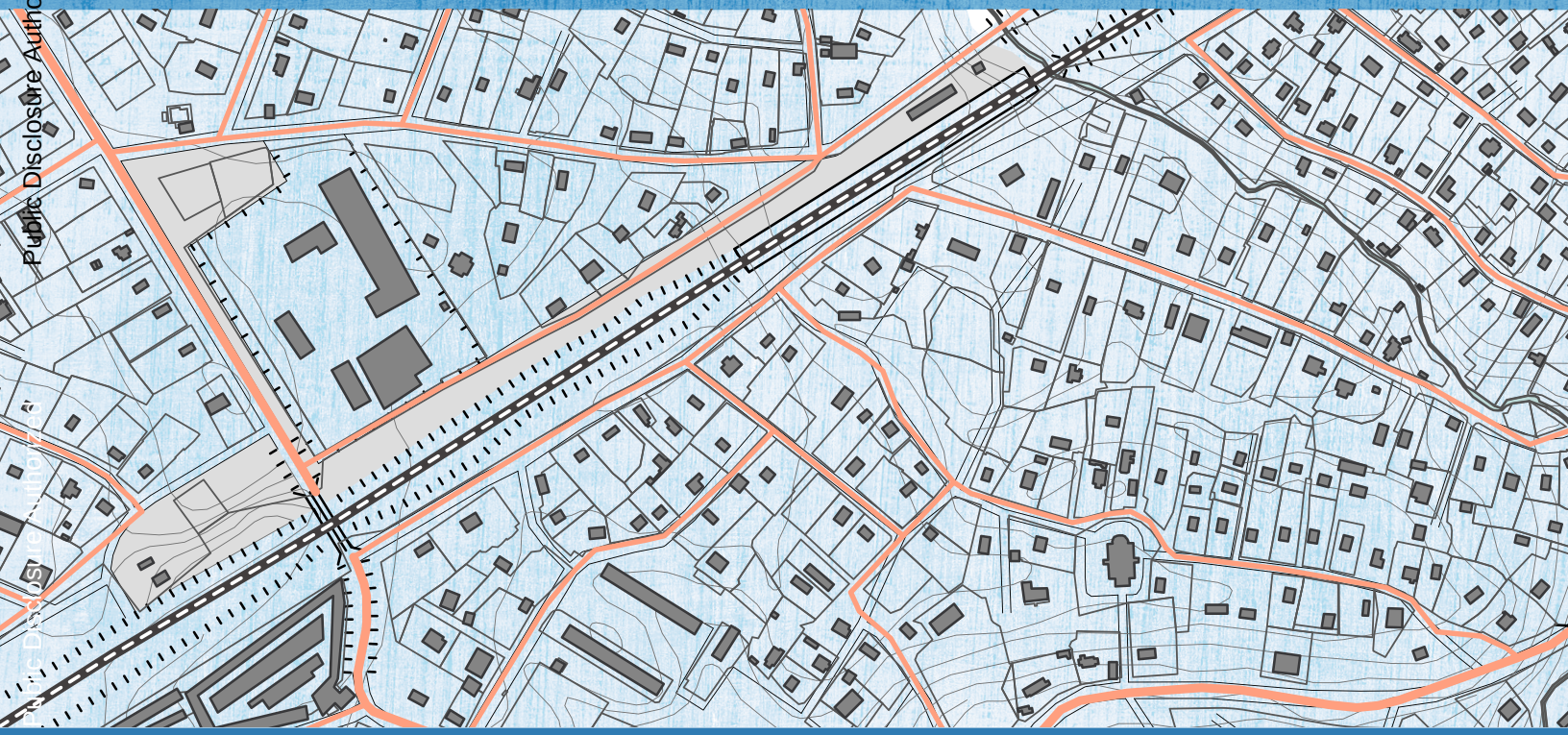
TECHNICAL NOTE

Leveraging Geospatial Technology for Financial Inclusion

FINANCIAL INCLUSION SUPPORT FRAMEWORK

SEPTEMBER 2020



WORLD BANK GROUP

Ministry of Foreign Affairs of the Netherlands

FINANCE, COMPETITIVENESS &
INNOVATION GLOBAL PRACTICE

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BOXES AND FIGURES

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NOTE

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ACRONYMS AND ABBREVIATIONS

ATM	automated-teller machine
FAP	financial access point
FISF	Financial Inclusion Support Framework
FSP	financial service provider
GPS	Global Positioning System

INTRODUCTION

Policy makers increasingly recognize the role of strengthening access to financial access points to drive broader financial inclusion. Individuals, households, and firms need appropriate financial products and services that are conveniently, cheaply, and safely accessible for saving, borrowing, making and receiving payments, and managing risk on a regular basis. However, proximity to financial access points continues to be reported as one of the major barriers to financial inclusion.[2] Additionally, access is not evenly distributed across the population; more vulnerable groups are likely to face poorer access.

Proximity to financial services should hence be viewed in terms of both its level and its distribution across space and population. Although many access points[3] per capita may exist in some areas, other areas may be left behind. The absolute number of access points in a given region may mask the fact that most of these points are concentrated in large cities (and not distributed more equally according to population). In fact, empirical evidence shows that distribution of financial services is often highly skewed toward cities; services tend to cluster in areas that are more urbanized and in populations with higher income levels and education.[4] Such concentrated distribution is especially true for traditional brick-and-mortar financial access points such as physical branches of financial institutions, whose high set-up costs may influence placement toward areas with known high profitability. It is possible that areas outside of those outlined above are also profitable, but the significant costs of exploring and identifying such potential areas add to the already high initial costs, making it difficult to build a business case for expanding into new territories. In developing countries, this often means that significant portions of the population, especially those whose income is low or reside in rural areas, are deprioritized and left underserved.

The advent of innovative financial services and channels, such as banking agents and mobile money, offers an opportunity to enhance access to financial access points, and ultimately financial inclusion, to previously underserved customers. Agents in particular have played a key role in enabling financial inclusion and extending services particularly to rural clientele. Yet, despite these initiatives, an estimated 1.7 billion adults continue to lack access to a basic transaction account, and many more remain underserved (Demirgüç-Kunt et al. 2018). The lack of financial access points outside urban centers, and particularly in rural areas, not only is prevalent with commercial bank branches but often also extends to other types of access points, including those intended to cater to rural markets. For instance, in 2015, only 31.5 percent of microfinance institutions in Nigeria were based in rural areas (Musuku et al. 2015). Furthermore, certain financial services, such as account opening or identity verification, may require a physical financial access point, as remote options may not be technologically possible or supported by regulations. Concentration of financial access points in urban areas not only risks leaving behind underserved communities but may also contribute to the duplication of efforts in highly saturated areas.

Governments have often attempted to tackle low access to financial access points with incentives or requirements for financial service providers to open financial access points in underserved regions.[5] However, it is difficult for financial service providers and policy makers alike to identify gaps in the provision of financial services without understanding the geographic distribution of existing financial infrastructure. Highlighting regions to prioritize in expansion of financial access points is even more difficult, as it requires understanding of geographical context, such as how the underlying population is distributed relative to access points.

New tools allow policy makers to address the above constraints and formulate better policy for boosting access to financial access points. One such tool is geospatial technology, which is becoming increasingly popular with respect to financial inclusion, as geospatial data can be leveraged to map existing access points and assess the distribution of financial services. Geospatial technology allows authorities to identify gaps in existing coverage clearly, often with much higher precision than is otherwise possible. This allows for policies that enable better targeting of the underserved through more precise identification of where expansion efforts should be prioritized.

This purpose of this note is to provide financial-sector authorities and other stakeholders with practical guidance for leveraging geospatial tools to inform financial inclusion policy making. To do so, this note draws from the work conducted as part of the **Financial Inclusion Support Framework** (FISF) program. The FISF program is a multidonor initiative that provides technical assistance to promote financial inclusion in eight countries. It supports policy and regulatory reforms, financial-infrastructure development, and other measures that catalyze private-sector financing, knowledge, and innovation. The ultimate objective is to enable low-income households and micro, small, and medium enterprises that are currently unbanked or underbanked to use a broad range of financial services such as payments, savings, insurance, and credit.

FISF supported financial regulators in three countries (Ethiopia, Pakistan, and Mozambique) to utilize geospatial technology for financial inclusion. This note also leverages insights from other country case studies as well as broader geospatial resources. The rest of this note will present (i) an introduction to geospatial data (section 1); (ii) an analysis of how geospatial technology can be used in the context of financial inclusion (section 2); (iii) a discussion on how policy makers can use geospatial technology (section 3); and (iv) detailed case studies from implementation in Pakistan and Ethiopia under the FISF program (section 4).

NOTES

2. According to Findex 2017, "financial institutions being too far away" is the fifth most commonly cited barrier to account ownership.
3. A financial access point is defined here as a physical touchpoint that offers access to a formal financial service. These include but are not limited to bank branches, bank agents, microfinance institution branches, microfinance institution agents, automated-teller machines, mobile money agents, and point-of-sale terminals.
4. For example, see Kumar 2005 and Claessens 2006.
5. For example, see Pakistan's Branch Licensing Policy or India's Rationalization of Branch Authorization Policy.

1

WHAT IS GEOSPATIAL DATA?

Geospatial data refers to any data that contains a geographic element. This means that the dataset includes locational information for each data observation. Location information can vary, ranging from highly precise (for example, Global Positioning System [GPS] coordinates or a complete address) to less precise (for example, neighborhood, city, zip code). Geospatial information makes it possible to visualize data on a map. This can be especially important for understanding spatial relationships, including any trends over time.[6]

While several types of geospatial data are relevant to financial inclusion, mapping financial access points (FAPs) is of particular interest when considering access to finance. A FAP can be a bank branch, an automated-teller machine (ATM), a mobile money agent, a credit union branch, a point-of-sale terminal, a microfinance institution branch, or any other touchpoint offered by a financial service provider (FSP). Any type of FAP can be mapped using locational data. If precise locational data is available, such as exact GPS coordinates or a complete address, then a specific point in space can be used to refer to the position of the FAP. Figure 1 illustrates ATMs in Pakistan based on their GPS coordinates. (The circle around each ATM point has a five-kilometer radius and depicts the area of reasonable access to the ATM.)

Although highly precise geospatial data is ideal for accurate mapping and analysis, it is not essential. In the absence of an exact location, a partial address may be used, which may include information such as a street, neighborhood (for example, postal or zip codes), and/or administrative unit (for example, town or district). Many central banks already collect basic locations of access points in some way, and these data points can often be leveraged to develop insightful maps, even if data is collected at only a coarse level (for example, town or district). Hence, the availability of precise locational data should not be a precondition for utilizing geospatial tools.

