The Migrant Integration Platform MICADO - A **Tool for Social Integration and Cohesion**

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Abstract

Anchored in the domain of migrant integration, the article reflects cross-national ICT development for public services. It reports about MICADO, a digital platform bringing together business intelligence, data analytics and visualisation in support of migrant integration management in EU cities. Resulting from a Horizon2020 innovation action, the solution targets public authorities, civil society organisations, and migrants, by providing information access, data exchange, and navigation across institutions. The paper examines challenges of embedding a new platform in the administation and data environments of cities and discusses the complexities of a solution aiming to address multiple target groups in multiple application areas. The text illustrates how MICADO created solutions responsive to local specificities while securing sustainability and institutional uptake. Finally, MICADO is discussed as a potential conceptual blueprint for similar challenges in the European public sector.

Keywords

Public Services, Migration, Government Technology

1. Background and Ambition

This article reflects on the potentialities and limits of cross-national innovation activities for ICT services in the public sector, as targeted by various EU funding programs. The paper discusses how complex processes of software design and development can be shaped in accordance to sensitive socio-cultural demands, and in respect to constellations determined by multiple stakeholders and application scenarios. Analysing the case of the Horizon2020 Innovation Action MICADO, the text introduces a novel conceptual approach that can serve as a future blueprint for challenges of similar nature. The acronym MICADO stands for "Migrant Integration Cockpits and Dashboards". The project brought together partners from public authorities, universities and ICT companies in Antwerp, Bologna, Hamburg, and Madrid in order to develop new services in support of migrant integration. Coordinated by the Digital City Science group at HafenCity University Hamburg, the consortium was designed to provide for an effective innovation process between authorities, research institutions, civil society and migrants in each of the partner cities. The partnership comprises fifteen institutions from five countries, conveying expertise from public administration, migration research, software development and city science. Running from 2019 through 2022, the project efforts have culminated in a novel digital solution whose prototype has been tested in four pilot cities – each one representing a hot spot of migrant integration in Europe. The solution aims to ease local challenges by enabling a user-driven exchange between migrants, public authorities and civil society organisations, and to fill in still existing gaps in terms of data availability, information access, and targeted servicing. This study is of particular importance in times of rising migration flows towards Europe, the inner-European discussion about the distribution of migrants and the aim of harmonizing asylum procedures

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among the member states. An improved cooperation both between European states but also within cities administrations and CSO can contribute to facilitate integration processes and to create better coping mechanisms and strategies to accommodate and integrate migrants. The project's very ambition was to exploit state-of-the-art ICT, data science and business intelligence in support of migrant integration, and to provide for effective analysis and management of migrant information by way of advanced visualisation tools, such as data cockpits and dashboards. To solve the problems of insufficient information linkage and data provision about and for migrants, MICADO aimed to tap the multiplicity of migrant-related data from all accessible sources in the cities, and to link them through a platform serving all user groups.

Complementing this technical goal, and building upon research in the fields of service design and co-creation [1], [2], the consortium also wanted to resolve a methodological deficit by testing a novel conceptual approach that would bring all relevant stakeholders into a goal-oriented innovation process. The working hypothesis was that well-designed co-creative interaction of all relevant stakeholders would catalyse migrant services provision on new levels of quality, transparency, and integrity. Therefore, the project envisioned a carefully calibrated linkage of three target groups which were recognised not as isolated but digitally interconnected entities:

- 1. Public Authorities (PA): Local authorities in charge of the administrative and legal processes concerning migrant integration;
- 2. Civil Society Organisations (CSO): Associations and citizens' initiatives actively engaged with migrants' integration;
- 3. Migrants: Especially non-EU country nationals (including 1st generation non-EU migrants), and EU migrants who were not born in the country of residence.

By investigating and cross-linking the needs and objectives of these target groups, the MICADO project was to design attractive digital services that could facilitate effective integration processes. Enabling communication and data flow between all stakeholders, it was to simplify and accelerate administrative integration paths, and achieve a substantial reduction of societal expenditures for the integration of migrants. Acknowledging both the diversity and scattered distribution of service applications and a lack of coordination between public and civil society actors — not only across Europe but also within each city — the project envisioned a digital "one-stop-shop". A first common denominator across the different geographical and cultural contexts was given by the four fundamental challenges in migrant integration management which need to be addressed in concert: housing, health, education, and employment. As each of these domains is usually addressed by a specific authority or administration in each city, cross-institutional data integration appeared to be a logical approach. However, organisational and technical constraints obstruct its implementation in practice. A second major challenge is the generation and usage of data by the migrants themselves — who are often difficult to reach. The creation of detailed knowledge by, for, and about migrants, however, is requisite for the provision of targeted services (Figure 1).

