability and loss functions are difficult to approximate, but the decision analysis can help elucidate policy options in the face of migration-related grey rhinos.

Figure 1. Examples of forward-looking approaches to aid migration governance decisions
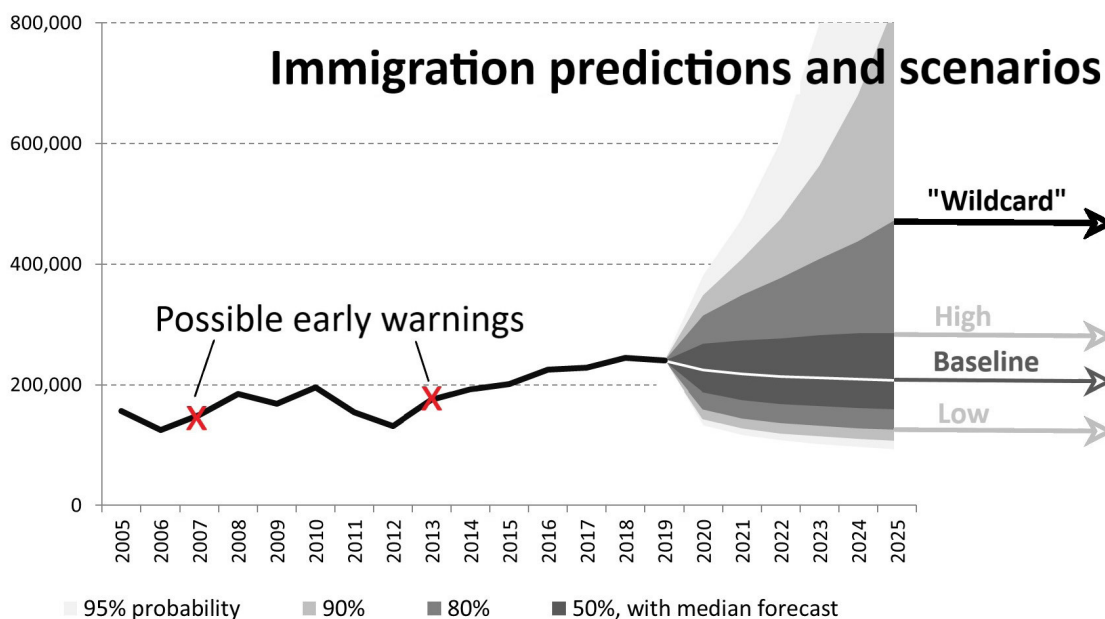
We can further reduce the epistemic uncertainty by exploring the regularities and existing stable features of migration processes, such as age or spatial structures, remittance flows, or migrant stocks. Another method with great potential is using more and different data sources creatively, in a joined-up way, subject to ethical and privacy constraints. This includes combining traditional and "new" data, such as digital traces, especially important in the context of early warnings (Spyratos et al., 2018). Training in prediction and honing "good judgement" skills among forecasters, while retaining realism about the limitations of predictions, are also promising options (Tetlock and Gardner, 2015).

Figure 2. Stylized decision analysis based on probabilistic migration prediction
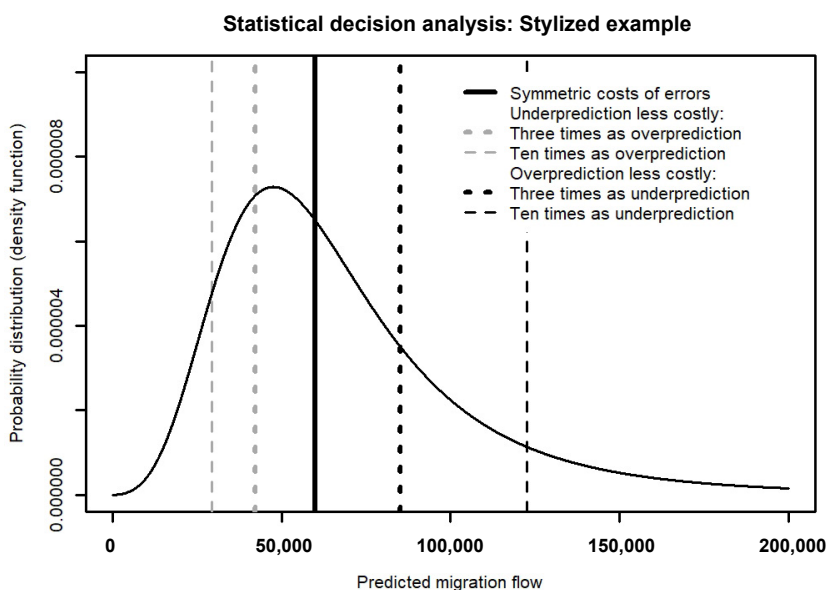
Note: Decisions depend on whether overprediction is more costly than underprediction – and by how much (grey dashed and dotted lines) – less costly (black dotted and dashed lines) or as costly (thick black line).

Taming the beasts: Towards better policies

Still, predictions are not the end, but rather the means to aid policy decisions. Ultimately, these decisions are down to the political and implied public choice among available options, weighing their costs, risks and feasibility. These choices, in turn, reflect the underpinning social values, such as in the "freedom versus security" dilemma. As quipped by the former British Prime Minister Margaret Thatcher, "advisers advise and ministers decide", and this adage is relevant just as well for predictions. Still, formal methods for taming the uncertainty can help improve the openness and transparency of decision-making by illuminating the trade-offs involved. This process needs to start from defining the problem and the policy question, which will then guide the choice of analytical tools and delineate the space of possible responses, alongside their limitations.

So which options work for black swans and grey rhinos, and how do we tame these animals? Being able to tell them apart is crucial: here, predictability is key, and the difference between aleatory and epistemic uncertainty becomes paramount. For unpredictable, aleatory black swans, the main responses entail preparedness and building resilience, so that the systems have enough spare capacity to react to unpredictable events, whatever they are. These solutions rely on the availability of dedicated resources and expertise, along with the political will to commit these resources in case they are needed.

Similar precautions hold for grey rhinos, with the caveat that their nature brings about an additional challenge: constant reminders of their presence when they do not happen may sound like false alarms and lead to complacency. Still, by acknowledging that such events occur, even if infrequently, a robust policy design can include built-in mechanisms to help learn from experience (Wucker, 2016). With many tools available for managing crisis and disaster response (e.g. Twigg, 2004), there are ample ideas to rely on – from creating separate crisis funds ("saving for a rainy day"), building up financial and operational capacity reserves, to redistributing resources across affected communities, or relying on market-based insurance and reinsurance mechanisms.

All these solutions do not have to be exclusively related to rapidly changing migration processes, such as forced displacement and asylum. They could also be used for relieving other localized and short-term pressures on public infrastructure that other types of migration may generate. Monitoring of crises at the European Union level already exists, including warning signals of potential displacement (European Commission, 2020), and its remit could be expanded to cover a varied range of high-impact flows.

For grey rhinos, it is crucial to acknowledge that any predictions are at best approximations of future migration – and to act prudently in light of this. This requires resources and, fundamentally, the political will to act now to avoid problems in the future. This brings us to one key obstacle: intertemporal trade-offs in policy design, with short-term political decision horizons, driven by electoral cycles, are usually not long enough to design robust solutions, which require investing resources now to mitigate uncertain crises and high-impact events later.

Conclusion

Our ability to predict future migration remains limited. Despite an increasing sophistication of analytical capabilities – due to better data, models and concepts – the acceleration, proliferation and diversification of social, economic, technological, and political transformations and "tipping point" events increase migration-related uncertainty, particularly in the long term. So, what can we do?

Searching for the root causes of migration to predict future flows does not help. Rather, we should understand the functioning of broad driver environments, and the conjoint effects of multiple interacting factors and forces that impact the aspirations and abilities of would-be migrants. We need to enhance our understanding of the ways by which sudden or gradual shocks may cause uncontrolled feedback, cascading effects, extreme events and unanticipated side effects regarding migration outcomes, which would increase the accuracy and reliability of migration flow estimates and forecasts.

A smart migration governance system that involves a network of policymakers, migration experts and other stakeholders reflects collectively and acts in a coordinated and coherent way to prepare for, adapt to, mitigate or prevent the manifestations of migration-related uncertainty. Such a governance system will not only be able to anticipate and act upon grey rhino shocks, but also be resilient and flexible enough to manage unforeseeable black swan

events that have the potential to destabilize entire societal and governance systems. Yet, ultimately, a smart governance system must also prepare to be unprepared.

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Expert opinion on future immigration to the European Union by 2030: Relevant, realistic and reliable?

Eduardo Acostamadiedo, Jasper Tjaden, Rhea Ravenna Sohst and Susanne Melde[1]

Introduction

There is increasing policy interest in the European Union and its Member States to better plan and prepare for future international migration. This is reflected in the growing number of reports that utilize foresight and migration scenarios as tools to provide insight into how different migration patterns may develop (IOM and NIDI, 2020a). As policymakers increasingly look to experts for guidance, careful consideration of the limitations of the approaches that rely on expert judgment is needed.

A new European Union–funded study[2] from IOM's Global Migration Data Analysis Centre (GMDAC) and the Netherlands Interdisciplinary Demographic Institute (NIDI) (2020b) provides estimates of future immigration flows to the European Union (total immigration, labour and high-skilled immigration, irregular border-crossings, and first-time asylum applications). The report assesses the value of migration scenarios commonly found in the literature and sheds light on the potential of and the challenges associated with relying on expert judgement. This article presents a summary of the main findings of the study.

The IOM–NIDI report shows that scenarios are useful for stimulating strategic long-term thinking and discussion. However, scenarios are often too vague to derive actionable recommendations for what to do in the short to medium term. Experts struggle to predict what different scenarios would mean for the volume and composition of future immigration flows to Europe. Disagreement among experts in this study reveals the lack of consensus on how basic drivers might affect future migration flows. Furthermore, disagreement and uncertainty present a challenge to decision makers, who demand clear messages to guide policy. Scenarios and expert opinion should therefore be assessed based not on their ability to provide actionable insights, but rather on their ability to provide input to discussions on policy design. Direct participation of policymakers in migration scenario exercises and engagement in discussions with experts allow them to gain a more nuanced understanding of migration processes and possibly reduce the risk of rushing into short-sighted policy responses.

Combining scenarios with expert surveys

Migration scenarios are a popular approach to developing an understanding of alternative future migration patterns. Rather than relying on quantitative data from past trends and predicting future migration flows based on these, migration scenario-building commonly follows a systematic process of eliciting expert judgement to derive coherent narratives that describe plausible futures. The storylines are built around migration drivers[3] perceived to be the most uncertain and most impactful on future migration flows (Vezzoli et al., 2017).

A second approach used is the Delphi survey – a method for facilitating iterative consensus-building among experts on numerical estimates of migration flows and their corresponding probabilities.

The study by IOM and NIDI combines both approaches. First, the authors synthesized four immigration scenarios from a group of studies selected from a systematic literature review of migration scenarios (IOM and NIDI, 2020a). In a second step that involved the use of a Delphi survey, 178 migration experts

[3] Migration drivers are "elements that have the potential to facilitate, enable, constrain, or trigger migration. Migration drivers might increase or decrease the salience of migration, the likelihood of certain migration routes, and the desirability of different destinations" (Natter et al., 2020).

rated the implications of these four scenarios for immigration flows to the European Union in 2030 and assessed the likelihood of each scenario becoming reality.[4] The report presents the average of the estimates for each scenario and analyses the degree to which experts, overall and grouped according to certain background characteristics, agreed on them.