Figure 2 illustrates an example of mapping the ATM points in figure 1 if only the tehsil (or sub-district) is known instead of the exact GPS coordinates. The black lines outline the shape of each tehsil, while the color of the shading indicates the number of ATMs contained within it (per 100,000 people). Due to limited information, the map in figure 2 can depict the tehsil for the ATM, but not where the ATM resides within the tehsil.

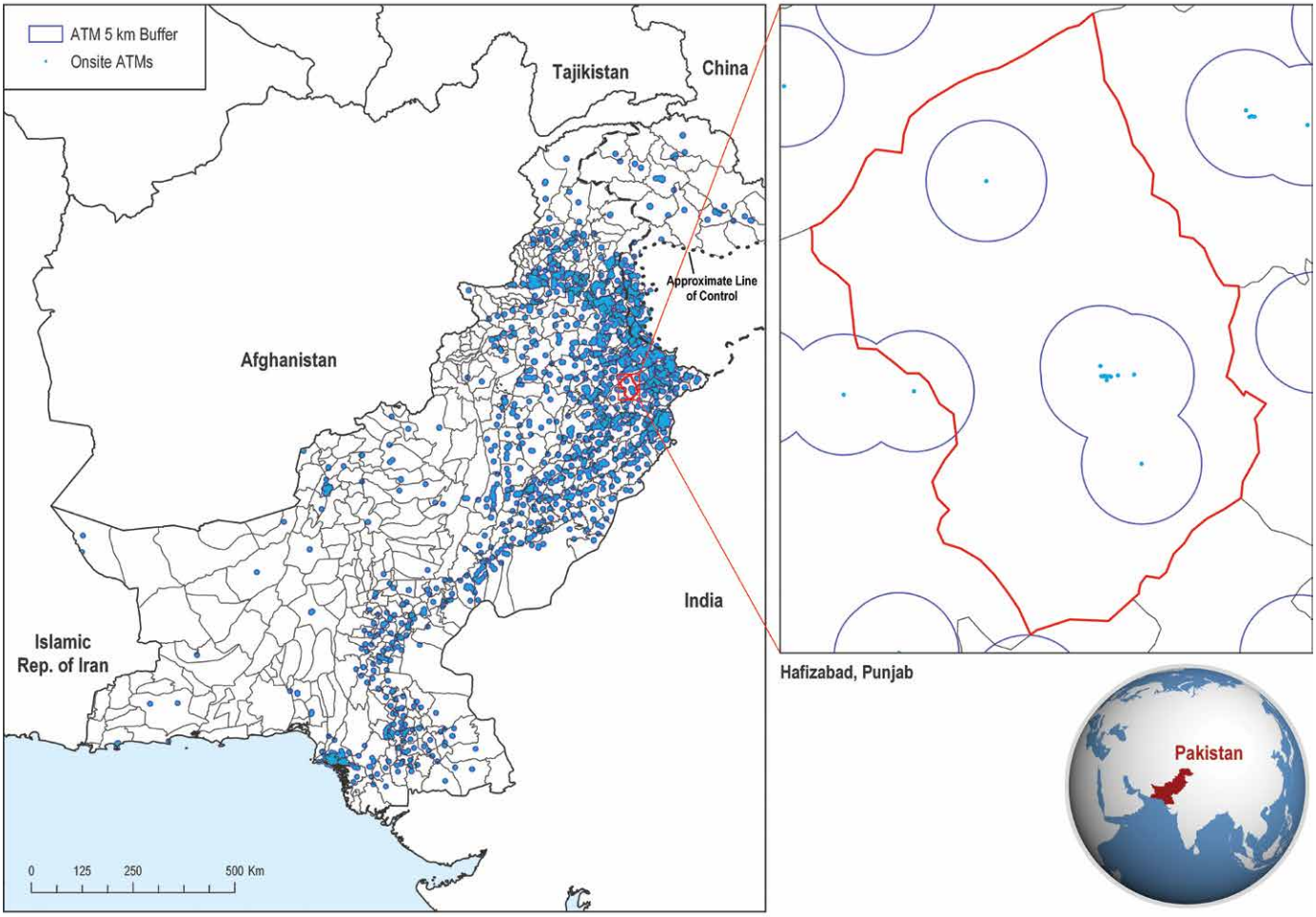
For the mapping of FAPs, policy makers may collect locational data via supervisory templates provided to FSPs around (i) branches of various FSPs, such as banks, financial cooperatives, microfinance institutions, and insurance providers; (ii) ATMs (on and off site); (iii) agents and e-money issuers; and (iv) any other type of FAP. Policy makers may also find it useful to use non-financial geospatial data in combination with FAP locations to provide context for better policy design. Sections 2 and 4 provide examples of how the two can be used in conjunction to identify opportunities for expansion of financial infrastructure.

NOTE

6. The location of the data point can be static in the short term (for example, the location of a road or population) or dynamic (for example, the spread of a disease or migrants). The latter is especially useful to map trends over time.

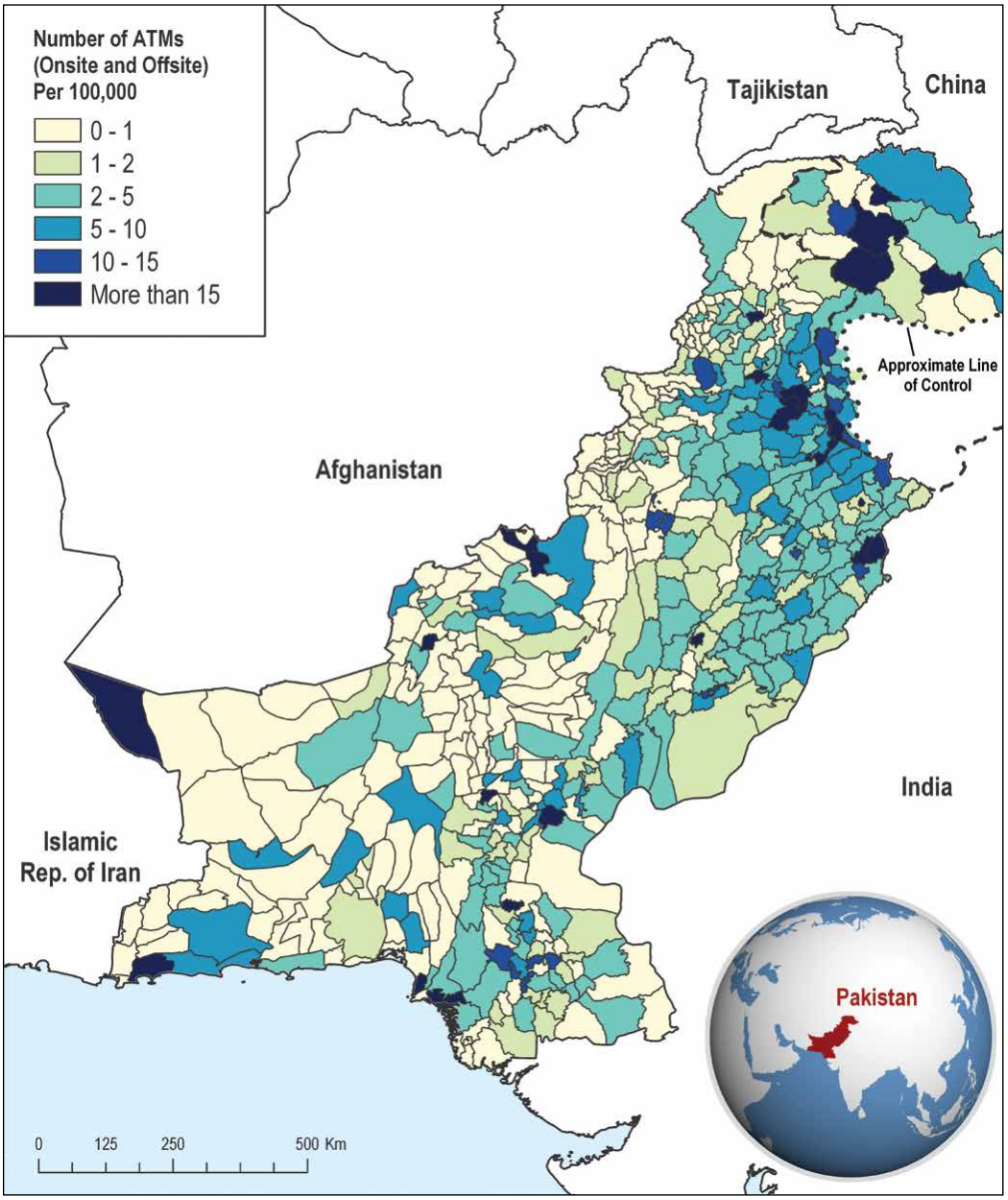
FIGURE 1: ATM Points Plotted in Pakistan

The right box shows the sub-district (tehsil) of Hafizabad zoomed in to illustrate granularity.



Note: The boundaries, colors, denominations and any other information shown on this map do not imply, on the part of the World Bank Group, any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries.

FIGURE 2: Number of ATMs per Tehsil (Normalized per 100,000 People)



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2

WHY USE GEOSPATIAL TECHNOLOGY IN THE CONTEXT OF FINANCIAL INCLUSION?

Access to FAPs is a critical prerequisite for financial inclusion, yet it remains a significant barrier for a substantial portion of the population, especially in developing countries. Improving access to FAPs often involves growing existing financial infrastructure. Effectively expanding the network of FAPs requires careful planning; a crucial aspect is identifying placement correctly to achieve maximum impact.

Geospatial technology can play a key role not only by identifying gaps in access to FAPs but also by considering other relevant geospatial data (such as population, poverty, and economic activity) to identify gaps with a high potential impact on financial inclusion. This can be more challenging, expensive, and time consuming to do without geospatial technology, especially at a large scale. Geospatial technology, therefore, lowers entry barriers for FSPs seeking entrée to new territories. Greater visibility on gaps and opportunity areas encourages FSPs to diversify geographically and to direct resources so as to maximize impact.