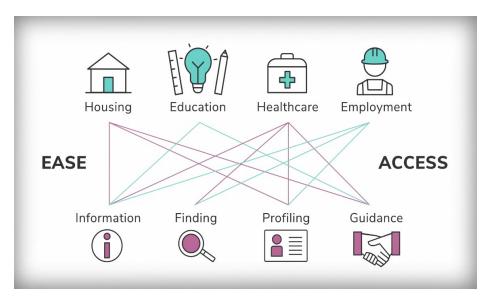


Figure 1: Application domains and basic services offered by MICADO (Source: MICADO)

On the backdrop of these challenges, the article discusses and reflects the inherent complexities of a society-oriented ICT venture that needs to address multiple target groups and application areas within highly diverse socio-technical settings – which the EU with its regions and cities certainly represents.

2. Digital Solutions for Migrant Integration Management: State of the Art and the MICADO Product

As a software development venture aiming to support the integration of migrant communities into European cities, MICADO is embedded within a wider landscape of digital solutions, many of which relate to agendas for ICT innovation and data policies set forth by the European Commission or related entities [3]. The Riga Ministerial Declaration issued by the conference "ICT for an inclusive society" (2006) envisioned the promotion of ICT as an effective tool for social inclusion as well as for the enhancement of creativity and civic participation of migrants and minorities (Article 24, European Commission, 2006). A growing body of literature indicates the benefits that derive from the use of ICT and digital tools for integration and inclusion [4], [5]. These findings found consistent and formal recognition by the EU, namely through policies addressing ICT development for the response to disadvantaged populations' needs, for instance in the strategy "i2010: A European Information Society for Growth and Employment" [6] or the "Europe 2020 Strategy" [7]. The more recent "Action plan on Integration and Inclusion 2021-2027" [8] encourages member states to ensure the accessibility and inclusivity of digital public services, whose creation and design should be based upon consultation also of the migrant population. Common to these framework documents is the notion that ICT has a profound impact at every stage of the migration trajectories – namely premigration, mobility, and settlement. This applies for the perspective of the migrant (who accesses information and resources, maintains transnational relationships, sends back remittances), for the perspective of national and supranational management entities (which observe and control migration flows), as well as for the perspective of migrant advocacy groups and associations (which intervene on the ground to facilitate reception, transit, and integration) [9], [10], [11]. Importantly, it is contested that the use of digital technologies by migrants, CSO and PA lies at the sensitive intersection between empowerment and surveillance through migration control [12].

As an ICT solution, MICADO embedded within a wider landscape of public services and useroriented applications supporting the EU agenda. One deliverable [13] has reviewed the landscape of existing technical solutions for migrant integration, focusing on the definition of user requirements, and outlining guidelines for the selection of functional components for the development of the future software application. Based on the experiences from other digital solutions for migrant assistance, key requirements for MICADO could be derived: simple user interfaces, culture sensitive design, language barrier avoidance, interactive visual and textual information, user privacy protection. The chapter "Interactive ICT functionalities" in the deliverable D2.1 relates the features of the MICADO product to similar functionalities of existing apps such as RefAid, ImMiGrantapp, or App4refs [14]. The document also indicates the heterogeneous data availability as well as the limited comparability of datasets stemming from multiple geographical locations with different migration contexts as major methodological constraint.

Most of the already existing applications focus on the necessities both for immigrants and refugees (language, health, education, housing, legal aspects). In addition, some of them include the possibility of creating communities and communicating between users with the same characteristics in order to share experiences and to help each other. Many apps focus on social integration, providing cultural events and language learning features. Some apps have an integrated map to locate points of interest. Most apps so far have been developed for a specific region or country.

MICADO on the contrary aims to provide an umbrella framework that can be easily adapted to different contexts and locations from small villages to metropolitan regions. In fact, very few applications are developed by country authorities or trusted entities such as wellknown NGOs . This causes the information to be unreliable to the immigrant/refugee. MICADO instead of focusing on one target group, like many of the other apps, creates a link between the different actors involved in immigration and integration processes. The logic of content provision foresees a multi-step approach during content generation, meaning that until information appears in the migrant application, it needs to be translated and validated, both if it was added via the interface for PAs or CSOs. This ensures accuracy and trustworthiness of all entries within the MICADO ecosystem.