Implications for future immigration flows to the European Union in 2030

The aggregation process resulted in four complex narratives (future scenarios) that describe the possible state of the world in 2030. The two main dimensions of the scenario framework are: (a) international cooperation (including closer integration of European Union Member States) and (b) economic convergence between the European Union and regions of origin of non–European Union migrants. These two variables are regarded as the most impactful and unpredictable future migration drivers for the European Union in 2030, as can be seen in Figure 1.

Figure 1. The four aggregate scenarios with their dimensions and summary of narratives
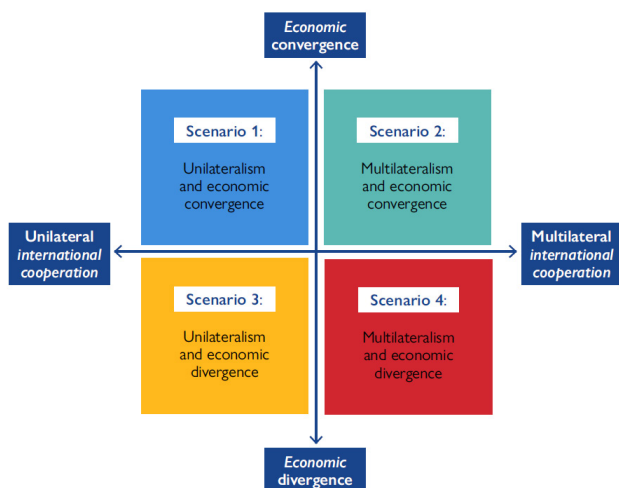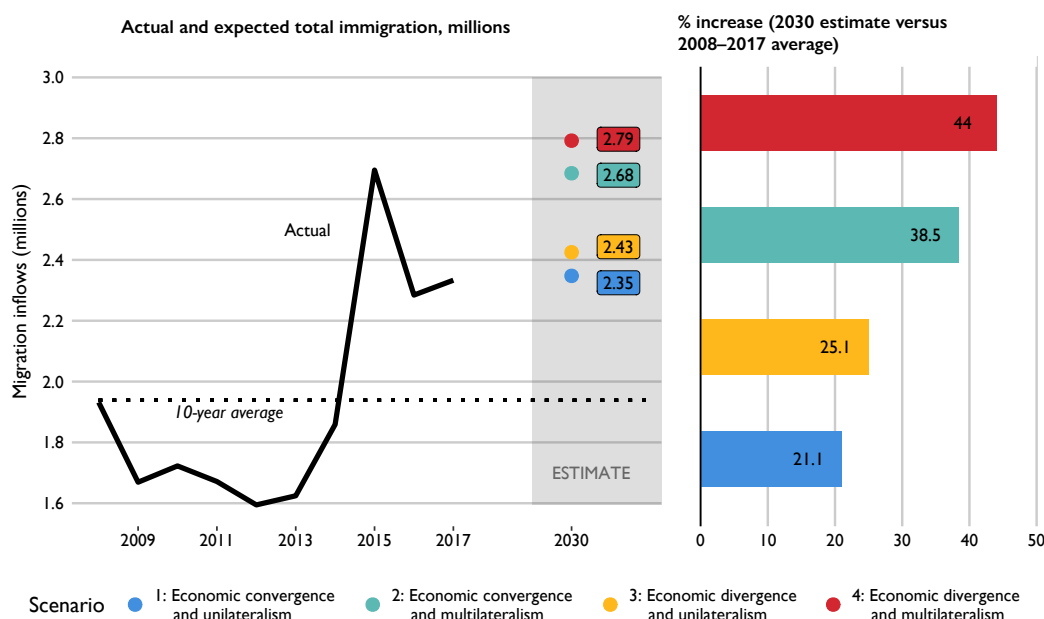

Note: Authors' own elaboration of migration scenarios aggregated and synthesized from the literature.

The migration drivers in the scenarios are evaluated by the experts as having differing, and sometimes opposing, effects on the five types of flows studied (total, labour and high-skilled immigration, irregular border-crossings and first-time asylum applications). Scenarios that describe future economic divergences between a wealthier European Union and poorer regions of the world are associated with higher levels of forced and irregular migration. In contrast, scenarios describing a future in which countries cooperate multilaterally are associated with higher levels of regular and labour immigration to the European Union. This is consistent with the fact that asylum applications reflect the result of forced migration often linked to instability in the asylum seekers' countries of origin. Such movements often occur regardless of the state of multilateral governance.

As shown in Figure 2 below, experts expect the total number of international immigrant flows (meaning total immigration, which includes all types of migrants) coming to the European Union in 2030 to increase in three out of the four migration scenarios, compared to the annual inflow recorded in 2017. For scenario 1 (economic convergence and unilateralism, the scenario judged as "most likely" by the experts), migration flows are estimated to be similar to 2017 levels. Compared to the average annual international immigration flow during the 2008–2017 period (dotted line on the left panel of Figure 2), experts expect an increase of 44 per cent in scenario 4 (economic divergence and multilateralism), 38 per cent in scenario 2 (economic convergence and multilateralism), 25 per cent in scenario 3 (economic divergence and unilateralism), and 21 per cent in scenario 1 (economic convergence and unilateralism) (the points in Figure 2 are averages of estimates given by the experts). Overall, experts seem to associate multilateralism with higher levels of total immigration to the European Union and, on the contrary, low levels of multilateralism with lower levels of immigration in 2030. Nevertheless, as it will be shown below, there is strong disagreement among experts in the ways that multilateralism could affect future migration flows. Some experts also seem to consider that countries can act together to close borders and reduce human mobility.

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4   Of the 1,656 prospective respondents who received invitations for wave 1 of the survey, only 178 participated. Of this number, 145 went on to participate in wave 2. Only the responses of experts with at least five years of experience in migration and expertise in European migration issues were analysed, thus reducing the number of respondents from 178 to 110.

Figure 2. Total annual international immigration to the European Union

Actual and expected total immigration, millions

% increase (2030 estimate versus 2008–2017 average)

Scenario 1: Economic convergence and unilateralism 2: Economic convergence and multilateralism 3: Economic divergence and unilateralism 4: Economic divergence and multilateralism

Source: IOM and NIDI, 2020b.
Note: Scenario estimates are averages of estimates given by individual experts.

In contrast to sharp increases in total immigration, experts estimate moderate or no change in the number of first-time asylum applications in 2030 compared to the annual average during the 2009–2018 period (Figure 3). For none of the four scenarios do the estimates reach levels similar to the recent peak in yearly asylum applications in 2015 and 2016. For scenario 1 (economic convergence and unilateralism), experts expect a stabilization of the number of asylum applications consistent with the average annual volume for the 2009–2018 period.

Figure 3. Annual first-time asylum applications to the European Union

Actual and expected first-time asylum applications, thousands

% change (2030 estimate versus 2009–2017 average)

Scenario 1: Economic convergence and unilateralism 2: Economic convergence and multilateralism 3: Economic divergence and unilateralism 4: Economic divergence and multilateralism
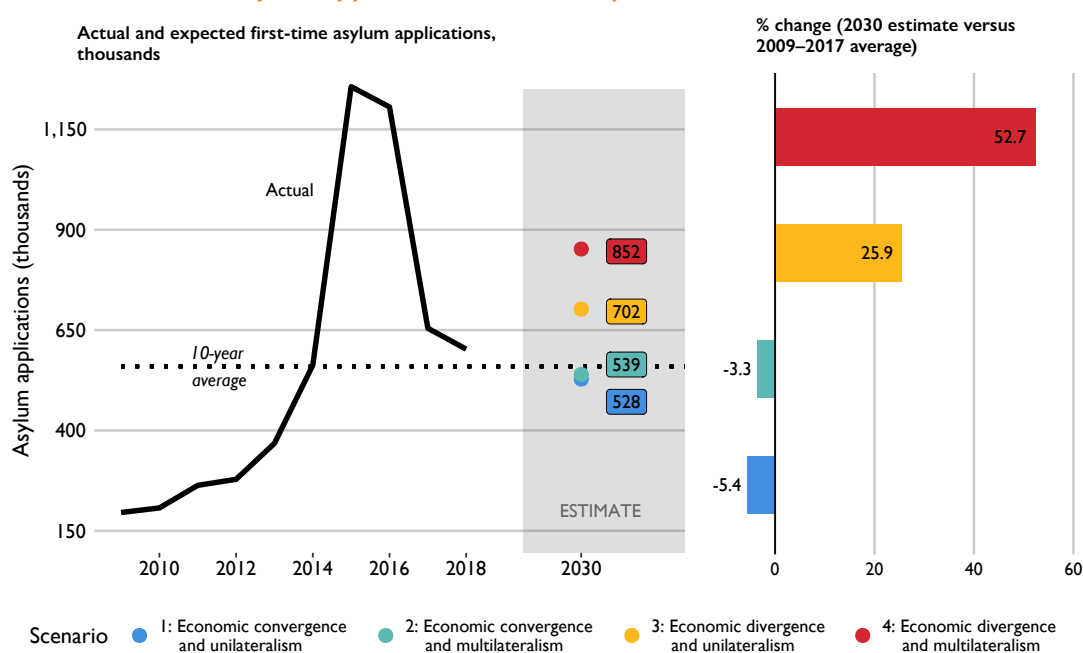
Source: IOM and NIDI, 2020b.
Note: Scenario estimates are averages of estimates given by individual experts.

How reliable is expert judgement?

The high level of disagreement and low tendency to converge over time point to the difficulty of estimating future flows – even among subject-matter experts. The disagreement may also be related to the abstract nature of future scenarios and the ambiguous relationship between various migration drivers and migration flows. For example, experts may see migration levels increase as a result of multilateralism. Countries may have multilateral labour agreements, leading to higher levels of mobility. In contrast, multilateralism may reduce future migration levels if countries choose to work together to curb flows through international agreements.

As shown in Figure 4 below, the level of agreement among experts about the implications of scenarios for future inflows to the European Union was low overall. With regard to total flows, one quarter of the experts believe that the number of total migrant inflows to the European Union in 2030 will be around 1.8 million (average for the four scenarios). Another

quarter estimate at least 3.1 million – a substantial difference of about 1.3 million immigrants compared to the previous group's estimate. As such, 50 per cent of all the experts disagree by a magnitude of at least 1.3 million migrants. To give some perspective, this figure approximates half of the total immigrant flows to the European Union in 2017. Regardless of the scenario, experts believe that total inflows to the European Union in 2030 will be between 2 and 3 million. Similarly, experts agree more that economic convergence will lead to a lower volume of first-time asylum applications, but they agree less whether economic divergence will lead to more applications to the European Union in 2030.

Figure 4 also shows the degree to which experts reach a consensus over time and change their opinion after learning about the responses of their peers during the first and second rounds of the survey. Only 1 in 10 experts changed their original estimation, highlighting that they did not consider other experts' assessments in revising their own.