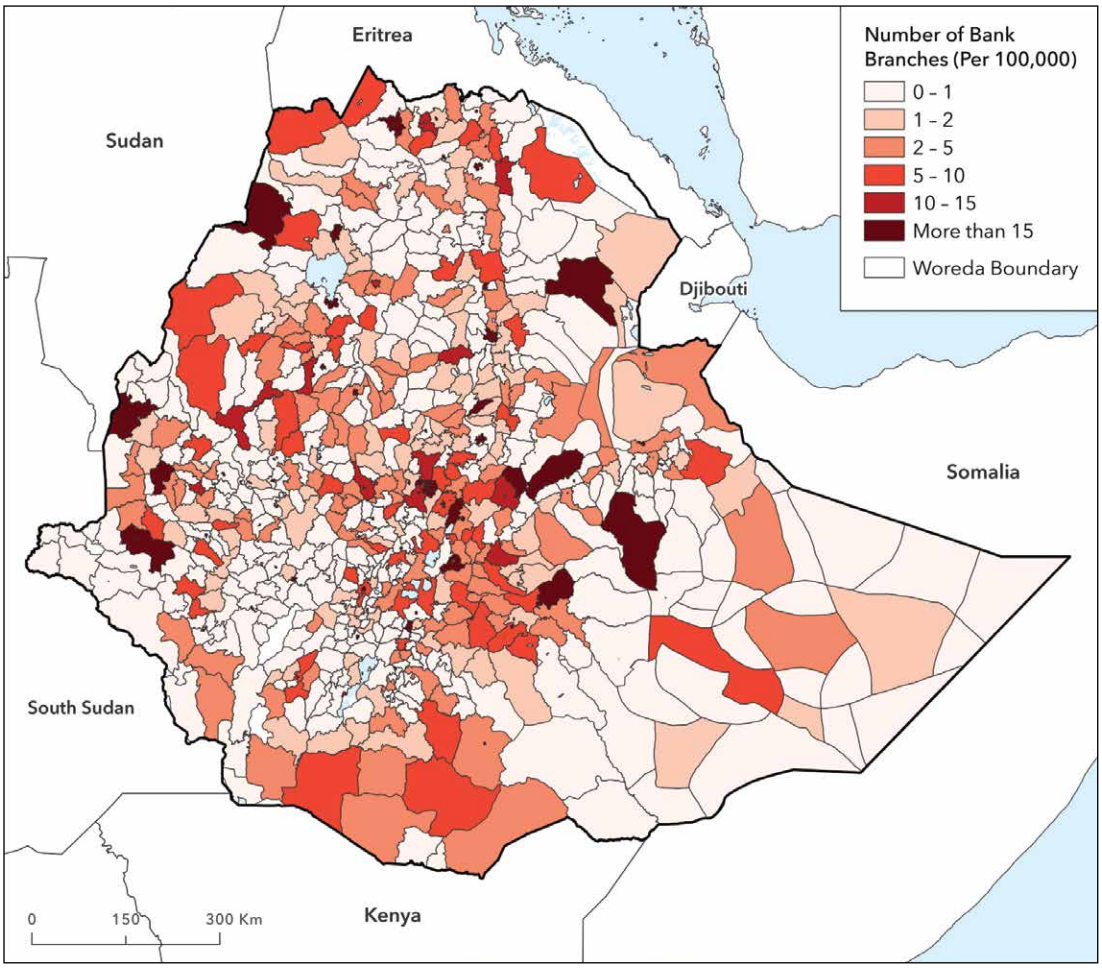
Figure 3 illustrates how this can be undertaken using a simple approach. It maps the number of bank branches per 100,000 people in each woreda (or district). This provides insights into the coverage of FAPs relative to population density. Lighter colors highlight woredas with lower penetration, whereas darker colors represent those with a greater number of access points per 100,000 adults. This simple mapping exercise can shed light on woredas that are relatively underserved in terms of access to FAPs.

Figure 3 demonstrates the value of geospatial mapping even when precise locational data is not available. Coarse locational data (at the district level) is often already available to policy makers and can be mapped easily to provide valuable insights around existing gaps in financial infrastructure as well as opportunity areas (that is, areas with high population densities and low penetration of access points). This can serve as a good starting point for policy makers and private-sector players to enhance access to FAPs and create motivation for a more detailed assessment.

Geospatial technology can be even more valuable when precise locational data is available. This allows for more precise identification of gaps, such as at the neighborhood or even street level, instead of larger administrative units. It also makes it possible to detect opportunity areas at the same precision to ensure maximum impact with limited resources. Utilizing relevant non-financial geospatial information can also greatly enhance the value of leveraging geospatial technology for financial inclusion. The remainder of the section illustrates the value addition on both fronts.

Not all geographical gaps in access will be ripe for FAP expansion since some may represent areas with uninhabitable land or very low populations. Ultimately, it is people, not land, that require access to FAPs and are the focus of policy. Hence, it makes sense to identify populated settlements that are outside the reach of existing FAPs. For this purpose, figure 4 overlays figure 1 (ATM locations) with settlement data (distinguishing between rural, low-density urban cluster, and high-density urban cluster) across land in Pakistan.[7]

FIGURE 3: Number of Bank Branches per Woreda (Normalized per 100,000 People)



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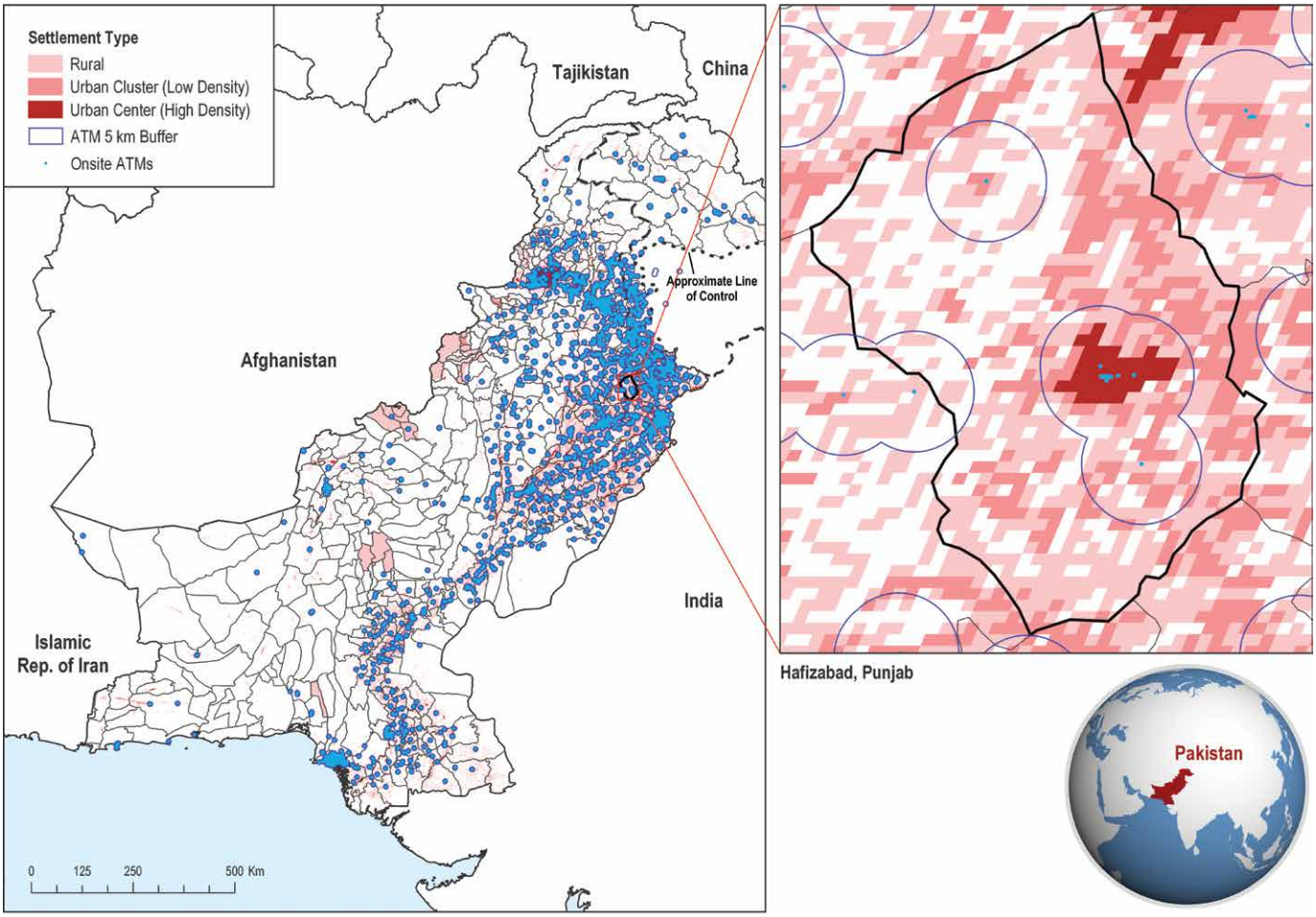
Physical connectivity to a road is also important for access-point placement for reasons ranging from better clientele reach (as consumer access to touchpoints is more convenient) to liquidity management (as it is easier and cheaper to transport cash to and from touchpoints). Hence, mapping a road network helps narrow target areas to those with road connectivity (which is defined as within two kilometers of a road).[8] Figure 5 maps the road network in Pakistan; roads are depicted as purple lines.

Different geospatial datasets (also known as layers) can be used in combination to identify areas of interest and opportunities for expansion. Figures 1, 4, and 5, when used in conjunction with each other, demonstrate how this is possible. Figure 6 combines these three figures. By doing so, policy makers are able to identify large populations residing outside of a five-kilometer radius of a bank branch but within two kilometers of a road in the tehsil of Sheikhupura, Punjab. These gaps are likely to be easily addressable (due to physical connectivity) and of high potential impact (due to the large surrounding population), making them more economically viable for FSPs to target. Figure 6 sequentially overlaps these layers (in each exhibit) and makes it possible to identify two densely populated urban centers near the main city of Sheikhupura but outside the reach of any bank branch (highlighted in the black box). These gaps are likely of interest to both policy makers and FSPs as opportunities for expansion.

Even without access to precise locations of FAPs (that is, GPS coordinates or complete address), a similar analysis can be undertaken but at a coarser level. Figure 7 illustrates this process using only woreda-level information on FAPs in Ethiopia. The figure maps the woreda of Mierab Emi within Afder, Somali Region, which was

FIGURE 4: Settlements (Rural, Low-Density Urban Cluster, High-Density Urban Cluster) in Pakistan



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selected due to its limited coverage of FAPs (fewer than five FAPs per 100,000 individuals), as shown in figure 3. Similar to figure 6 for Pakistan, figure 7 overlays geospatial data for FAPs, settlements, and road network sequentially across the exhibits. The maps show that the woreda is primarily rural but has decent road connectivity. Opportunities for expansion are identified in the black box. As before, these are likely to be of interest to policy makers and FSPs due to their high potential impact (dense population) and addressability (physical connectivity). The only difference here is that an existing FAP may already be serving all or part of the identified region, as it is not known where access points are placed within the woreda. This may be overcome by further assessment on the ground before undertaking expansion.

Further use cases that leverage geospatial technology to identify gaps and different types of expansion opportunities are discussed in section 4, which documents the implementation of geospatial analysis in Pakistan and Ethiopia under the FISF program. In addition, section 4 also outlines additional analytical tools to enhance the impact of using geospatial mapping for financial inclusion, including the role of geospatial modeling and the development of "readiness" scores for financial inclusion expansion.