Different local, regional, and national indicator structures for the target domains (housing, labour, education, and health) pose a substantial difficulty for ICT solutions that want to create a coherent setting and supply meaningful data for migrant integration. Comprehending these challenges, the MICADO project managed to put forward a product on Technology Readiness Level (TRL) 7 – that is: a field-tested and ready-to-use ICT prototype. The very product itself is a complex solution composed from three separate service applications (one per target group) which, however, interconnect via the system backend (Figure 2):

- 1. PA application, through which administration operators are able to monitor migration events at the local level and process individual migrants' cases;
- 2. CSO application for third sector entities that allows for the dissemination of information on services targeting migrants;
- 3. Migrants application with multi-lingual virtual assistance through which individuals are able to receive guidance on integration processes, access relevant information, and store their documents a.o.



Figure 2: Distinct yet connected applications for three target groups (Source: MICADO)

To adequately address the three target groups, the web design, contents, and user rights are structured differently per each application. Generally, migrants are viewed as the main users, while local CSOs and PAs produce content, monitor integration progress, and gather and exchange information about the users. For migrants, the platform presents easy information access and communication channels, interactive assistance, as well as institutional navigation through the processes of arrival and integration. Given their diverse backgrounds and different levels of literacy, the application provides for easy and intuitive handling, avoiding extensive and legalistic texts. Graphical elements are to support low-threshold accessibility and quick comprehension. To overcome language barriers, MICADO users can access content in preferred language, such as Arabic, Chinese, Ukrainian, or Dari. For illiterate users, the solution capitalises on reading tools that provide an auto read-functionality. The universally applicable MICADO prototype comprises the following key functionalities that are thoroughly linked by way of internal data exchanges and communication processes:

- Info Portal: Provision and exchange of valuable information for migrants
- Step-by-step Guides: Guided processes towards migrant integration
- Courses & Events Monitor: Publishing activities for migrant integration
- Migration in Figures: Display and analysis of local migration statistics
- Migrant & CSO Accounts: Display and management of service accounts
- MICADO Analytics: Tracking of the platform's activities and performance

The listed functions include a range of sub-functionalities, such as a personal portal with a document wallet, a registration and consent management feature, an overview of personal integration process, as well as a dashboard solution called "Migrant Situation Monitor". Detailed descriptions of technical features as well as scientific results are accessible via the project's website (www.micadoproject.eu). More detailed information on the MICADO ecosystem and the implementation of its components is made available on a webpage for solutions exchange (www.solutions.micadoproject.eu).

The software codes are published with the copy-left open source public license scheme of the EU (EUPL European Commission's European Union Public License) on the repository GitHub (https://github.com/micado-eu/). The components described above form what the consortium had labelled the "universal MICADO" – that is: the generic solution prepared for and provided to all partner cities.

The MICADO ecosystem has adopted a circular design approach in software development, as laid out in the design framework of the MacArthur Foundation [16]. This means that the overall system architecture has been designed enable a simple maintenance of the components, as well as to facilitate to reuse, refactor and recycle these based on the needs of its adopters. Practically, this translated into the adoption of containerization software (Docker) in development and deployment, which enables to run specific components in a coordinated, though individually independent mode [17].

As an example, MICADO uses a PostgreSQL database to store all required information hosted within the installation (including user information, available languages, en- and disabled functionalities). All included containers (e.g. the interface for migrants, the translation platform, the identity management) query the same data source. However, if an adopter decides to use another DB system (e.g. MySQL), the container can be changed and with relatively little adaptation the same connections can be established to re-enable data flows between the components.

During the course of the project, the containerized approach has been proven useful, on the one hand because it enabled a better coordination and delegation of technical development efforts, on the other because of easing an update of the system architecture during the course of the project. This has happened multiple times, for example as an API-manager component has been removed from the architecture and identity management swapped the initial tool implemented within the MICAO ecosystem.

The overall modular approach within the project has also been a premise to meet the main objective of the project to further derive local "MICADAs" whose functional profiles would more closely respond to the specific conditions of each city. This adaptation process is explained in detail in the following chapters.