Figure 4. Variation and convergence of expert immigration estimates for 2030 by scenario and wave
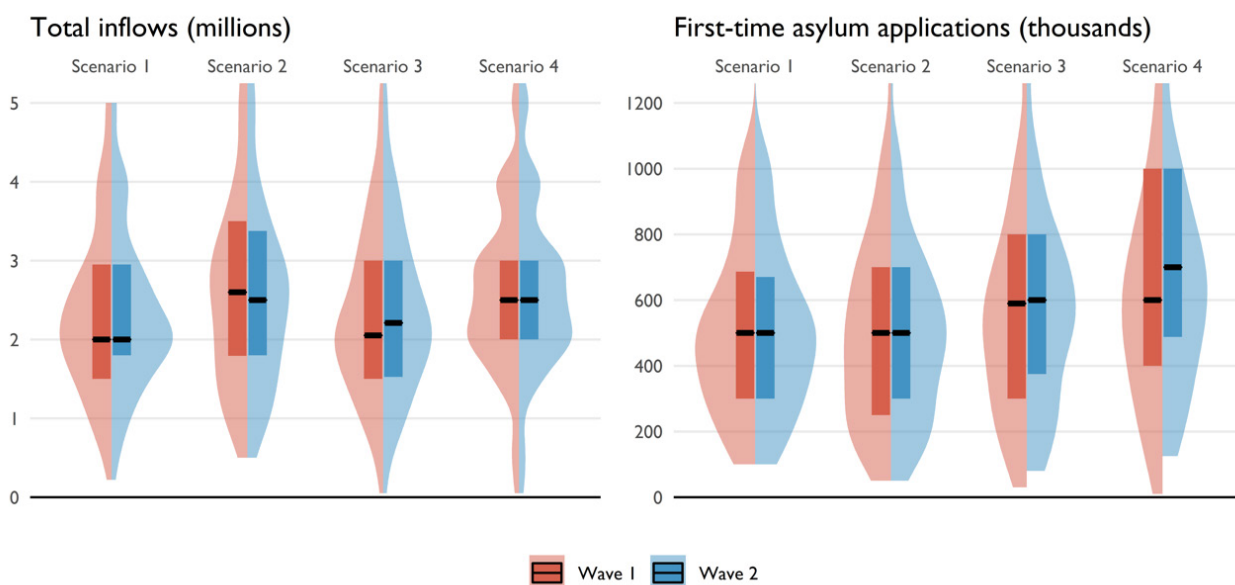
Note: The figure shows a "violin plot" (which is commonly used to illustrate variation in survey responses). For each scenario, the corresponding plot shows the total volume of immigration flows to the European Union in 2030 (vertical axis), as estimated by experts. Only the estimates of experts that participated in both survey rounds are included in the plot. The red half of each "violin" represents estimates from the first round (wave 1) of the survey. The blue part of each violin represents second-round (wave 2) estimates.

Inside the violin is a so-called "boxplot". The black line in the centre of the box, or the "median", indicates how half of the respondents responded. For example, a median of 2 million means that 50 per cent of all respondents estimated 2 million or fewer immigrants in 2030. The length of the box and, accordingly, the length of the violin plot illustrate how far apart the experts' estimates are. The lower part of the box represents the bottom quarter of the estimates (25th percentile or first quartile), while the upper part represents the top quarter (75th percentile or third quartile). As such, 50 per cent of the estimates fall within the range of the box.

This graph also shows the degree to which experts agree on each scenario – in other words, whether the variation in their responses is smaller and narrows over time (convergence). The larger the box, the more uncertain experts are.

Experts show intermediate levels of confidence in their estimates of future inflows to the European Union. On a scale of 1 to 100, the average level of confidence was 41 for the final survey round. In addition, the average level of confidence was similarly midlevel across different types of inflows: 39 per cent for first-time asylum applications and 42 per cent for total inflows.

How much does judgement vary by type of expert?

Looking at the different groups of experts separately (meaning disaggregating responses by academic discipline, migration-related expertise, years of experience and type of stakeholder – i.e. practitioners versus scholars) shows that a respondent's area of expertise does not seem to influence his or her estimates substantially. In addition, migration scholars and experts with more years of migration-relevant experience are not more confident in their estimates than practitioners and experts with fewer years of experience. Experts with fewer years of experience tended to change their responses more than their more experienced peers. There were almost no differences by background of the experts: 7 per cent of practitioners and 8 per cent of scholars changed their estimates in the second and final round. Experts thus showed a wide variety of opinions, likely basing their assessment on personal experience, assumptions, ideological considerations and other biases.

Policy conclusions and recommendations

Rather than quantifying the "unquantifiable", the IOM–NIDI report aims to assess the relevance of common migration scenarios produced in recent years, as well as the reliability of expert opinion in the field of migration. The results are humbling and generally in line with the larger literature on the elicitation of expert opinion (Kynn, 2008; Morgan, 2014; Sutherland and Burgman, 2015; Tetlock, 2017). The results suggest that experts tend to have little confidence in their estimates. They also disagree, and most stick to their original estimates even when presented with the estimates of their peers.

Furthermore, there are broader patterns that emerge: On average, experts expect immigration to increase across scenarios. This is particularly true for highly skilled labour and total labour immigration. Forced and irregular migration is expected to remain at similar levels compared to the 2009–2018 annual average. In none of the four scenarios do estimates of forced and irregular migration exceed the levels observed in 2015 and 2016, which are thus considered as "outliers" by experts and unlikely to repeat in a decade from now. Despite these broader conclusions, the level of disagreement across different scenarios suggests that it remains unclear, even to experts, how structural migration drivers such as multilateralism and economic convergence between the European Union and other regions would shape migration. This finding adds to the evidence of the theoretically ambiguous effects that migration drivers have on the volume, composition and direction of migration flows (de Haas et al., 2019). Many experts appear to rely, at least implicitly according to the results presented above, on the conventional push–pull model: more economic convergence leads to less irregular flows; more international cooperation leads to more regular flows.

What do the results mean for policymakers?

Expert advice should be taken with caution. From an academic perspective, high uncertainty is a natural and important feature, as it underscores the complexity and difficulty of estimating future migration.[5] However, it presents challenges to decision makers, who desire less ambiguous advice to guide policy (Aspinall, 2010). Processes wherein expert opinion is used to inform policy need to find a middle ground: being transparent about uncertainty while minimizing it as much as possible. Migration scenarios lay bare the complexity of migration. Scenarios of future migration are diverse and abstract, leaving a lot of room for experts´ imagination. The findings suggest that any evaluation of these scenarios' likelihood to materialize can only be partially assessed by experts. The results also suggest, however, that merely changing the composition or background of participant experts is not likely to yield different results.

This is not to say that migration scenarios and Delphi surveys are not useful. In fact, eliciting expert opinion using these methods enriches the policy debate even without necessarily providing a clear number of migrants arriving in Europe. Scenario studies appear most useful as tools when they are applied to facilitating strategic long-term thinking of executive decision makers (Szczepanikova and Van Criekinge, 2018) and when quantitative data sources are scarce

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5   For example, see: Bijak and Wiśniowski, 2010; Abel et al., 2013; Wiśniowski et al., 2013, 2014; Sander et al., 2013.

or of low quality. However, they appear to have limited use for providing short-term operational inputs. Overall, the scenario method allows policymakers to understand the complexity of migration in a highly effective way, consider a wider range of migration drivers and challenge their own assumptions, as long as they actively participate in the scenario-creation process (Vezzoli et al., 2017). The scenarios potentially help policymakers, with a more informed and nuanced understanding of the challenges ahead, to avoid short-sighted policies. ∎

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Foresight: Using machine learning to forecast and understand forced displacement

Alexander Kjærum[1]

Need for better predictive analysis in the humanitarian sector

The world faces the challenge of an increasingly high number of forcibly displaced persons and people in need of humanitarian assistance. While numbers continue to grow, displacement crises are not being solved. For refugees alone, the number of protracted situations has gone up from 25 in 2009 to 51 in 2019, and the number of refugees living in protracted displacement has tripled since 2009. According to the United Nations Office for the Coordination of Humanitarian Affairs (OCHA), overall the number of people in need of humanitarian assistance will reach 235 million in 2021 (2019). The long-term effects of COVID-19 remain to be seen but will likely increase the number of people in need through its secondary impact on livelihoods and food security, for example.

The humanitarian system therefore faces growing needs in a context where humanitarian and development funding is expected to be negatively impacted by COVID-19 (seeing its effect on the global economy). While humanitarian funding has generally increased following increasing needs, there continues to be a funding gap of approximately 40 per cent. In absolute terms, the financing gap has increased from USD 3 billion in 2011 to USD 10 billion in 2019. Humanitarian actors should therefore become more efficient in using the available funding to address said mounting needs. One such way is through anticipatory action. Rather than seeing crises erupt and then reacting, planning for emergencies ahead allows for a swifter response, which can help prevent demands from emerging in the first place – and aid actors to respond faster when those demands do arise.

Anticipatory action is contingent on the actors' ability to accurately forecast what will happen in the future. This is not new in the humanitarian sector, where scenario-building continues to be an exercise conducted in most operations to strategically plan for coming events. But the accuracy of these exercises is still being challenged. The Danish Refugee Council's (DRC) analysis of planning figures on the number of displaced persons used in humanitarian response plans (HRPs) for Cameroon, the Central African Republic, the Niger, Burkina Faso, Mali, Nigeria, South Sudan, Iraq and the Syrian Arab Republic showed that the planning figures were on average 10 per cent (Central African Republic) to 47 per cent (Burkina Faso) off the actual figures of displaced populations. In close to 80 per cent of the cases, the planning figures underestimated the level of displacement in the coming year.

When planning processes fail to accurately assess risks and build scenarios, actions fail. An evaluation of the United Nations Children's Fund's (UNICEF) response to the Rohingya crisis noted this: "Given the history of the Rohingya, further refugee arrivals were predictable … UNICEF's March 2017 two-year strategy does not refer to scenarios or contingency plans for new influxes – a clear gap. In fact, the strategy hardly refers to any preparedness activities at all. … [It] should be noted that when the August 2017 refugee influx began, few systems, if any, were in place to respond in an adequate manner" (2018). An evaluation of the United Nations High Commissioner for Refugees' (UNHCR) response to the Rohingya crisis noted: "UNHCR has an emergency preparedness tool, whereby situations are monitored on an ongoing basis and ranked as either low, medium or high risk. In early August 2017 (just three weeks before the mass influx), the Bangladesh operation was ranked as a medium risk of experiencing an emergency. … [The lack of preparedness meant that] when the Rohingya started crossing in late August 2017, UNHCR had little emergency stock and a small team dealing with a stable caseload of 34,000 [registered] long-term refugees. This meant that UNHCR was effectively responding from a 'standing start' – it had to import emergency supplies and deploy emergency specialists, all of which takes time even when it is done very rapidly" (UNHCR, 2018).

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One reason for this inaccuracy is the fact that the current planning and scenario-building processes often use limited data sources, resulting in a fragmented view of current events. Such view also lacks rich details about the complex network of events that ultimately drive displacement and needs. Systems and tools are needed to enable the integration of more data into these strategic planning and scenario-building exercises to make them more accurate. While lack of data in the humanitarian system is often highlighted, the ability to integrate and use existing data to the full potential is a first step in becoming more data-driven and exposing where the critical data gaps exist.

Foresight project: Predicting forced displacement one to three years into the future

Against this backdrop, DRC has been exploring the use of predictive analytics to inform strategic planning and scenario-building. The Foresight analysis platform, which DRC has developed together with IBM, is designed to inform strategic planning and scenario-building exercises by providing accurate forecasts of the total number of forced displacement from a given country one to three years into the future, while also providing a Bayesian network model that analyses the interlinkages between key drivers of displacement. The analysis platform has specifically been designed to give the user the opportunity to adapt the capabilities of the machine-learning model to facilitate expert-in-the-loop interaction.