FIGURE 5: Road Network in Pakistan along with Plotted ATM Points

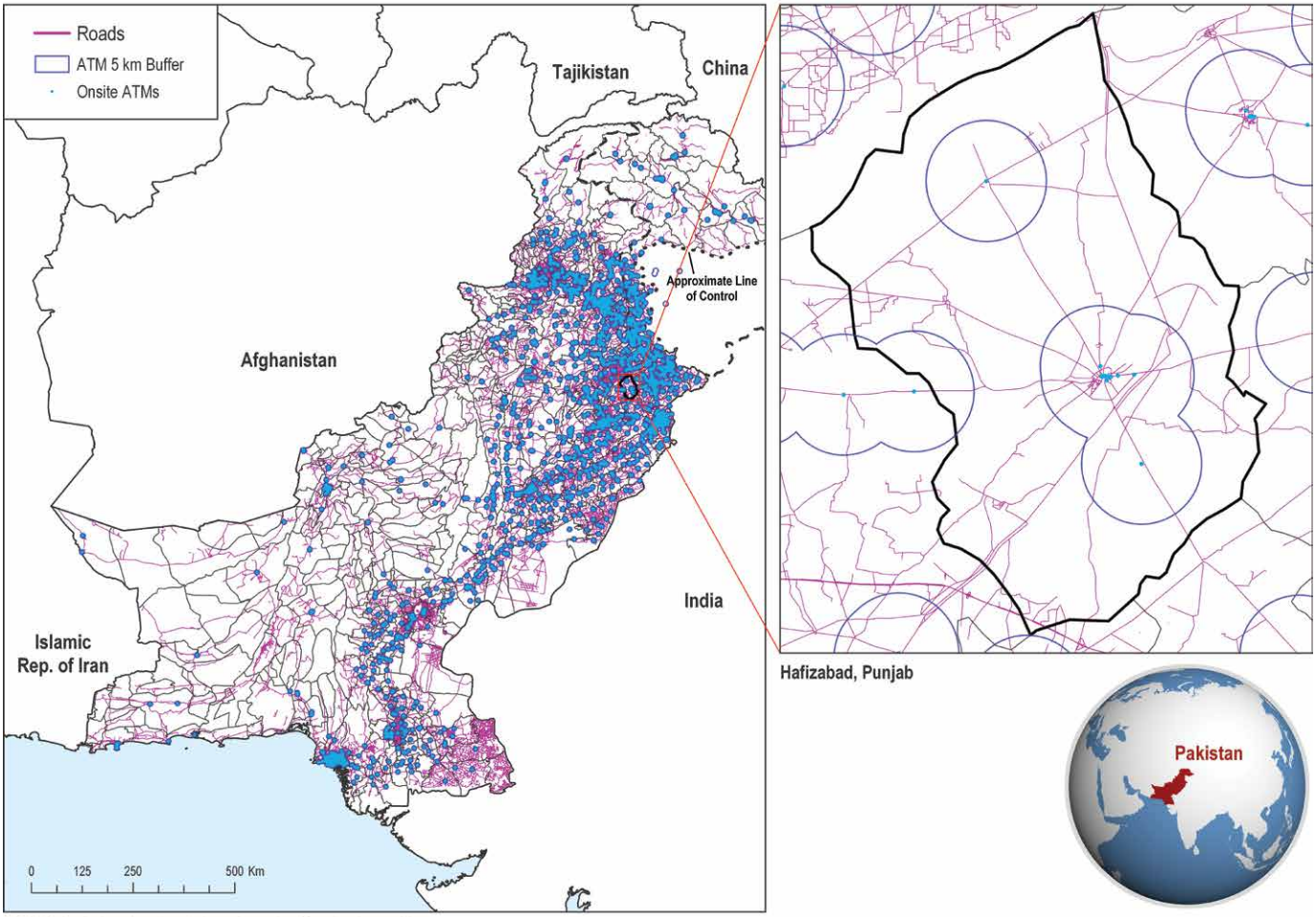

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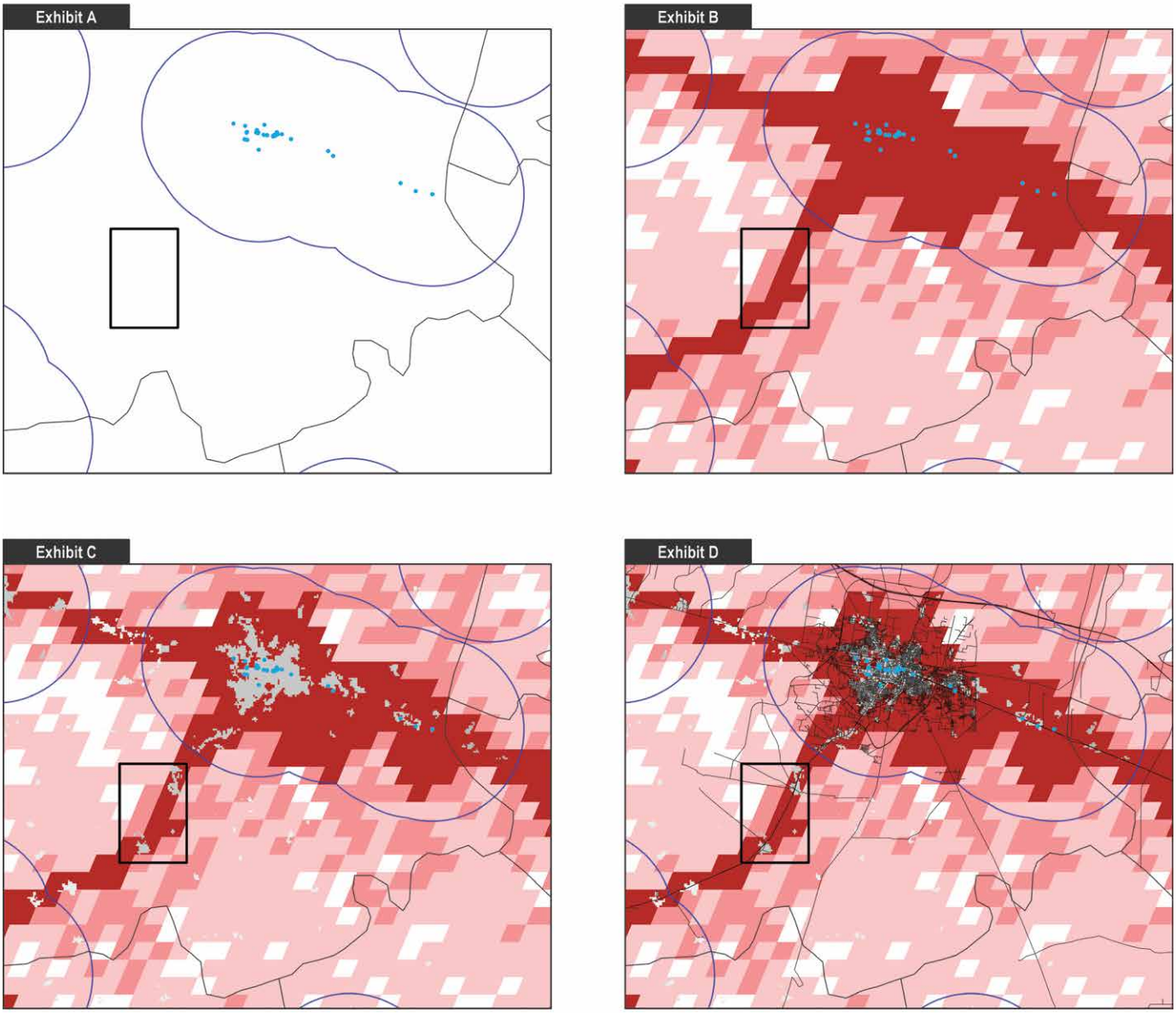
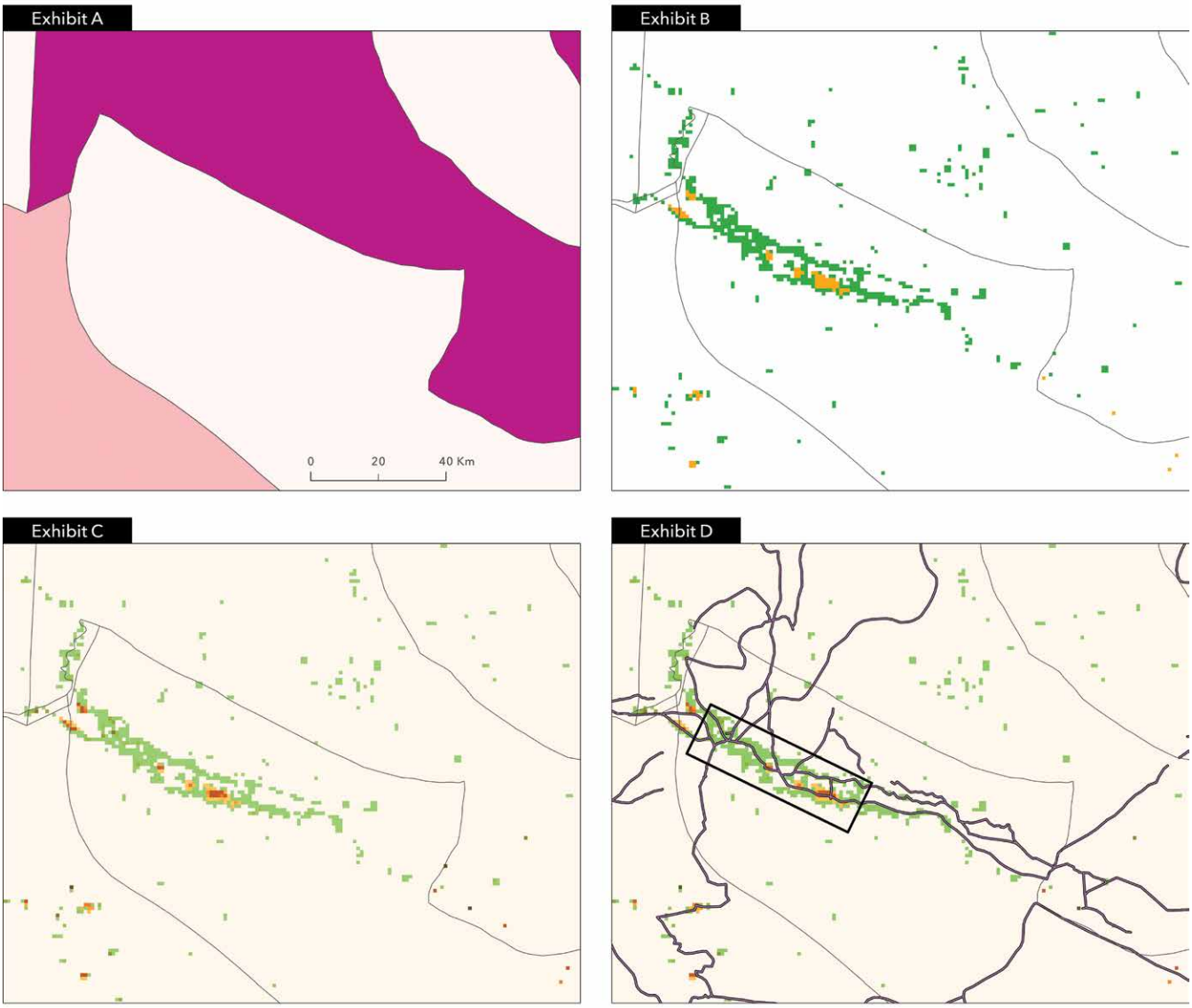
FIGURE 6: Illustrative Example to Identify Opportunities for Expansion of Financial Access Points



This figure overlays four layers for the tehsil of Sheikhupura, Punjab. Exhibit A contains only the base layer, representing bank branches and their corresponding 5km radius (Figure 1). Exhibit B adds the settlements layer (Figure 4) while Exhibit C adds the population layer (Figure 8). Exhibit D adds the road network layer (Figure 5). Areas of interest are highlighted in the black box. Map legend is as defined in Figures 1–8 except for the road network with black.