3. Contextualising the Solution and Adaptation to Local Demands

The transformation of the general MICADO solution into multiple local and context-specific applications for each pilot city ("MICADAs") was a key challenge in the overall project pursuit. The prerequisite for the successful pilot implementation of the project was building the universal Minimal Viable Product (MVP) [15] as a modifiable structure that allowed for adaptation to different local conditions. Although the universal MVP represents key requirements and features shared by all four pilot cities, specific demands would still vary from place to place. The translation of highly specific user needs into local MVPs constituted a second development phase within the project which would not result in a "one for all" solution but branch out into multiple derivatives. This was possible due to the technical decision to design the universal MVP in a modular way, based on a set of key functions that could be enabled or disabled in order to adjust the individual MICADAs to local requirements. To facilitate the successful contextualisation of the universal MICADO into multiple MICADAs, the decentralised project structure proved to be pivotal. It gave high independence and flexibility to local stakeholder groups in terms of involving specific institutional and social environments. Thus, customised local stakeholder networks could form with a capacity to operate, further develop, and utilise the local solutions. In the process of adaptation, these groups played a crucial role in bringing together migrants, PA officials and CSO representatives in each place. Each pilot city's group had a different composition in terms of organisational structure, expertise, and activity range, thus clarifying the differences between the locally adapted MICADAs. The proactive work of the LESCs catalysed the local adaptation and conveyed the appropriate means for it, while securing a constant update of information and relevance of content in the application.

Each city's local group created context-specific use cases and personas to determine the MVP features to be included in the customised versions and tested with end-users. In addition to the different sets of features for each city (Figure 3), the local solutions predictably also presented different content for each domain. A multiplicity of factors finally determined both the angle and the selection of content for the app – including the desiderata identified at the initial research stage of the project, the user stories generated in the co-creation phases, or the availability of data or local technical support.

MVP Feature \ City	Antwerp	Bologna	Madrid	Hamburg
Guided Processes	X	X	X	X
Info Portal	X	X	X	X
Personal Portal	X	X		
Document Wallet / Register	х	х		
Integration Task Monitor	Х	X		
Migrant Situation Monitor (MSM)		Х	Х	Х
Consent Manager	X	X	X	X

Figure 3: Distribution and activation of key-functions in pilot cities (Source: MICADO)

In the case of Hamburg, for example, the local team decided against implementing functions that collect personal data from migrant groups. The intention was to align with the strict General Data Protection Regulations, and to secure the data of vulnerable groups to a maximum. However, the Hamburg stakeholder network had identified the digitisation of the so-called "Situation Report on Refugees" a relevant use-case for MICADO. The Situation Report is a public document regularly issued by the refugee management task force in the city administration, collecting relevant migration indicators and processing trends. During the co-creation and convergence activities of MICADO, Hamburg's authorities expressed an interest in transforming the report from a conventional print document to an interactive, digital solution. Throughout the development process, this idea transformed into a central use case for MICADO, resulting in the dashboard application of the "Migrant Situation Monitor". Generating interactive and accessible charts on the ground of migration data inputs from PA users (Figure 4), it became a component of the universal MVP since also the other cities wished to harness its utility.

The focus on a clear layout and simple interface is a strength across all interfaces, especially of that addressing migrant users. During usability testing and piloting with end-users, targeted questions were included in the guidelines and questionnaires to inquire about the cross-cultural understandability of symbols and icons, such as for the button for language selection or the glossary, which have been updated multiple times during the development process.

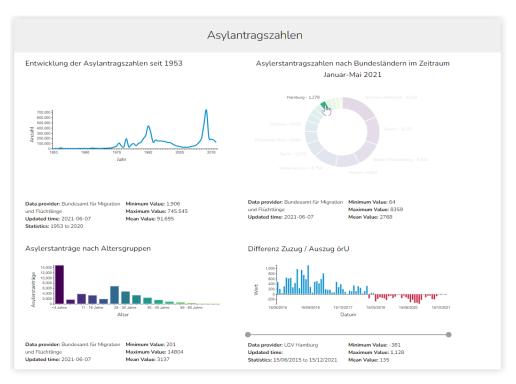


Figure 4: PA interface for Hamburg-specific Migrant Situation Monitor (Source: MICADO)