The analysis platform is built on open-source data from the World Bank, various United Nations agencies, non-governmental organizations and academic institutions. More than 120 indicators are used to measure aspects such as conflict, environment, economy and governance – all known to be potential drivers of displacement. By relying on global data sets from credible institutions, it ensures consistency in data updates, as well as the ability to easily apply the model across countries.

The model has been tested thoroughly in Afghanistan and Myanmar, where results show that the forecast of total displacement for the coming year had average margins of error of approximately 8 per cent for Afghanistan and 10 per cent for Myanmar, which are considered fairly accurate and better than the

baseline of using the previous year's value as forecast.[2] Preliminary forecasts have also been made for Burkina Faso, Cameroon, the Central African Republic, Mali, the Niger and Nigeria; and with the exception of Burkina Faso and Cameroon, the average margin of error on the forecasts was 15–16 per cent. These forecasts significantly outperform the accuracy of the current planning figures being used in the HRPs for these countries, except Burkina Faso and the Central African Republic.[3]

Despite the accurate results, there are still a number of limitations in the model. Given the methodology of building on historical patterns, the forecast model is less likely to accurately predict unprecedented events or black swans. The model did not capture sudden large increases in displacement, such as what happened in Burkina Faso in 2019.[4] There is also some evidence that the model performs less accurately in countries where the displacement context is more regionally confined, such as Myanmar, due to reliance on national-level indicators. The current focus is to minimize this by including more subnational data where possible.

Due to the above limitations, it is not foreseen that the model forecast is to be used for direct decision-making. Rather, the model can be utilized for scenario-building to factor in potentially unprecedented developments on the ground. A good example of this is the current situation with COVID-19, which means that it should not be expected that the forecast for this year and the next will be accurate, as the model currently is not taking the impact of COVID-19 into account. Therefore, to use the model in the present context, the user would have to factor in the impact of COVID-19 on some key drivers of displacement, to build more reliable displacement scenarios.

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[2] The model was evaluated on the years 2010–2019 by training it on the prior years and benchmarking the forecasts against the known values of displacement (i.e. the difference between the forecast for a given year and the known value of displacement that year). The average margin of error is thus based on 10 predictions (2010–2019).

[3] Data for only three years is available to compare the Burkina Faso model results to the HRP (2017–2019). In these years, the model has an average margin of error of 66 per cent, while the HRP figures' average margin of error is 47 per cent. In the Central African Republic, the HRP figures have an average margin of error of 10 per cent, while the Foresight model results have an average margin of error of 15 per cent.

[4] The model predicted a 27 per cent increase in displacement that year (from 63,000 to 80,000), yet in reality, numbers increased by 800 per cent (from 63,000 to 575,000).

To support the scenario-building process, the second model in the platform – the Bayesian network model – explores the relationship between 15 key drivers of displacement that have been identified through a number of expert interviews and discussions. Network analysis determines whether those relationships can be found in the data and what the values of the linkages are (e.g. if the quality of public institution decreases by x, how will that impact human rights and public services). The model builds on historical data for 28 countries with a history of displacement, and as such is not country specific. This can thus be used to inform scenario-building exercises by providing the user with a clear understanding of the complex network that drives displacement. Building a scenario where, for example, only conflict changes is not realistic – as conflict would have an impact on not only displacement but also the governance situation, which in turn would impact displacement as well. The Bayesian network model thereby helps the user build smarter and more reliable scenarios. The model can further be used to explore displacement risk scenarios as it enables the user to see how changes in the context change the risk of increased displacement.

Figure 1. Bayesian network model
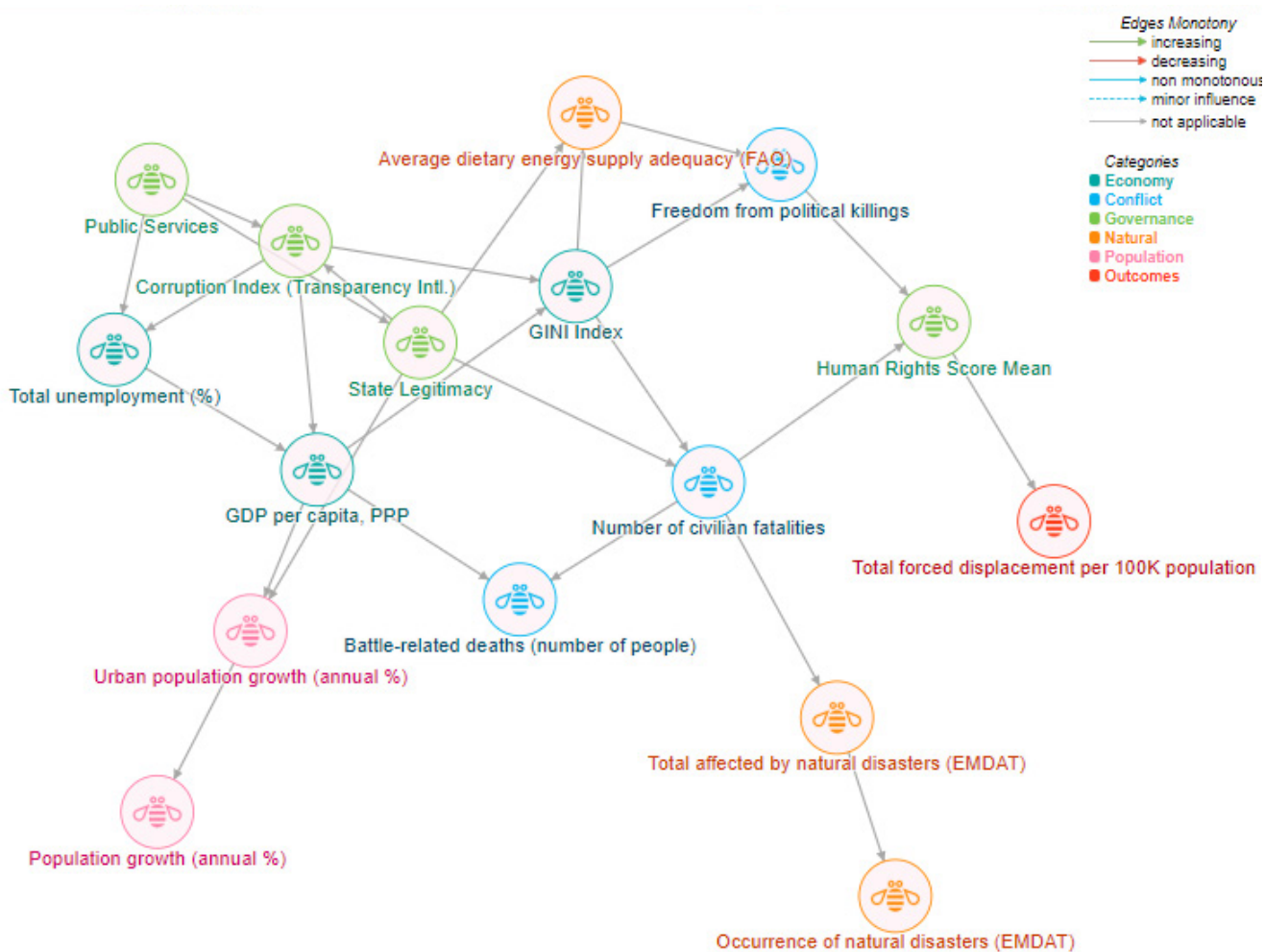
Source: Foresight online user platform.

To facilitate the integration of the two models into humanitarian planning and operations, both are made available as an online user platform. Here the users can access the models and build their own what-if scenarios by changing parameters related to conflict, governance, the economy, etc. The user can further access all the underlying data in the models to build their own graphs, export the data and benchmark countries to each other. This way, the user platform functions as a curated database for displacement analysis. Given that the models mainly build on globally available data, the platform can be used in all countries – including in areas where forecast models are not yet available.

The models and user platform are used to inform DRC's annual review processes, where country and regional offices analyse the context and build scenarios for the coming year to inform their yearly strategy process. The models and user platform will further be made accessible to the wider humanitarian community with a vision that they contribute to more evidence- and data-driven analysis, strategic planning and response in the sector. This could be achieved through using them in the annual humanitarian needs overview or humanitarian response plan processes, as well as for anticipatory financing mechanisms, for example.

By establishing the areas where the platform adds the most value to humanitarian response, and by rolling it out widely in the sector, the vision is that it helps to increase protection outcomes, enhances early response and action, and contributes to minimizing or even preventing humanitarian needs from emerging in the first place.

Lessons learned from exploring the use of predictive analytics

1. **Models will complement rather than replace existing analyses and tools.** As highlighted, there are some clear limitations in the machine-learning model, including the challenges to forecasting sudden large-scale displacement. As such, it is not foreseen that the model will replace existing analysis and scenario-building processes; rather, it will complement them and help ensure that they become data- and evidence-driven and more accurate.

2. **Displacement trends are (to some extent) predictable.** It is often said that displacement happens due to such a complex network of factors that predicting it is not possible.

Experience with the Foresight project shows that displacement trends are to some extent predictable – in particular, when supported with expert inputs in scenario-building. With this insight, it should follow that there is no excuse for not being prepared. As displacement trends are predictable, displacement is also to some extent preventable.

3. **Real challenge is not building the model; it is applying it.** Even with the most accurate prediction tools, a key challenge is to make sure that they are actually used to inform action. To that end, there needs to be clear policies for their application – clear use cases in terms of when and where the models are going to be used and who will use them. Furthermore, machine-learning models suffer from the fact that they are somewhat of a "black box" – meaning that their internal workings are often difficult to explain, and the models do not provide explanations for how and why results or forecasts are reached. Thus, capacity building, training, and enabling non-technical staff to use the models and engage with them (e.g. for scenario-building) are key to build ownership and trust in forecasting and, in turn, enable the models to inform actions.

4. **Caution is needed when it comes to using digital data**. The advent of predictive analytics and modelling has come about partially as a result of the growing availability of digital data. Many actors have explored the use of social media data, call detail records and Google search data to predict population displacement in disasters (ACAPS, 2013) and migration (Böhme et al., 2017). While there can be good use cases for these types of data for a humanitarian agency targeting the most vulnerable population groups, these new data types are also a source of risk. Social media penetration in Africa is still only around 16 per cent. In a country such as Mali, which accounted for about 5 per cent of arrivals on the Central Mediterranean migration route from January to August 2020, 75 per cent of youths (aged 18–35) say they do not have a phone with Internet and have never used the Internet. Generally, across sub-Saharan Africa, almost a third of those youths that have actively planned to emigrate do not use or have access to the Internet (Afrobarometer, 2019). These groups are digitally invisible. By basing models solely on digital data sources, there is a risk of biasing the models and humanitarian aid towards more affluent segments of the

populations rather than the most vulnerable. At the same time, as vulnerable groups become more digitally visible, there is an increasing risk of using digital surveillance to restrict movement and access to asylum.

5. **Engaging with affected communities.** With new models enabling a fairly detailed understanding of the local contexts and development trends without being based in the local context, there is a risk that this will decrease the incentive to engage with affected communities and ensure their participation. It is therefore important to guarantee that affected communities are involved in providing inputs on the design and use of the models. Given the above issue of "digital invisibility", there is a need to establish engagement with communities to gather data and information, to better integrate these into the modelling process. Indeed, the model still needs ground truthing.