FIGURE 7: Illustrative Example to Identify Opportunities for Expansion with Low-Precision Locational Data on Financial Access Points



This figure displays four layers for the woreda of Mierab Emi, Somali Region. Exhibit A depicts FAP density for the woreda. Exhibit B shows the settlements layer while Exhibit C adds the population layer. Exhibit D adds the road network layer. Areas of interest are highlighted in the black box. Map legend is as defined in Figures 4–17, with the exception of roads (which are depicted in purple) and settlements (which depict high-density urban clusters in red, low-density urban clusters in yellow and rural clusters in green).

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NOTES

7. Locational data on on-site ATMs was used as a proxy for bank branch locations given that it covered a significant majority (approximately 78 percent) of bank branches in the country.
8. The two-kilometer buffer is based on the Rural Access Index by the World Bank, which measures access to transport infrastructure.

3

HOW CAN POLICY MAKERS LEVERAGE GEOSPATIAL TECHNOLOGY TO ENHANCE FINANCIAL INCLUSION?

Policy makers can leverage geospatial technology to boost access to FAPs and financial inclusion in several ways: (i) enhancing evidence-based policy making, (ii) facilitating supervision of the financial sector, (iii) monitoring and evaluating progress of financial inclusion, and (iv) creating a public good to support the financial sector.

EVIDENCE-BASED POLICY MAKING FOR FINANCIAL INCLUSION

Policy makers can use geospatial technology to inform evidence-based policy making to boost access to FAPs and financial inclusion. Authorities have often attempted to tackle low access to financial services with incentives or requirements for FSPs to open FAPs in underserved regions—for instance, through branch licensing policies, expansion regulations, or targets (at sector or FSP level). Geospatial technology can prove to be a valuable tool in improving such policies, as it allows authorities to map all FAPs in the country and identify gaps in existing coverage. With highly precise geospatial data, authorities can even design policies for local targeting, such as at the neighborhood or even street level, instead of larger administrative units, as is the norm currently. Furthermore, geospatial technology can also help policy makers prioritize existing gaps (see next section for details on how) to sharpen focus on those with high potential impact.

Additionally, geospatial technology can help determine the correct mix of policy interventions for financial inclusion at a hyperlocal level. This includes differentiating areas for FAP expansion from areas where other prior policy interventions may be needed, such as those related to infrastructure (for example, electricity, physical connectivity, mobile signal coverage) or demand-side factors (that is, where financial inclusion remains low despite easy access). The former will require policies targeted at improving infrastructure, while the latter will require policies to boost demand (for example, initiatives related to building financial literacy, awareness, trust). In addition, policy can also be customized with respect to certain population segments (for example, low-income households, women, youth, and so on) that may dominate certain areas. Lastly, geospatial technology can also be used to improve understanding of what is required by underbanked populations by assessing areas ripe for particular financial services over others.

Geospatial technology can also help to improve financial inclusion by improving government-to-person payments. This can be done through better targeting mechanisms for social assistance, as population and poverty levels can be mapped. Such mapping may shed light on beneficiaries that are far from an existing access point, which can also help to increase understanding of true costs to receiving government transfers at a local level. Furthermore, mapping can help in optimizing delivery of government-to-person payments by assessing the most effective existing channels to do so, as well as customizing policy to address barriers for recipients to improve access over time.

BOX A

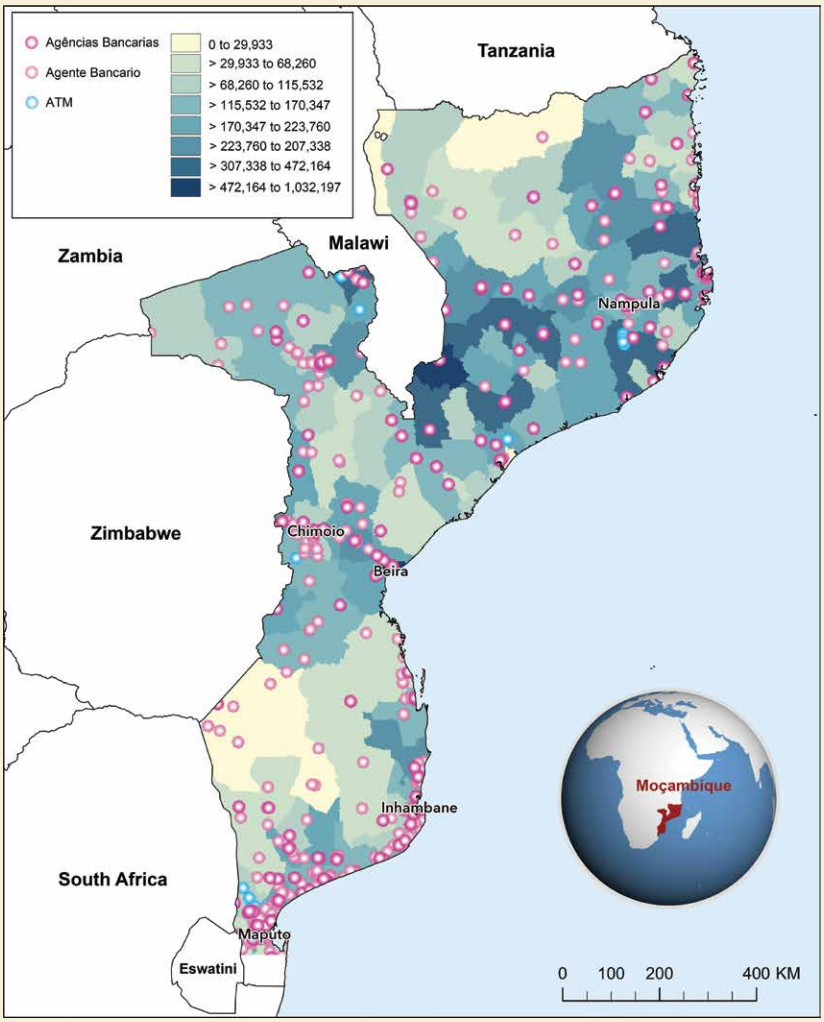
Country Examples of Leveraging Geospatial Technology for Financial Inclusion Policy

Evidence-based policy making: To boost financial inclusion, the Bangko Sentral ng Pilipinas in the Philippines conducted a mapping exercise of FAPs in the country. This allowed the bank to identify several areas with no formal FAPs. It addressed these gaps by **waiving** processing fees for opening branches in unbanked areas to incentivize FSPs to serve these markets.

Supervisory tools to monitor compliance: Geospatial data allowed the Financial Inclusion Secretariat at the Central Bank of Nigeria to identify areas that had high population density but no financial services. Efforts to address these gaps by the central bank included setting individual targets for each deposit-taking bank to increase the number of FAPs. In theory, compliance with these targets could be monitored by mapping new access points for each bank in the underserved areas.

Monitoring and evaluation: Tanzania launched a Financial Services Registry in 2020 to map all FAPs across the country. This registry will serve as a national system for tracking growth and distribution of FAPs as well as for informing key stakeholders and the public of the progress of the National Financial Inclusion Framework 2018–2022.

FIGURE A1: Online Mapping of Financial Access Points in Mozambique



Public good for financial inclusion: The FISF program supported the central bank of Mozambique (Banco de Moçambique) as it collected locational data for FAPs, which were then mapped on a dynamic web-based **platform.** (Figure A1 depicts the online map.) An updated version of this platform, launched in 2020, leveraged additional non-financial geospatial data from the Ministry of Transport and Communications to provide additional context. To encourage use of this public good, the central bank released a **video** highlighting its benefits and raised awareness through local media **coverage.**

SUPERVISORY TOOLS TO MONITOR COMPLIANCE

Authorities can also use geospatial analysis as a supervisory tool to assess FSPs' compliance with requirements related to access to FAPs (for example, branch licensing policies, expansion regulations, or targets). For this purpose, supervisors may require FSPs to report geospatial data on new FAPs on a regular basis. Such data will allow authorities to map growth of different types of FAPs for individual FSPs and track progress against requirements to target previously identified gaps. For example, the central bank of Mozambique (Banco de Moçambique) used geospatial mapping to track banks' compliance with a new policy that prioritized the opening of new branches in underserved districts.[9] Further supervisory activities can also be facilitated, conditional on data availability. For example, if complaints data is geotagged (that is, location information is included), supervisors can identify new patterns across space and time for issues pertaining to financial consumer protection.

MONITORING AND EVALUATION OF FINANCIAL INCLUSION PROGRESS

Policy makers can further leverage geospatial analysis for monitoring and evaluation purposes. For example, it can be used by regulators, supervisors, or a financial inclusion secretariat[10] within the context of a financial inclusion strategy to measure and monitor progress and expansion of access-point coverage to determine progress with national financial inclusion goals. In addition, it can be used to track the evolution of spatial distributions of FAPs throughout the country and in specific regions (for example, provinces, districts, and so on) over time. It can also be used to evaluate the impact of introducing new FAPs in different areas, both on financial inclusion and economic activity.[11]

PUBLIC GOOD TO ENHANCE FINANCIAL INCLUSION

Authorities can leverage geospatial data as a public good to create an enabling environment for financial inclusion and innovation. This can be done by making analysis and reports public or, in some cases, sharing anonymized financial-sector geospatial data with the broader financial sector (for example, through an institution's website or even an Open Data Initiative[12]). It is important to take into account data-privacy concerns, as authorities may consider part of the collected geospatial data to be sensitive. In such cases, it is important to limit sharing to non-sensitive data or to anonymize the sensitive data aspects thoroughly. Sharing the data publicly in a responsible manner can help encourage FSPs to expand past already-banked areas, reduce duplication of efforts in terms of access-point placement, and target new areas with greater potential for uptake of financial services. However, it is worth nothing that FSPs may use this data to instead narrow their focus on attractive areas if the Open Data Initiative is not supplemented by appropriate policies to incentivize growth in underserved areas. FSPs may also find geospatial data useful in developing their own analysis to improve efficiency, such as through optimizing liquidity management across access points and identifying effective distribution partners in the field. Such open initiatives can also attract investment to underserved markets, including through innovative financial services.