4. Outlook and Project Sustainability

Third-party funded research projects – especially those in which large multinational consortia are equipped with substantial resources – face the challenge of securing their sustainability beyond the actual funding period. Many digital solutions created with large public support have ended up as "abandonware". Recognising that specific uptake measures are needed if a project is not to remain just an experiment, and that research is not getting lost in archives, securing the future continuation of the MICADO solution emerges as the central task. Already in the pre-project phase of MICADO, the sustainability of the solution had been identified as a crucial issue and targeted activities were included in the project design. Since the project's start a constant dialogue with local agencies and city administrators has been curated to prepare the "survival" of the results and outcomes in the long run. Most eminently, the work package for "Local Solutions Development & Exchange" was drawn up to address the proliferation, continuous development and usage of the platform solution, and to enhance the intellectual exploitation of the research products by the scientific community. Besides strategies that address the local uptake in the four pilot cities, the work package also targeted broader dissemination concepts that reach beyond the original partnership (e.g. establishing a non-profit organisation, social venture, or foundation), in order to make it a universally accessible solution. The main instruments in support of these objectives are so-called "Uptake and Sustainability Plans" (UASPs). These plans are to support the pilot cities in their decision concerning the terms by which MICADO will be embedded in their digital and administrative ecosystems. The plans are drafted from a double perspective, taking into account the two-fold nature of this European scale innovation venture which resulted in the universal MICADO solution, but also in a multiplicity of local MICADA solutions. This implies a General UASP that works on a higher and systemic level, and relates to a larger range of locations across Europe. In parallel, Local UASPs were created that acknowledge the specifics of the four pilot cities – which naturally represent the first sites for a potential long-term application. The General UASP defines common goals for all post-project sustainability efforts pertaining to the maintenance of MICADO's open-source identity, the

continuation of operations and funding, as well as the synchronization of scientific-technical refinements with the evolution of practice-side user requirements. The plan defines three generic levels of uptake and sustainability to be considered in any local instance, and indicates the respective stakeholders to be addressed:

- 1. Usage: regular application in professional work context (solution owners)
- 2. Hosting: technical deployment and maintenance of operations (IT provider)
- 3. Development: exploration of use cases and technologies (developer community).

In contrast, the Local UASPs of each pilot city comprise site-specific measures and means that help transform the universal MICADO solution into contextualised derivatives – the local MICADAs. The Local UASPs comprise tutorials and guidelines for adaptation activities and formats on site. With them, each city can clarify how far one institution can accommodate the three levels of uptake (as outlined in the General UASP), or whether a more complex scheme distributing the roles across different parties is necessary.

The decision to use only open source components within the MICADO ecosystem enables flexibility of customization and facilitates adoption in potential use cases, as no additional costs are required for licensing or usage. The platform and all its components are hosted on the same server, meaning that adopters are not dependent on the availability of external services. At the same time, opting out from using proprietary tools naturally leads to a scale-down of the scope of available functions. As an example, even though the MICADO platform is able to display content regardless of languages and scripts, the text-to-speech function is available only in a very few of them.

As the development and training of such a component is very costly and complex, it is challenging for developers to generate accessible and open source tools without financial backing. This highlights the importance of (financial) incentives from public bodies not only to create ready-to use solutions and ecosystems such as MICADO, but also to develop basic components to be used in such initiatives.

MICADO's uniqueness, which might prevent the app from becoming "just another app" is its all-encompassing character, being one application that addresses three very different actors in the field of migration through its three connected interfaces. The information being inserted by the government agencies create a trustworthy information source, which – depending on the work flow of the respective governmental agency – always contains the most up to date insight regarding asylum procedures and other aspects of integration. Providing all necessary information can be an empowering tool for migrants throughout their integration process [18].

Nonetheless, here lays also one of the weakness when implementing ICT solution for social services and especially for migration and integration matters, which are highly complex and contested. As the overall MICADO solution comprises the option to collect personal data and to create personal integration plans, there is a risk of misuse, especially by restrictive and conservative governments, to use it rather as a tool to control migration [19].

Considering the challenges that commonly obstruct innovation projects run by supranational and multidisciplinary consortia, the successful development and pilot testing of MICADO may count as a significant scientific and technological achievement. The strong interest to further the solution, as expressed by public administrations as well as from partners in science and technology, hints at a potential long-term sustainability of the product. This makes MICADO a promising conceptual pattern for similar research and innovation challenges in the future, targeting ICT systems in the public realm. Its generic applicability to a variety of contexts makes it suitable especially for multinational and transdisciplinary partnerships which need to recognize, process, and transform complex socio-technical requirements into feasible technical solutions.

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The data that support the findings of this study are openly available on the website of the MICADO project (www.micadoproject.eu) in the subsection "Project/Project Reports" https://www.micadoproject.eu/project-reports/. The source code of the MICADO platform is published under EU Public License (EUPL) on the open source repository github: https://github.com/micado-eu/

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