There is a strong use case for predictive analytics to inform humanitarian action provided that efforts are based on humanitarian ethics and protect people, more than borders. ∎

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How economic development shapes migration: Facing the emigration life cycle

Michael A. Clemens and Cassandra Zimmer[1]

Governments around the world have invested heavily in one big idea about migration. They are directing development assistance to deter people in poor countries from emigrating. This big idea unites people across the political spectrum, from sceptics of immigration to supporters of foreign aid.

Will this work? It seems beyond question that it must work, to some degree. Many people migrate for better economic opportunity. So if they have such opportunity in their home countries, they must be less likely to decide to live and work abroad.

If this idea were correct, we would expect to look at developing countries and see three patterns:

(a) Individuals with greater economic opportunity at home should be less likely to choose living abroad.

(b) In relatively richer countries, people should be less likely to prefer living abroad.

(c) And as countries get richer over time, people should become less and less likely to decide to live abroad.

But none of these things are supported by the data. In almost all developing countries, people with better economic opportunity are more likely to emigrate. In countries where the average income is high, people are more likely to want to live abroad. And as the poorest economies grow, more people flow out as emigrants.[2]

Here we will briefly summarize some basic facts, address a couple of frequently asked questions, and talk about what they do and do not mean for development assistance.

The basic facts

First, in poor countries, people with better economic opportunity are not more likely to stay in their home countries and take advantage of it.

The figure below shows about 125,000 individuals in 24 of the lowest-income countries on earth, including Mali, Ethiopia and Afghanistan. The orange hump is the distribution of personal income across the horizontal axis, where zero shows the average income for the country where each person lives. The blue line is the probability that a person at each income level is currently actively preparing to permanently emigrate. The shade around that line is a range of statistical confidence.

Figure 1. Emigration and income at the individual level, in low-income countries
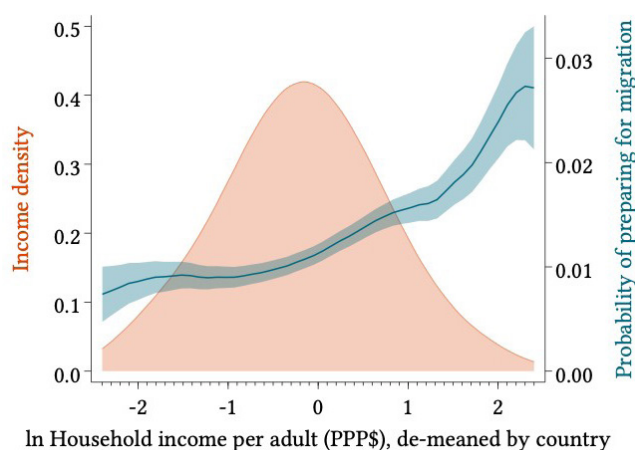
There is no hint that economic opportunity deters people from emigrating. The richest people are about three times as likely to be preparing to emigrate than the poorest.

Does this represent relative incomes only? What if the country as a whole gets richer? The figure below shows countries (not individuals). It shows every developing country that experienced net positive economic growth over the past half century, leaving out micro-States with populations below 2.5 million. It counts only emigration to high-income countries, omitting most South–South migration.

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[2] The full research underlying this summary can be found in: Clemens and Mendola, 2020; Clemens, 2020.

Figure 2. Emigration and income at the country level, changes over time
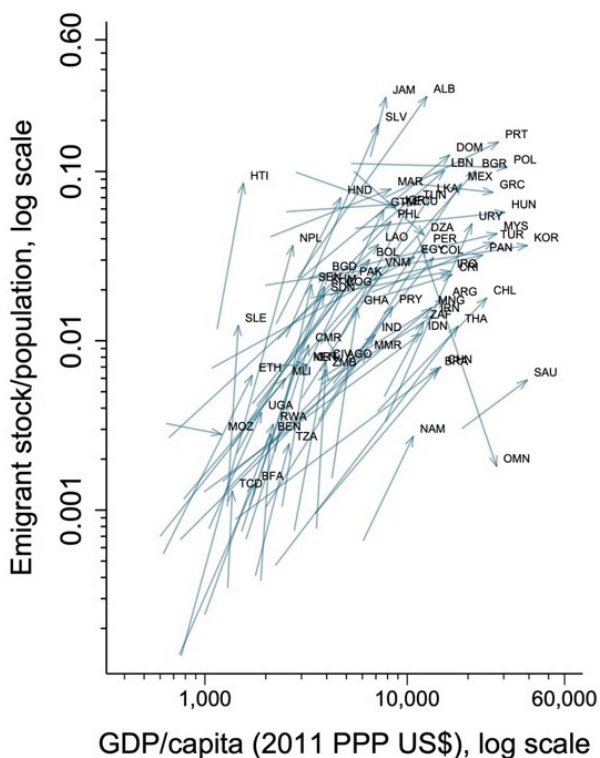
The pointed tip of each arrow shows the relationship between the country's average income (on the horizontal axis) and the fraction of the population living abroad in a rich country (on the vertical axis), in 2019. People born in countries with around USD 10,000 GDP per capita (adjusted for price differences) – countries like the Philippines or Morocco – are about 10 times more likely to live abroad in a rich country, compared to people born in the poorest countries.

The shaft of each arrow shows how these countries moved over the half century leading up to 2019. That positive relationship in 2019 does not just represent a snapshot in time. It roughly but accurately reflects how typical developing countries, each with its own circumstances, have evolved over time.

In sum:

(a) Richer individuals in poor countries have a greater propensity to depart to live abroad.

(b) People born in rich developing countries have a greater propensity to live abroad.

(c) As their country of birth gets richer over time, people have a rising propensity to live abroad.

Economic historians have called these patterns the emigration life cycle, because emigration tends to taper off at higher incomes in later stages of development.

Common, reasonable questions

These very strong, statistically unmistakable patterns strike many observers as counterintuitive. That is natural and sensible. Here are answers to many common questions about these facts.

Is this applicable to micro-States only, or is this the case for South–South migration as well? No. The figure above showing countries' paths over time leaves out the smallest quarter of developing countries (with populations below 2.5 million people). The data only counts emigration to countries defined by the World Bank as "high income". In fact, this relationship between emigration to rich countries and high income is much stronger than the emigration–income relationship for South–South migration.

This might reflect long-term relationships, but what about the short run? The long-term relationships above must also represent the relationship in the typical short run. To see this, imagine driving a car out of a city. Suppose that during any given hour (in the short run), the car gets farther south. It is not possible that ten hours later (in the long run), that car ends up north of the city. The fact that countries ending up richer have higher emigration prevalence in the long run requires that during the average short-run period, higher incomes go hand in hand with higher emigration prevalence – no matter how short that period is.

How do we know that this correlation reflects causation? The relationships shown above are nearly universal features of the development experience. Richer individuals are more likely to be preparing to imminently emigrate in 93 out of 99 developing countries where these statistics exist. Among today's developing countries that experienced substantial economic growth since 1970 (again, omitting micro-States), there was an accompanying increase in the prevalence of emigration to rich countries in all but 3 of them.

It is not plausible that relationships this large and nearly universal are mere coincidences. The reasonable interpretation is that either rising incomes themselves, or conditions that are key drivers of

rising incomes, cause people to be more likely to live abroad. It is possible that economic development in the future will proceed entirely differently from how it did in the past, with entirely different drivers, but this remains a conjecture.

Aren't these just about cumulative numbers of past migrants? What about flows of new migrants? The figures above show both. In the cross-country figure, the arrow tips show the relationship between the cumulative number of migrants and the level of average income. The arrow shafts show the relationship between net flows of new migrants and growth in income, over time. And individual-level data in the first figure shows people just about to emigrate – that is, when they will become a flow of new migrants to their country of destination.

What about sudden-onset crises in developing countries? The analysis above has no relation to sudden-onset crises such as natural disasters, conflicts or epidemics. Such crises often result in short-term contractions of economic activity and surges of emigration. That is, in a crisis, there is often a negative relationship between emigration and income. This pattern is entirely separate from the positive relationship between emigration and sustained economic development – the lasting and gradual unfolding of economic specialization in a country. For example, the Mexico peso crisis of 1994 produced a short-term fall in Mexico's GDP per capita and a surge in emigration to the United States. That was separate from, and much smaller than, the large rise in emigration that accompanied Mexico's generally rising GDP per capita before and after the crisis. The figures above describe economic development. Development is not the absence of crises any more than the growth of a human body is the absence of illness.

What about irregular migration, specifically? The numbers above reflect data sources, like censuses and labour force surveys, that seek to include all migrants regardless of status. They therefore represent an aggregate of permanent migration, both regular and irregular. The same positive relationship to economic development need not hold for either regular or irregular migrants considered separately. But the fraction of a migration flow that is irregular is strongly shaped by the availability of regular channels – a policy decision rather than an inherent feature of the development process. Countries assisting development to reduce irregular migration could

partly achieve that result by creating more regular migration pathways. They generally do not, implying that the typical policy goal is to deter migration overall, both irregular and regular. Thus, overall migration is a proper focus of study.

Does the economic approach capture the full, non-economic aspects of development? The emigration trend looks similar even if one uses statistics that capture human development instead of purely economic development. For example, people are much more likely to emigrate from countries with lower child mortality (Clemens and Postel, 2018). This obviously does not mean that people prefer to live in countries where their children are at risk. Rather, this pattern is best interpreted as reflecting the fact that both child survival and international mobility are common features of the development process. Sociologist Doug Massey of Princeton concludes that "emigration is a normal by-product of economic development". Sociologist Hein de Haas has been pointing this out for many years, as have many others – from geographers such as Ron Skeldon to Jørgen Carling and Cathrine Talleraas, as seen in their recent work.[3]

What this does and does not mean for development assistance

Besides the above questions, this is perhaps the most common: Does this mean that development assistance is counterproductive, and should be curbed?

To this we answer no in the strongest terms. Development assistance has many legitimate purposes, including to promote public health, encourage resilience in crises, adapt to climate change, fight corruption, build infrastructure and reduce poverty. All of these goals are difficult to achieve, but they have inherent value, as well as serving the long-term self-interest of donor nations.

To see the emigration life cycle as a simple reason to cut development assistance is to throw all of this aside and declare that a core purpose of development assistance is to halt migrants. The case for that normative claim must be made before cutting aid in response to the emigration life cycle. We do not

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[3] See: Massey, 1989; de Haas et al., 2019; Skeldon, 1997; Carling and Talleraas, 2016.

believe it has been made. And even if it had been, the idea of deliberately keeping poor countries in poverty as a method of migration control is a proposal with so many potential side effects that it could not serve even the narrowest definition of donor nations' interests.

The empirical relationship between crisis aid and sudden bursts of migration suggests that timely crisis assistance could, in fact, deter migration if that goal is sought. The single most important act lies in the degree to which political leaders choose to work with or against migrants as crises evolve. Humanitarian assistance in countries of origin or third countries can shape people's decisions to move onward. But the purpose and function of humanitarian assistance is not the sustainable creation of more and better jobs and business opportunities; it is not economic development. The migration effects of how policy shapes development and the migration effects of how policy shapes crises are fundamentally different and must be considered separately.