BOX B

Guidance for Policy Makers Interested in Adopting Geospatial Technology for Financial Inclusion

Adopting geospatial analysis requires careful planning to build capacity and data infrastructure, as traditional resources are unlikely to meet the needs specific to geospatial technology. The first step for integrating geospatial analysis, especially for policy makers, is outlining a strategy to collect geospatial data. Supply-side geospatial data is of primary importance, but demand-side data can be equally crucial.[13] The essential elements of a data-acquisition strategy include the following:

1. *Objectives:* The objectives of the mapping exercise will typically be related to one of the four use cases listed in section 3. For instance, authorities may conduct a one-time mapping exercise to revise a bank licensing policy or regularly engage for monitoring compliance. The objectives should be clearly identified, as these determine the remaining components of the data-acquisition strategy.
2. *Data indicators:* The objective will also influence the data indicators to be collected, which will always include some type of locational data but may include additional variables such as type of FAP, products/services available, size, usage activity, and so on. Demand-side indicators can also include additional elements such as consumer preferences and awareness.
3. *Collection frequency:* Collection frequency is determined primarily by objectives (one-time exercise or regular data updates required) and the costs, which form the major component of the mapping exercise. Policy makers should aim for the minimum collection frequency that satisfies the objectives.
4. *Method of collection:* Supply-side data collection is typically undertaken through enumerators or self-reporting by FSPs, for which supervisory templates may need to be modified. Less common alternatives include crowdsourcing or a hybrid approach (that is, a mix of both enumerators and FSP reporting). Demand-side data collection is undertaken through enumerators and hence can be expensive. For this reason, it is recommended that such efforts be integrated into existing demand-side surveys.

It is important to note that precise locational data should not be a precondition for utilizing geospatial tools. Less precise data (for example, a partial address) on FAPs may already be collected by authorities and can also be leveraged. Third-party geospatial data should also be utilized for an advanced analysis. This can include geodata on population, settlements, economic activity, natural-disaster risk, births, poverty, physical isolation, and infrastructure (such as roads and mobile signal coverage). Box C provides details on some examples and sources of third-party geospatial data.

Once relevant geospatial data is gathered, it needs to be stored, cleaned, and analyzed to translate it into any meaningful policy measure. FISF's experience has shown that developing countries often face severe capacity and IT infrastructure constraints on this front. Given this limitation, it is recommended that policy makers either invest in developing internal capacity or contract an external partner or consultant.[14] The ideal option depends on the objective of the overall geospatial exercise, sensitivity of data, and resources at hand. Developing internal capacity is worth considering if the authority in question intends to undertake a geospatial analysis on a regular basis.

Once geospatial is collected and analyzed, policy makers may consider sharing the resulting maps and analysis. There is an opportunity for authorities to create a public good by sharing it for external use with other stakeholders in the financial sector or even the general public. This can potentially enable innovation, increase efficiency, and boost competition in the private sector. It can also possibly help financial regulators expand geospatial capability through synergies with other ministries, such as the ministry of energy and ministry of information technology and telecommunication. One option on this front is to consider an Open Data Initiative.

An Open Data Initiative, however, requires consideration of data sensitivity (such as anonymity of provider-level data), as authorities may consider some elements of the geospatial data sensitive. Data that can be considered sensitive may include exact GPS coordinates of access points, details of provider, geotagged demand-side financial inclusion data, and other data that may be proprietary to FSPs or collected under supervisory confidentiality. In such cases, authorities should seek either to anonymize sensitive data thoroughly (for example, by introducing noise on locations[15]), to aggregate such data (for example, reporting at district level only), or to remove sensitive elements completely. The exact approach will be dictated by the nature of the geodata collected as well as local laws and good practices around data privacy. A second consideration is required on the technology front, especially around hosting server and platform. Local regulations may again dictate which kind of hosting servers can be used. Additionally, cost elements need to be considered for both server and platform choice.

NOTES

9. AFI 2016. Note that introducing brick-and-mortar bank branches is not always the optimal method to address underserved areas and is used here only as an example to illustrate how geospatial technology may be utilized as a supervisory tool.
10. A financial inclusion secretariat is often established to coordinate the implementation of a national financial inclusion strategy. The secretariat is typically established within a relevant institution, such as a central bank, as a separate unit, or embedded within an existing department.
11. Previous research (Henderson, Storeygard, and Weil 2012) shows that geospatial data on nighttime light intensity can be used as a reasonable proxy for local economic activity.
12. An Open Data Initiative attempts to make data publicly available and accessible. Open data and content can be freely used, modified, and shared by anyone for any purpose.
13. Supply-side data refers to locational data on FAPs. Demand-side data refers to geotagged data representing some factor that determines demand for financial services. The latter is typically collected through geotagged demand-side surveys.
14. For example, the central bank of Mozambique (Banco de Moçambique) collaborated with the Ministry of Transport and Communications to develop a geospatial **platform**.
15. Adding noise to locational data can be undertaken by reducing its precision so that exact locations cannot be identified. Particular attention should be paid to areas with small populations of interest, as data may still be identifiable despite adding noise. A different approach may be required for such areas.

4

GEOSPATIAL MAPPING CASE STUDIES IN PAKISTAN AND ETHIOPIA

4.1. GAPS IN ACCESS TO FINANCIAL ACCESS POINTS IN PAKISTAN

The World Bank, in the context of FISF, undertook a detailed geospatial analysis in Pakistan in 2018–19. The State Bank of Pakistan was able to provide GPS coordinates for on-site and off-site ATMs throughout the country.[16] It was possible to exploit on-site ATM geospatial data as a proxy for bank branch locations given that it covered a significant majority (approximately 78 percent) of bank branches in the country.

As a result, it was determined that roughly 50.5 percent of the population lives beyond an accessible distance (five kilometers) to a bank branch. ATM locations for Pakistan are plotted in figure 1. There appears to be a greater focus on larger cities (in terms of population) at the expense of smaller settlements, as approximately 29 percent of tehsils (representing 7 percent of population) have absolutely no access to bank branches. The results highlight not only the low levels of access to FAPs in Pakistan but also wide variation in its distribution across tehsils, even when accounting for population differences. (Figure 2 reports ATM density per tehsil.)[17] A more equitable distribution of access points is needed to facilitate greater financial inclusion.

The above maps indicate the geographical gaps in existing coverage, but not all of these gaps are equally important for financial inclusion. Some of these gaps, for instance, may represent areas with uninhabitable land or very low populations. Others may be of higher priority due to greater local poverty. To determine opportunity areas for expansion, it is important also to consider non-financial geospatial data that can provide relevant context. (See box C for examples of such datasets that are publicly available.) Section 2 discusses the value of combining two such datasets around human settlements (figure 4) and the road network (figure 5) with locational data on FAPs.

Additional geospatial data (or layers) can also be considered to provide further insights. Some supplementary layers used for the geospatial analysis in Pakistan include a high-resolution population layer (figure 8), poverty layer (figure 9), economic activity layer (figure 10), and natural-disaster risk layer (figure 11). Figure 8 depicts population in Pakistan, which is mapped in the form of a grid across the country. Each grid cell measures approximately 100 meters squared and represents the population density for that area; darker cells show higher densities. Figure 9 maps local poverty levels by representing the proportion of people living in poverty (defined according to the Multidimensional Poverty Index) for each square kilometer throughout the country. Figure 10 depicts economic activity (estimated value of production in US dollars) at a local level. Figure 11 maps the level of natural-disaster risk based on multiple hazards (cyclones, earthquakes, floods, and landslides), with five categories ranging from low to extreme risk.

Policy makers may want to consider prioritizing regions that have the most to gain from access to FAPs, and such additional layers allow identification of high-potential opportunity areas. Prioritization will depend on specific policy objectives, for which different geospatial datasets (or a combination of them) will need to be used. The next section discusses how geospatial data on poverty, economic activity, and natural-disaster risk was utilized to address potential policy objectives in Pakistan.