Development assistance can fruitfully shape migration flows, shifting migration from irregular channels to more tangibly mutually beneficial regular channels. The most effective way to shape migration flows is in partnership with countries of migrant origin. For low-income countries, this often requires support from aid agencies. One example of this is Global Skill Partnerships, which are bilateral agreements to support technical training for both migrants and non-migrants in the origin country, supported by the destination country (Clemens, 2015).

The emigration life cycle is a fact that aid agencies should face, not fear. Many developing regions have passed through the life cycle and are now on the other side, including large parts of Latin America and Asia (Hatton and Williamson, 2011; Hanson and McIntosh, 2016). Cooperating with today's poor countries to assist them can help them get through that same transition in ways most beneficial to migrant origin and destination countries. Abandoning them will not. ◾

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Forecasting asylum-related migration to the European Union, and bridging the gap between evidence and policy

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Introduction

Of all the demographic processes, migration is well known to be the most difficult to analyse and predict. Asylum-related migration is a subset of migration linked to international forced displacement, caused by persecution, armed conflict, violence or violations of human rights. As a result, it carries the highest degree of uncertainty among all types of migration flows (Bijak et al., 2017).

To better understand asylum-related migration to the European Union – and being consistent with the mantra of "what gets measured gets managed" – in 2012 the European Asylum Support Office (EASO) launched its Early warning and Preparedness System (EPS). It is an information-exchange mechanism with the aim of providing EASO, European Union Member States, Schengen associated countries and the European Commission with timely, accurate and comparable data on where applications are being lodged in the European Union and by whom, as well as the processing of applications by receiving countries in line with the Common European Asylum System (CEAS).[2]

Since then, information exchange through the EPS has grown significantly and now encompasses 19 standardized, comparable and disaggregated indicators, which are shared with EASO by all European Union Member States plus Norway and Switzerland. EASO has also formed the EPS Network, composed of national experts who meet regularly to manage the exchanged data, which also fosters research, evidence-based policymaking and a well-informed public discourse.[3]

Given that the asylum procedure is a combination of administrative and judicial processes following a legally defined sequence of events (European Union, 2013), the EPS indicators have been developed around the logic of an **input(*flow*)→process(stock)→output(*flow*)** model. This is important because it means that developments affecting one procedure can cause knock-on effects on later procedures. For example, a sudden surge of applications for asylum immediately impacts registration and reception, and it will create more cases to be processed, with impacts on processing times and the number of first-instance decisions to be issued. Furthermore, depending on the appeal rate of the citizenships involved, more applications in one time period may, quite predictably, result in more appeals being lodged against negative first-instance decisions in a later time period, thereby representing a significant and partially predictable transfer of cases from asylum authorities to the judiciary. Hence some of the data collected by EASO could potentially be analysed, forecasted and even simulated with process management techniques such as process mining (van der Aalst, 2012).

EPS data are extensive and add much value, but they also have limitations: consistent with most administrative data, the EPS indicators count and describe procedures rather than people, so it is not yet possible to interlink individual cases across asylum indicators. Furthermore, at the European Union level, the asylum procedure is not yet integrated with other procedures related to regular (e.g. visa applications, resettlement) or irregular migration (e.g. illegal border-crossing, refusals of entry, illegal stay). However, the interoperability regulations[4] adopted by the European Commission in 2019 foresee the linking of such non-personal data for the purposes of analysis and research. Thus, in the future, increased visa applications, visa-free travel authorizations, or detections at the external borders could be used to forecast asylum applications, in some contexts. Indeed, in 2021 data availability is becoming less of

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[2] See also: EASO, 2011.

[3] More information is available at www.easo.europa.eu/latest-asylum-trends.

[4] See: Regulation (EU) 2019/817 and Regulation (EU) 2019/818.

a hindrance. Instead the value of any data source is magnified immensely when it can be linked with others.

EASO has overseen much progress when it comes to asylum data and proposing ways in which such data can be analysed, visualized and linked with other sources, but levels of uncertainty remain high. For example, asylum and migration data are usually pooled at the level of nationality, which is insufficient to capture fine-scale migration patterns. Bijak and Czaika (2020) make reference to epistemic uncertainty which is imperfect knowledge that can be improved with better data and research, and aleatory uncertainty (derived from stochasticity) which refers to unknowable and irreducible complexity about the future. These uncertainties universally apply to the data we collect, the identification and evolution of migration driver complexes, and the methodologies we employ to understand them.

Figure 1. EASO analytical framework

To make the best possible use of the available data and expertise, EASO employs an analytical framework which is consistent with a recent review by IOM (IOM and NIDI, 2020). Specifically, nowcasting uses EPS and other data to provide a retrospective understanding of past events, while forecasting generates probabilistic short-term predictions, and scenarios describe a range of what-if alternatives for possible futures (Bijak, 2011).

Forecasting methodology

To forecast migration and provide early warnings, *early* should mean as early as possible, so EASO's forecasting work is inevitably concentrated on the situation in countries of origin and transit. Indeed, anyone can predict a crisis once it has already begun, so systems that produce alerts based on increased arrivals at the European Union external borders or applications for asylum within the European Union are to some extent too late to be called early-warning systems.

Migration, and especially asylum-related migration, is a complex system, affected by short-lived, context-dependent drivers which interact with each other in unexpected ways and vary wildly between individual displacement events. As a result, migration forecasts which depend on local knowledge and on/off low-quality data tend to be limited in time, space and scope. To mitigate this issue and to create a system that can be applied at the level of the European Union plus Norway and Switzerland, EASO has developed a data-driven adaptive system (Carammia et al., 2020) which uses machine-learning algorithms to combine administrative data with non-traditional data sources at scale.
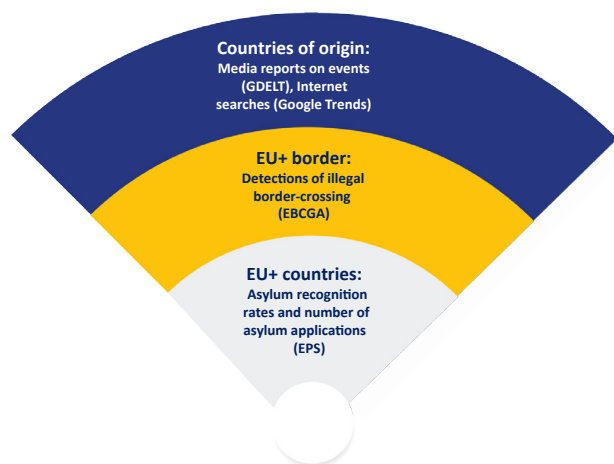
Data sources

Three tiers of data are used to model and forecast asylum-related migration flows to the European Union plus Norway and Switzerland (Figure 2):

Tier 1 – in countries of origin: EASO extracts conflict, negative and disruptive events from the Global Database of Events, Language and Tone (The GDELT Project, n.d.). These events are then weighted, placed in five broad categories and used as proxies of asylum migration drivers. Internet searches for asylum- and migration-related topics (Google, 2020) are also used as indicators of migration intentions (Böhme et al., 2020).

Tier 2 – at the border: Public data on detections of illegal border-crossing (Frontex, 2020) per route is used in the model because detections can and often do precede asylum applications.

Tier 3 – in the European Union plus Norway and Switzerland: Asylum recognition rates are used to estimate pull factors towards individual Member States. Asylum applications are also in the model to account for seasonal variation, dependence on historical values (autoregression with a partial autocorrelation function), and the possibility that applications in one country (in the European Union plus Norway and Switzerland) may be preceded by applications in another.

Figure 2. The three tiers of data used by EASO to model and forecast asylum-related migration to the European Union plus Norway and Switzerland

Countries of origin:
Media reports on events (GDELT), Internet searches (Google Trends)

EU+ border:
Detections of illegal border-crossing (EBCGA)

EU+ countries:
Asylum recognition rates and number of asylum applications (EPS)

Each of these data sets is replicated 25 times, each with a different time lag to account for the passing of time between, for example, conflict events in a country of origin and applications for asylum in the European Union plus Norway and Switzerland. Hence, of the 2,000 or so variables, the model only retains significant linear correlations, thereby simultaneously selecting the important drivers and estimating the delay between drivers in one country and applications in another.
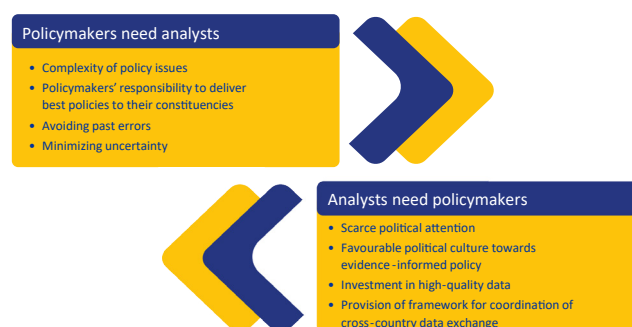
The Adaptive Elastic Net model provides short-term forecasts of individual asylum-migration flows up to four weeks ahead, which are designed to support the operational response and preparedness of countries in the European Union plus Norway and Switzerland and Justice and Home Affairs agencies. At the same time, heat maps illustrate which drivers of asylum migration are retained in the model over a 52-week period, which can be used to inform medium-term planning and support policymaking at the national and European Union levels. Thus, the approach described here is able to add value at both the operational and strategic levels.

Evidence-informed policy and policy-informed evidence

In isolation, empirical analyses could be described as intellectual gymnastics unless the results actually feed into a legitimate policymaking process. Historically and in an ideal sense, the interaction between analysis and policy has been based on the notion of "speaking truth to power" (Wildavsky, 1979), wherein

independent scientific evidence is used to underpin better policymaking. However, the relationship between evidence and policy is in fact a two-way street: policymakers demand evidence from analytical and research communities, but at the same time, analysts rely on the policymakers to create legislation that generates more data for the purpose of gathering evidence (Figure 3).

Figure 3. Reasons for the interaction between policymakers and analysts/researchers

Policymakers need analysts
• Complexity of policy issues
• Policymakers' responsibility to deliver best policies to their constituencies
• Avoiding past errors
• Minimizing uncertainty

Analysts need policymakers
• Scarce political attention
• Favourable political culture towards evidence-informed policy
• Investment in high-quality data
• Provision of framework for coordination of cross-country data exchange

The importance of evidence is widely recognized in the Western world, including in the area of migration (Boswell et al., 2011). There are multiple reasons why policymakers have an interest in scientific evidence (Figure 4). To start with, policy issues are usually complex, but some are more complex than others. Migration is a perfect example of what scholars refer to as a wicked or unstructured problem, which means that there is both factual complexity or uncertainty as well as conflict over norms or preferences (Bannink and Trommel, 2019; Hisschemöller and Hoppe, 1995). Migration trends are driven by a multifaceted interplay of factors – on individual, meso and macro levels. Interactions between factors are the rule rather than the exception: a change in one factor often has repercussions on others. For policymakers who do not have the time to monitor and assess developments in the multiplicity of factors with all the underlying information, analytical expertise is crucial for understanding what has happened and why, as well as for preparing for the future. Uncovered evidence can also help debunk myths, which is increasingly important with the contemporary overload of information.

Furthermore, policymakers have a responsibility to work on policies that "have the best chance of contributing to the health, safety, and well being of their constituencies" (Thissen and Walker, 2013). Similarly, this also applies to the spending of

taxpayers' money. Such a contribution can be achieved only if policy proposals and their eventual materialization are driven not by assumptions but by rigorous scientific information about cause and effect.