BOX C

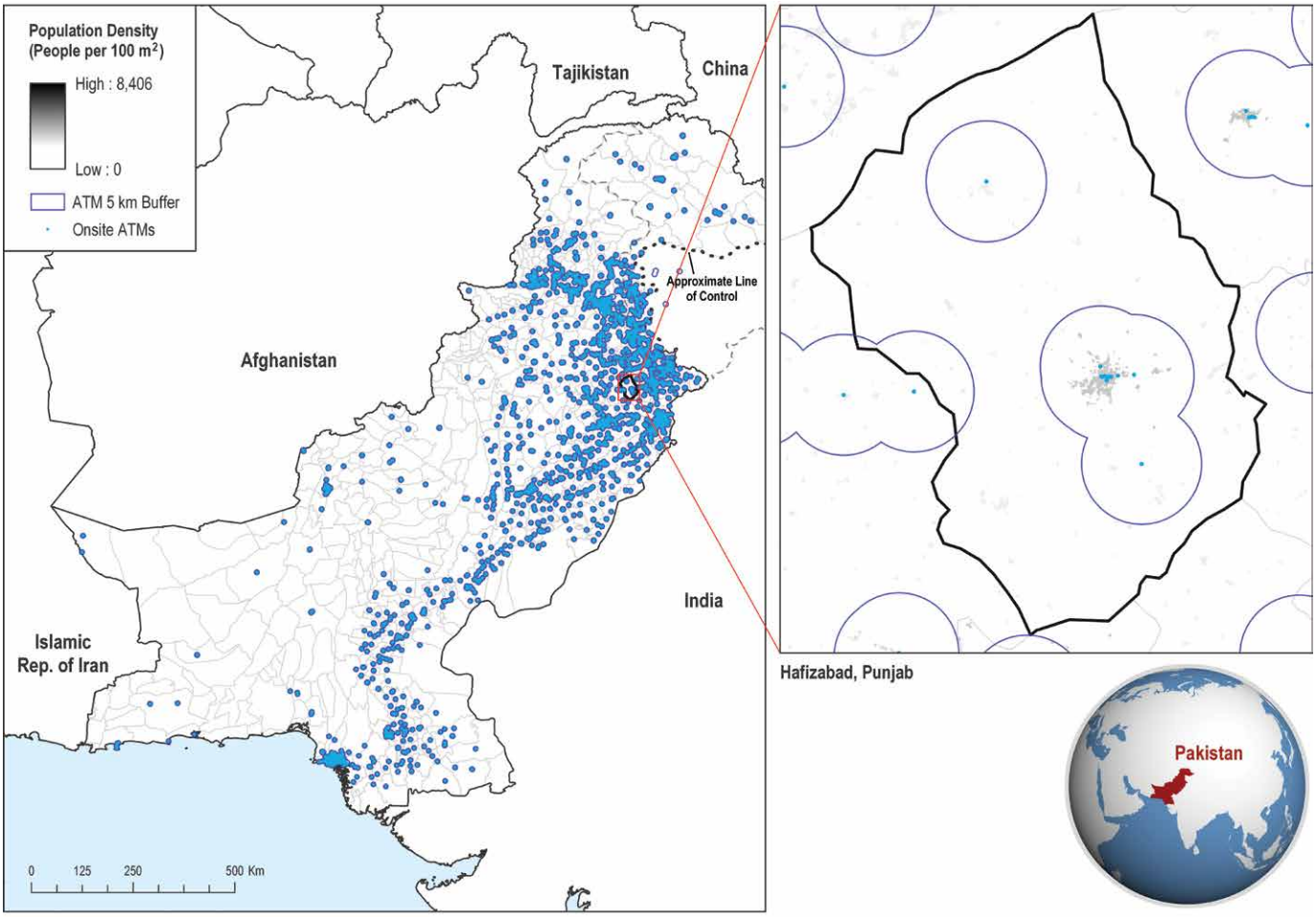
Publicly Available Geospatial Datasets

Third-party sources provide publicly available geospatial datasets on relevant non-financial data that can be leveraged to inform policy making to improve access to FAPs. The analysis conducted in Ethiopia and Pakistan relied on such publicly available geodata on population, settlements, economic activity, natural-disaster risk, births, poverty, physical isolation, and road network. The sources for these datasets are listed below:

1. Administrative boundaries: Database of Global Administrative Areas (**www.gadm.org**)
2. Settlements: Global Human Settlement dataset (**ghsl.jrc.ec.europa.eu**) maintained by the Joint Research Centre, European Commission.
3. Population density: WorldPop (**www.worldpop.org**)
4. Number of live births: WorldPop (**www.worldpop.org**)
5. Poverty levels: WorldPop (**www.worldpop.org**)
6. Physical isolation: Joint Research Centre, European Commission (**https://forobs.jrc.ec.europa.eu/products/gam/**)
7. Economic activity: Global Risk Data Platform, United Nation Environment Programme (**preview.grid.unep.ch**)
8. Natural-disaster risk profile: Global Risk Data Platform, United Nation Environment Programme (**preview.grid.unep.ch**)
9. Road network: Open Street Maps (**www.geofabrik.de**)

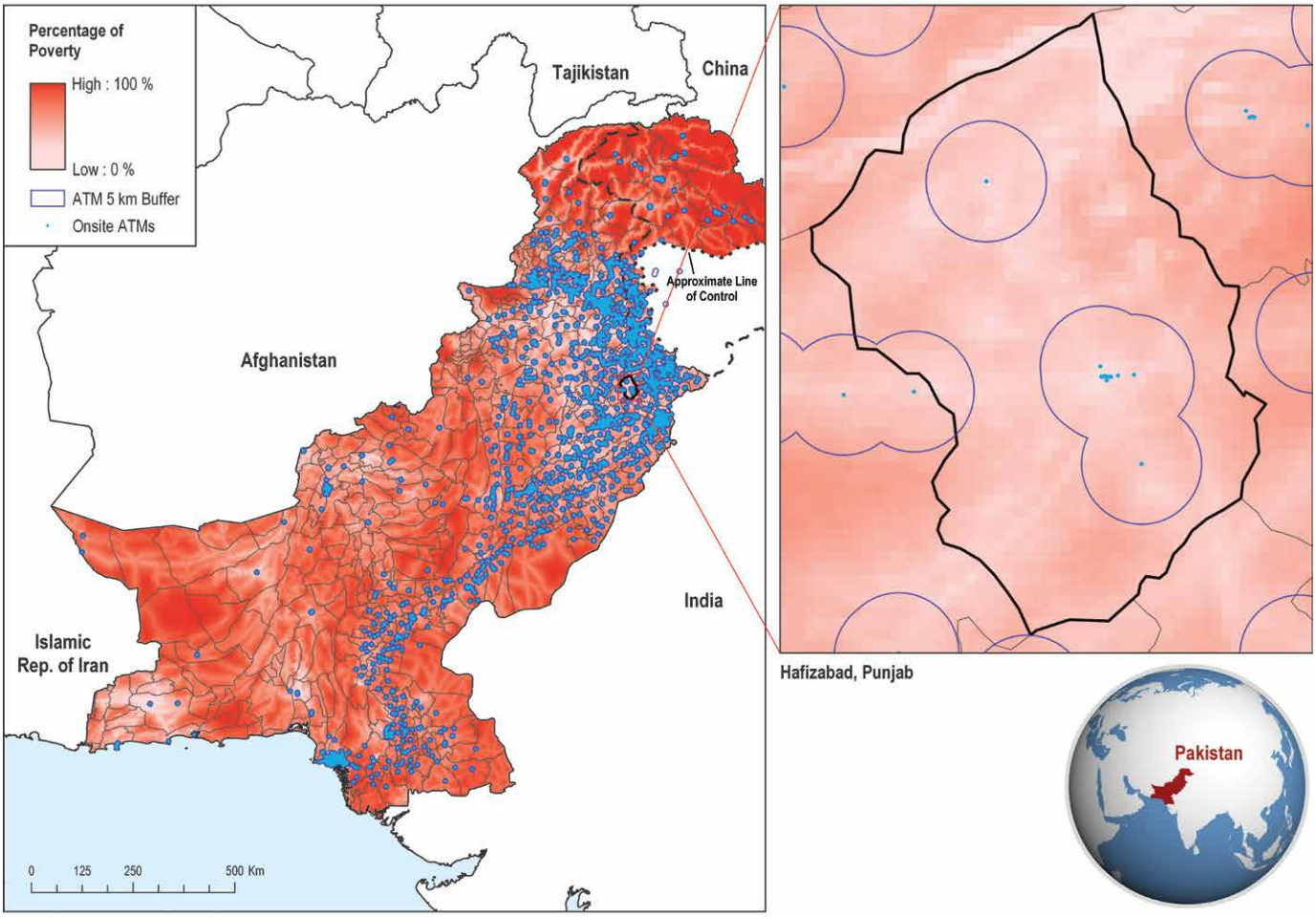
Publicly available geospatial datasets on FAPs are less common, but two popular sources are FSP Maps (by insight2impact) and FINclusion Lab (by MIX). FSP Maps (**www.i2ifacility.org**) hosts a web platform that maps FAPs across nine countries. It allows users to customize maps by overlaying their choice of layers, which also include non-financial geospatial data for context. FINclusion Lab (**www.themix.org**) also offers an interactive platform that allows visualization of FAPs and local demographics at various administrative levels. It also offers additional analysis beyond a geospatial framework. In addition, a new initiative of the Bill and Melinda Gates Foundation in partnership with the Boston Consulting Group, maps cash-in, cash-out agent networks across seven countries. These can be viewed via an interactive web platform (**www.connect.bcg.com/cicoeconomics**), which also identifies gaps that are economically and operationally viable for agent expansion.

FIGURE 8: Population Density in Pakistan



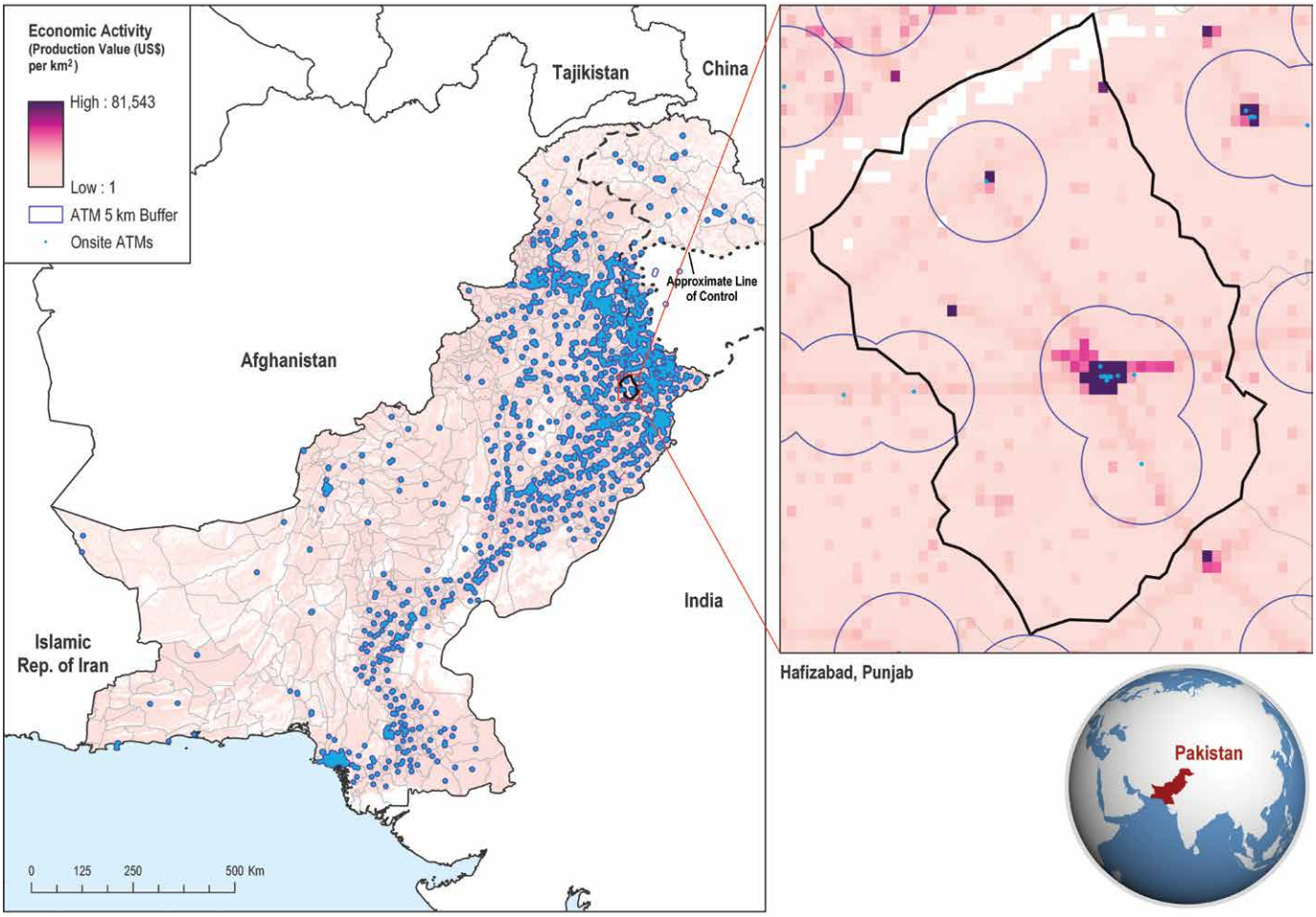
Note: The boundaries, colors, denominations and any other information shown on this map do not imply, on the part of the World Bank Group, any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries.