Next, learning from previous developments or from experience is key to not repeating errors which occurred in the past (Knill and Tosun, 2012). Analysis based on scientific premises can help explain the reasons behind errors and highlight what are needed to avoid them in the future. In turn, this could contribute to efficiency gains and effectiveness (Head, 2008) as well as facilitate policy success and the avoidance of policy failures, even if these concepts are somewhat relative (Howlett, 2009).

Finally, policymakers are aware of the existence of uncertainty in general, but they usually have difficulty incorporating it in their work where concrete decisions are required. However, carefully considering uncertainty in terms of its sources, possible magnitude and implications is crucial to minimize the negative consequences on the public (Walker et al., 2013). Policy analysts can offer support in this regard by formulating plausible scenarios, identifying thresholds in predictions for future trends, and dynamically adapting such scenarios and forecast thresholds based on real-world events.

Analytical results could help sustain or overturn existing policy images (Timmermans and Scholten, 2006), offer alternative solutions and provide insights into the effectiveness of policies (Knill and Tosun, 2012). However, there are several reasons why science cannot always deliver what policymakers require (Figure 4). First, analysing complex phenomena and drawing valid and reliable conclusions demand high-quality data that often does not exist or at least is not accessible.

Second, research is generally a time-consuming enterprise, and long-anticipated results often remain context dependent and transfer poorly to different circumstances. In practice, this means that new projects often need to be designed or piloted and extended to cover newly emerging needs. It also means that time-sensitive policymakers do not always have the luxury of waiting for repeated and confirmed research results, which increases the pressure on those producing evidence (Davies, 2012).

Third, policymakers are interested in definitive and absolute solutions to policy problems, but reality is messy and complex. Moreover, analysts and researchers communicate in terms of probabilities, uncertainties and margins of error, particularly when it comes to cause and effect. Good policy analysis "hedges its recommendations with margins of sensitivity to changes in underlying conditions" (Wildavsky, 1979).

Figure 4. The challenges for science to meet policymakers' expectations
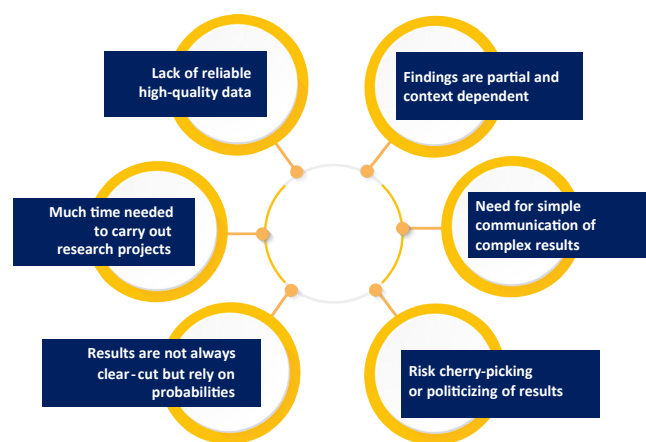
Fourth, policymakers, like all impressionable beings, might overvalue and unquestioningly accept evidence that supports a preferred course of action, a phenomenon known as *the politicization of science* (Weingart, 1999), which might happen consciously but also as a consequence of confirmation bias. No matter what the line of inquiry, a quick search of the literature will inevitably uncover widely conflicting results. However, cherry-picking studies to support any single conclusion is highly dangerous because it undermines the very idea of evidence-based policymaking. Therefore, it is the task of policy analysts not only to be objective and impartial in their search for evidence (Thissen and Walker, 2013) but also to highlight the limitations of their findings and those of their peers.

Fifth, for the relationship to function well, it is also important that analysts focus on communicating their findings in a comprehensible way for policymakers. This is necessary because not only are those making the decisions likely to be unfamiliar with all methodological considerations, but also their time and attention are scarce (Jones and Baumgartner, 2005). This implies that analysts require an additional

skill in formulating clear messages, which involves a careful balance between reducing complexity and highlighting all quintessential caveats.

Finally, even with the best conditions for carrying out any scientific inquiry (plenty of time, resources and high-quality data), it is hardly possible to provide comprehensive answers to complex issues, such as migration. Therefore, it should be acknowledged that evidence for policy "does not come in finite chunks" and should instead be seen as "a never-ending network of conditionalities and contingencies", where one layer of evidence could act as a trigger for changes in another (Pawson et al., 2011). More layers are likely to be added with time as new aspects of the policy issue come to the fore and need to be integrated into an overarching analysis.

The two-way interaction between analysts and policymakers implies that in order for analysts to be able to deliver relevant evidence, certain conditions need to be fulfilled on the policymaking side. For analysis to have impact on the work of policymakers, the latter needs to be willing to listen. This is by no means trivial because political attention is always scarce and policymakers need to attend to multiple problems at the same time (Jones and Baumgartner, 2005). Nevertheless, listening is just the first step. Policymakers also need to be open to integrating analytical results into legislative proposals, implementing acts and practical guidance instruments. Hence, a favourable political culture towards evidence-informed policy is crucial (Head, 2010). This is tricky as practice has shown: many findings even of commissioned research "end up gathering dust on a shelf" (Boswell et al., 2011).

Moreover, important data for analysing trends or making forecasts in migration is collected by governmental bodies, as national (or in some cases, regional) authorities are the actors that register administrative procedures related to different aspects of migration. For example, data on asylum applications is created by national asylum authorities once such applications are lodged by foreigners. Therefore, governments' investment in maintaining high-quality information bases (Head, 2010) and analysts' access to the aforementioned governmental data – in particular, in a timely manner – are essential for both nowcasting and forecasting. Furthermore, interaction can be crucial for analysts to gain access to research subjects – for example, to conduct surveys or undertake field experiments. But not all relevant phenomena are (fully) covered by existing indicators, which often raises the need to design new indicators or expand existing ones in order to achieve higher reliability. It is very important to define indicators that are clear-cut and comparable across countries to enable drawing valid analytical conclusions.

Although this technical task is conducted at the level of practitioners, policymakers need to ensure that the framework for coordination at the cross-country level exists, and possibly even provide the legal framework for coordination to occur whether formally or informally. An example of such a legal framework for formal data collection is the Eurostat regulation on migration and international protection statistics.[5] In contrast, the EPS system is an example of a highly coordinated but more informal data exchange, since contribution is voluntary. Improvements in data quality are often needed, and advocacy by analysts in this direction is key to ensuring the usability and consistency of, as well as access to, high-quality data. A current example of this are the interoperability regulations (mentioned above), which were framed also with EASO's contribution. ∎

Conclusions

Policymakers increasingly rely on evidence produced by analysts in order to make decisions regarding asylum and migration management. Due to the complexity of the field, analysts rely on multiple data sources and novel methodologies to analyse trends or make forecasts which are forwarded to policymakers. The available data sources can be improved by policymakers, as the interoperability regulations show, and this can have only positive repercussions on research and analysis concerning asylum-related migration, as well as evidence-informed public policy.

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Forecasting migration: The way forward for national and European policymaking

Tobias Molander and Manfred Kohler[1]

The following article is largely based on considerations expressed in this year's virtual Austrian National European Migration Network (EMN) Conference on "Forecasting the future of migration", which brought together experts from national governments, international organizations, academia and civil society to discuss the potential and limits of migration forecasting. While we, in the Austrian Ministry of the Interior, are still trying to develop and deepen our expertise in migration forecasting methods and tools, we are interested not only in how we can improve our methodology and accuracy, but also in how forecasting can be best put into practice. Therefore, this article's main focus is on the way forward for national and European policymaking – more specifically, migration foreign policy, which in our view is key to any sustainable migration policy fit for the challenges of the twenty-first century.

Shaping real events

To quote John F. Kennedy: "The purpose of foreign policy is not to provide an outlet for our own sentiments of hope or indignation; it is to shape real events in a real world" (1963). It is thus of utmost importance that migration foreign policy is creative and able to shape real-world events. For this to happen, three elements are essential.

First, we must have a clear vision or goal of what we want to achieve and which international system we want to create and establish. Second, we need to have a clear understanding of what the world looks like today and of the challenges and future ahead. And the third element constitutes the strategic use of available resources to achieve goals.

In other words, a proactive, forward-looking migration policy should be evidence based, building on analysis, strategic foresight and scenario-building.

Dealing with uncertainty and reducing uncertainty

Establishing a forward-looking migration policy is an inherently difficult task as forecasting itself faces many limitations. Forecasting is thus – to paraphrase the Bismarck quote that says "politics is the art of the possible" – also the art of the possible against the background of methodological and real-world limitations.

First, we are operating in a complex world of extreme uncertainty, where a multitude of factors may cause or contribute to migration. This is a world fuelled by global power politics, international conflict-induced displacement, the possibly disastrous repercussions of a pandemic, an economic depression that might have a destabilizing effect for years on prosperous and poverty-stricken societies alike (Reinhart and Reinhart, 2020), climate change, smuggling and human trafficking, and countless other challenges that may have a significant impact on global migration.

Second, we are operating in a field where research is still developing, and predictive methods and tools are evolving quickly, despite existing methodological, statistical, technological and even legal limitations (IOM and NIDI, 2020). It is therefore crucial that many distinguished experts and policymakers get together on a regular basis to define the way forward and exchange best practices.

Richard Fontaine, CEO of the Center for a New American Security, former member of the United States National Security Council and former Foreign Policy Adviser for United States Senator John McCain, recently said in a *Foreign Affairs* article: "Ultimately, the unpredictability of world events puts a priority on human judgment and undermines rigid formulas" (2019). That means that predictive tools and methods may not be able to detect the black swan amid all the white swans – they may not be able to predict singular migration events. However, in a world of uncertainty, they might contribute to a better understanding of present and future developments in global migration (thus reducing the uncertainty) and shed more light on such a complex phenomenon. We, in Austria, are therefore also working on our own predictive models.

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To name just one example, our current MiTrAs research project is developing new methods for the monitoring, early recognition and trend analysis of migration flows. A fusion of information from satellite images, open-source data and social media data shall be used to estimate developments in Northern Africa. The research findings will be presented by the end of 2020 and then internally evaluated.

Two preliminary conclusions can be drawn from the above. First, as Elizabeth Collett, Special Adviser to the IOM Director General, put it during the conference: "Exact predictions are impossible." This is particularly true when it comes to major disruptive events. However, it is still an effort worth undertaking. Second, forecasts are not an end in themselves but should be the basis for our actions – a guideline on how our limited resources are best used to shape the world we live in.

Linking foresight and scenario-building with migration policy

The second part of this article thus discusses the necessary link of forecasting and scenario-building with migration policy. Just like forecasting, migration and asylum policymaking is also the art of the possible. On the European Union level, we have been struggling for years to create a better, truly fair, and humane asylum and migration system. Given the multitude of drivers of migration, clearly a whole-of-government approach is needed for the external dimension of migration.

We need predictive analysis to approximate answers (or at least hints) on how and where we can react in a timelier manner to future crises – and help people in need of protection as early as possible in the region of origin. It goes without saying that forecasting can also contribute to combatting irregular migration and breaking the business model of smugglers, who spread lies about the situation in destination countries and cause much death and suffering along migratory routes.

Building scenarios based on sound migration forecasting tools is thus key to effective migration management and should help us guide our interventions and investments. For example, regarding information campaigns, predictive analytics may inform us where social media and online communication campaigns for potential migrants are most needed, to protect people from false promises and misleading information given by smugglers.

At present, Austria (just like many other States) is already investing in information campaigns – from Northern Africa, over the Western Balkans, to the countries along the Silk Route – focusing on the prevention of illegal migration as well as the possibilities and prospects of voluntary return. We are highly committed to placing an even bigger focus on the use of information campaigns and modern communication tools in the future. Of course, we would like these future campaigns to be much more targeted, in terms of both geography and content. Information campaigns need to be tailored to the local circumstances and challenges. It would also be very interesting to have more knowledge of what social media platforms can do in terms of predictions and how research and governments could cooperate with them to make migration predictions.

Migration forecasting and scenario-building can also give us clues in order to pursue targeted projects and capacity-building in and with countries of origin and transit. Ideally, we can arrive at concrete recommendations on where to best direct our resources to create an environment in which a possible scenario for future migration developments that is more favourable becomes more likely than another scenario that is less favourable. It might show us where we need to improve the economic and social situation and resilience of potential migrants and returnees, giving life to an effective whole-of-route approach.

Today, we are already helping countries like Tunisia to improve their border management systems and create economic perspectives as an alternative to irregular migration. We promote voluntary return activities in Bosnia and Herzegovina, and we want to become more active in providing protection and capacity-building in Eastern Africa. We are probably already moving in the right direction, but predictive analytics could contribute to making our actions more effective in terms of reaching the goal of developing a more resilient international migration and protection system. In short, forecasting might allow us to move from a *reactive* migration management system to a *proactive* migration management system, thus making better use of our available resources.

Finally, we want to be able to detect and predict mixed migration flows as early as possible, not only in third countries, but also at the European Union level. Forecasting can thus help national border protection forces and Frontex to be better prepared to secure the European Union's external borders, improve the reception capacities of European Union Member States and increase their general preparedness for new challenges.

Harbouring high hopes for migration forecasting

There is no doubt that we harbour high hopes for new predictive tools, as we are determined to lead the charge in contributing to the creation of a more humane and fair international protection and migration system. This system will take into account the interests of the migrants and refugees themselves, the countries of first reception and transit, and of course the interests and concerns of the receiving societies as well. Let us not forget that Austria's and the European Union's migration policies need popular backing and democratic legitimacy.

We want to continue and strengthen our commitment to supporting science in establishing functioning and effective predictive tools. We are very keen on knowing which models have real predictive value. A lot needs to be done, and we trust in the cooperation between science and governments to contribute to making the complex nature of migration a bit less intricate, opening the pathway to producing new and more targeted policies. In an ideal world, we can possibly formulate a proactive migration policy that provides the basis for action before crises, threats, conflicts and displacement, and large-scale international movements even occur. We must move forward jointly with a positive spirit to reach these commendable goals. ■

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Migration monitoring and preparedness at the European Union level: The need for multi-stakeholder cooperation

Zsuzsanna Felkai Janssen[1]

The refugee crisis of 2015 shed light on the urgent need to redirect the European migration and asylum policy towards a more efficient and coordinated response, both in normal times and in pressure and crisis situations. This response should be based on constant solidarity among Member States and on improved cooperation with third countries. Significant progress has been achieved over the years, starting from the negotiations launched in 2016 to reform the Common European Asylum System, to the legislative, financial and operational measures taken to upgrade the sustainability of migration management. While the combination of these efforts resulted in a considerable reduction of irregular arrivals, mixed flows of migrants and refugees have become more complex.

The New Pact on Migration and Asylum adopted on 23 September 2020 "will preserve the compromises already reached on the existing proposals and add new elements" for a comprehensive approach that brings together a number of policies in the areas of migration, asylum, integration and border management. Among the actions envisaged by the New Pact, the determination to work in order to reach a "stronger foresight, crisis preparedness and response" is worth mentioning (European Commission, 2020).

The New Pact aims to reduce the risk of being caught unprepared when faced with situations of crisis and force majeure, and to ensure that the principle of responsibility-sharing and individual fundamental rights are always respected. Then, in order to close the gaps and mitigate the inconsistencies that emerged during the 2015 crisis, the new Migration Preparedness and Crisis Blueprint was issued as part of the New Pact to "move from a reactive mode to one based on readiness and anticipation". The blueprint revolves around two core objectives – namely, monitoring and preparedness, and crisis management. These are key

to build resilience and enhance flexibility at the Union and Member States' levels in the face of different types of crisis. At the first stage, the blueprint outlines the steps to provide regular situational awareness and early warning/forecasting, as well as to support the preparation of the annual migration management report. In fact, real-time monitoring of the migration situation underpins the kind of evidence-based approach necessary "to increase anticipation and help to prepare EU responses to key trends". At the second stage, the blueprint ensures that up-to-date and comprehensive information is swiftly shared to all the relevant actors to prompt a timely, effective and coordinated reaction (European Commission, 2020).

A successful implementation of the blueprint relies on the achievement of broad consensus and coordination among all the stakeholders involved in what will be the European Union Migration Preparedness and Crisis Management Network ("the Network"). This includes the Member States, the European Council, the European Commission, the European External Action Service (EEAS), the European Asylum Support Office (EASO), the European Border and Coast Guard Agency (Frontex), the European Union Agency for Law Enforcement Cooperation (Europol), the European Agency for the operational management of large-scale IT systems in the area of freedom, security and justice (eu-LISA), and the Fundamental Rights Agency (FRA). The Network should ensure that relevant information is selected and exchanged for the two stages, and to this purpose, it should establish implementation guidelines and appoint a Point of Contact. The Network should also set up bilateral and multilateral channels of cooperation with third countries of origin, transit and/or destination when needed.

As the Network should perform its tasks by using existing tools and complementing them with new ones, the challenge will be to harmonize the operationalization of the blueprint with the instruments already available. Since 2016, in the area of monitoring and forecasting, the European Union Integrated Political Crisis Response (IPCR) web platform and the Integrated Situational Awareness

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and Analysis (ISAA) have made it possible to collect and elaborate data in a way that helps decision makers and policymakers anticipate surges in arrivals.

While the lessons learned with IPCR and ISAA remain a solid base for enhanced situational awareness, technical advancements have broadened the horizon of analytical possibilities. In particular, artificial intelligence tools offer a direction that is worth exploring in looking for an alternative to ISAA. Different techniques and approaches involving artificial intelligence tools such as machine learning, machine reasoning and robotics have been widely employed in the private and public sectors. For example, artificial intelligence tools have proved to be useful in assisting decision-making by aggregating and categorizing data to complete experts' assessments with analysis or estimates of probabilities. An early-warning system and a prevention mechanism able to identify emerging trends and developments both in the European Union and in third countries of origin and transit, in a highly reliable and timely manner, could support the European Union and its Member States in their work to put in place necessary preparatory and preventive measures. To this end, the European Commission is conducting a feasibility study on a forecasting and early-warning tool for migration based on artificial intelligence technology.

The aim is to provide an analysis of the feasibility of developing a tool based on artificial intelligence technology that might provide a certain degree of anticipation and support analysts and policymakers in their decisions. The study should determine the possibilities and conditions needed to design a tool capable of forecasting migratory flows and predicting potential critical situations, within the European Union and in third countries. This tool could have an impact on migration and asylum, both in the short term (one to four weeks) and in the medium term (one to three months). The preliminary findings of the study resulted in an assessment at different levels of the feasibility and of the risks associated with such a system, considering the current normative framework, and in a series of recommendations based on it.

The existing literature on forecasting in migration management has noted a number of limitations that might need to be taken into account (IOM and NIDI, 2020). One issue is data sources. There are no homogenous definitions and parameters to measure different types of migration across countries, and national data can be missing, incomplete or biased. Recently, the analysis of big data – such as social media feedbacks, Google search terms, phone records and so on – has opened new paths of research. However, while these data are timelier and more consistent than administrative ones, privacy and ethical concerns as well as the limited diffusion of social media globally represent major drawbacks. Second, the drivers of migration are many, complex and constantly evolving, accounting for events that are not predictable – the so-called black swan events (wars, conflicts and pandemics). At the same time, real-time monitoring of worldwide events through open sources – such as broadcast, print and web news – may be hindered by media bias. While uncertainty cannot be ruled out completely, these shortcomings may be minimized by combining more data sets, both quantitative and qualitative, to enhance the precision of the predictive analysis.

According to the study's preliminary findings, the most significant output for an artificial intelligence tool in the area of predicting and forecasting migration flows would be forecasting on the number of irregular arrivals at the European Union external borders along all routes and its variation across time. This kind of predictions could improve preparedness not just of frontline European Union Member States but also of Member States interested with secondary movements, increase the effectiveness and timeliness of border management and asylum operations, and incentivize political and international cooperation on migration management. At the same time, the need to hone existing monitoring and forecasting tools was highlighted, in order to exclude events in third countries that do not necessarily affect migration to the European Union.

The lack of collaboration among European Union actors on migration data sharing and access as well as the gaps in the quality of data sources, data-reporting timeframes and data registration were also stressed. One possibility to address this concern could be the creation of a central migration data management system starting from the Central Repository for Reporting and Statistics under development by eu-LISA, with the aim of collecting data produced by different systems and making them available. Moreover, a governance structure should operate and manage this tool and the information it produces, while a quality monitoring and assurance system should process the data input and output.

At the legislative level, the development of a forecasting and early-warning artificial intelligence tool for migration aligns with European Union primary legislation – in particular, with Article 77 of the Treaty on the Functioning of the European Union (TFEU). The design and operationalization of the tool should take into consideration all the relevant European Union primary legislations (TFEU, Treaty on European Union, and the Charter of Fundamental Rights of the European Union), along with European Union secondary legislation and the mandates and coordination mechanisms of the relevant European Union agencies, in order to guarantee that all its potential users remain accountable and transparent and that fundamental rights are protected.

Central to the organizational assessment is the appointment of the host of the artificial intelligence tool, which should be individuated according to criteria referring to three groups: operations, analysis and dissemination. The identified host might need to strengthen their operational/analytical capacity and develop coordination mechanisms to ensure that different tasks may be performed by multiple agencies. The host entity should also guarantee that dissemination of the artificial intelligence tool's output is adjusted to fit the needs of different audiences and that European Union agencies, institutions and bodies have variable access to said tool according to the confidentiality level of the data sources.

At the operational level, the artificial intelligence tool's life cycle was identified as composed of five stages: data treatment, application development, training, execution and decommission. The architecture of the artificial intelligence tool would be formed by components corresponding to three scenarios (low, medium and high), determined according to different levels of ambition and/or resource availability. In order to comply with the Ethics Guidelines for Trustworthy Artificial Intelligence published by the European Commission High-level Expert Group on Artificial Intelligence (AI HLEG), a trustworthy artificial intelligence framework should revolve around four elements: fairness, explainability, monitoring and governance. The objective of the framework is to measure the requirements of human agency and oversight, robustness, transparency and accountability, which are core components in developing lawful, ethical and robust artificial intelligence tools. Finally, the risk assessment pointed at 38 risks in three areas: business, organization and technology. The importance of each risk (low, medium

or high) was assessed, and its likelihood was evaluated (unlikely, occasional, frequent) along with its impact cost (low, medium or high). The risk analysis helps determine the strategy to address the identified risks throughout the project implementation by applying contingency planning, tracking and evaluation of the risks.

The study will be completed on 18 November, and its final results will be made available thereafter. ∎

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