FIGURE 9: Poverty in Pakistan



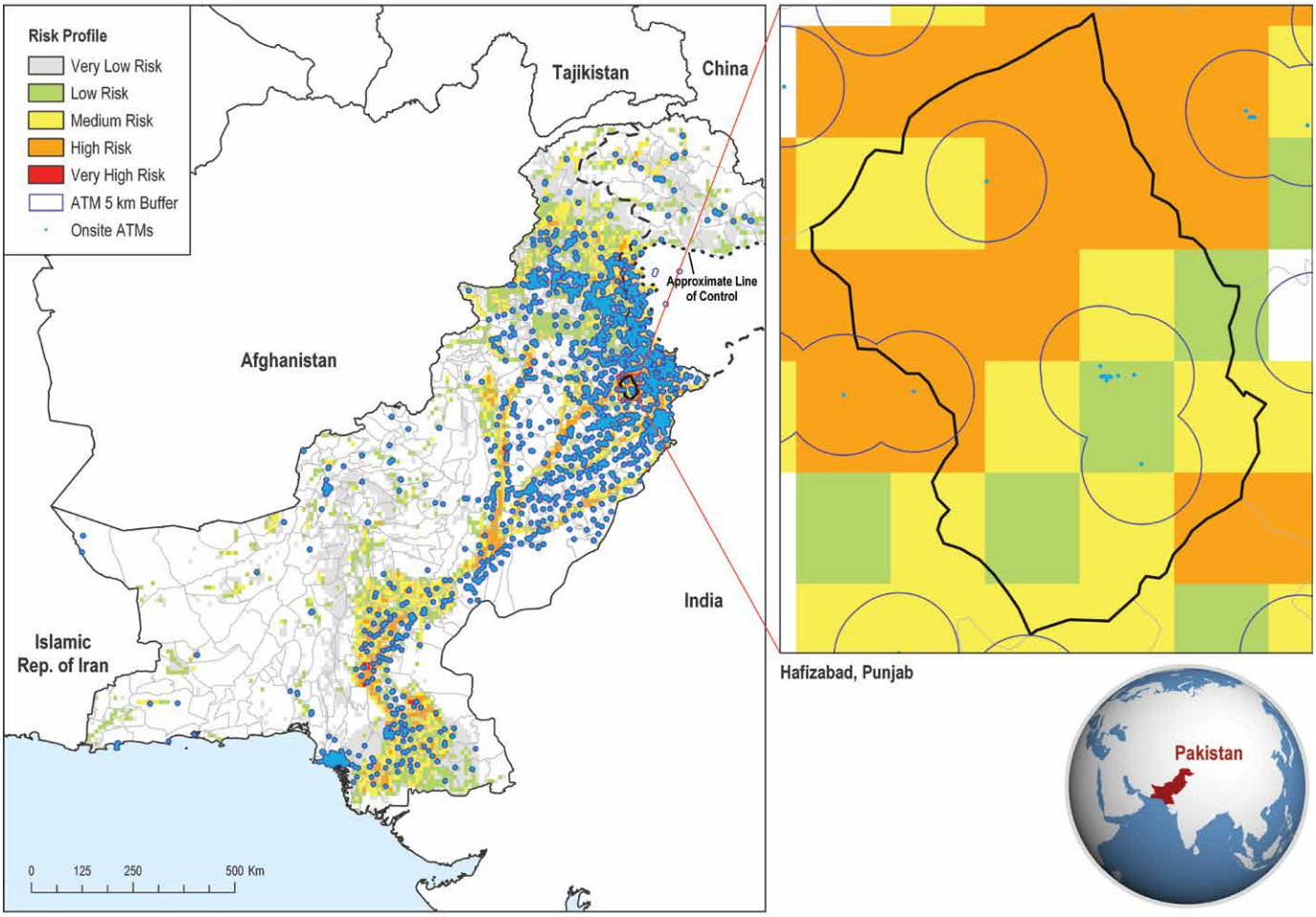
Note: The boundaries, colors, denominations and any other information shown on this map do not imply, on the part of the World Bank Group, any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries.

FIGURE 10: Economic Activity in Pakistan



Note: The boundaries, colors, denominations and any other information shown on this map do not imply, on the part of the World Bank Group, any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries.

FIGURE 11: Natural-Disaster Risk Profile of Pakistan



Note: The boundaries, colors, denominations and any other information shown on this map do not imply, on the part of the World Bank Group, any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries.

4.2. IDENTIFYING OPPORTUNITIES FOR ACCESS-POINT PLACEMENT IN PAKISTAN

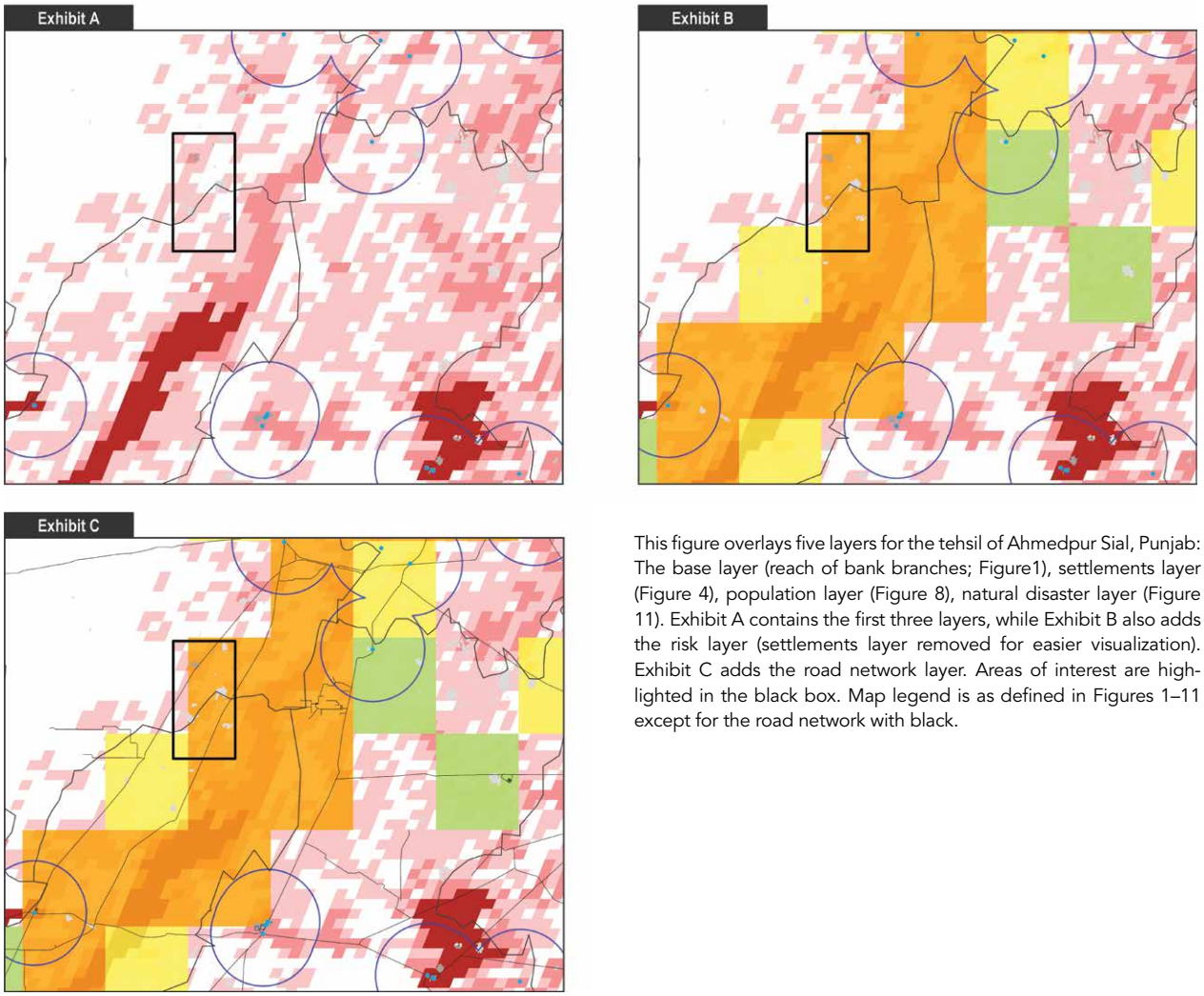
In order to identify and target large communities with no existing access to FAPs, several of the above geospatial maps need to be used in combination. Geospatial data for financial inclusion is most informative when combined. The value of doing so is demonstrated in this section through three case studies local to Pakistan. Each type of geospatial data was layered with others to identify gaps in existing coverage and highlight areas for optimum placement for new access points.

Policies related to financial inclusion can have a range of target outcomes; hence, policy makers will require flexibility in the tools at their disposal. For example, policy makers may be interested in targeting populations with low or no access to FAPs that specifically have low incomes or are vulnerable to natural disasters. Alternatively, they may aim to target financially inaccessible regions with high economic activity to maximize the economic impact of financial inclusion. In this regard, choosing layers correctly is vital to identifying communities that are most relevant to the specific policy objectives in mind. Each case study featured below aims to address a different target or policy objective and hence utilizes different combinations of layers.

4.2.1 SELECTED CASE STUDY 1: Opportunities in Ahmedpur Sial, Punjab

Areas that can increase the financial resilience of rural communities vulnerable to aggregate risks can also be targeted. From an inclusion perspective, this entails identifying significant clusters of financially excluded rural populations that are also highly exposed to natural-disaster risks (although other risks could also be considered). Figure 12 highlights these considerations within the tehsil of Ahmedpur Sial in the district of Jhang, Punjab. Four

FIGURE 12: Identifying Excluded Rural Settlements with High Risk Exposure in Pakistan



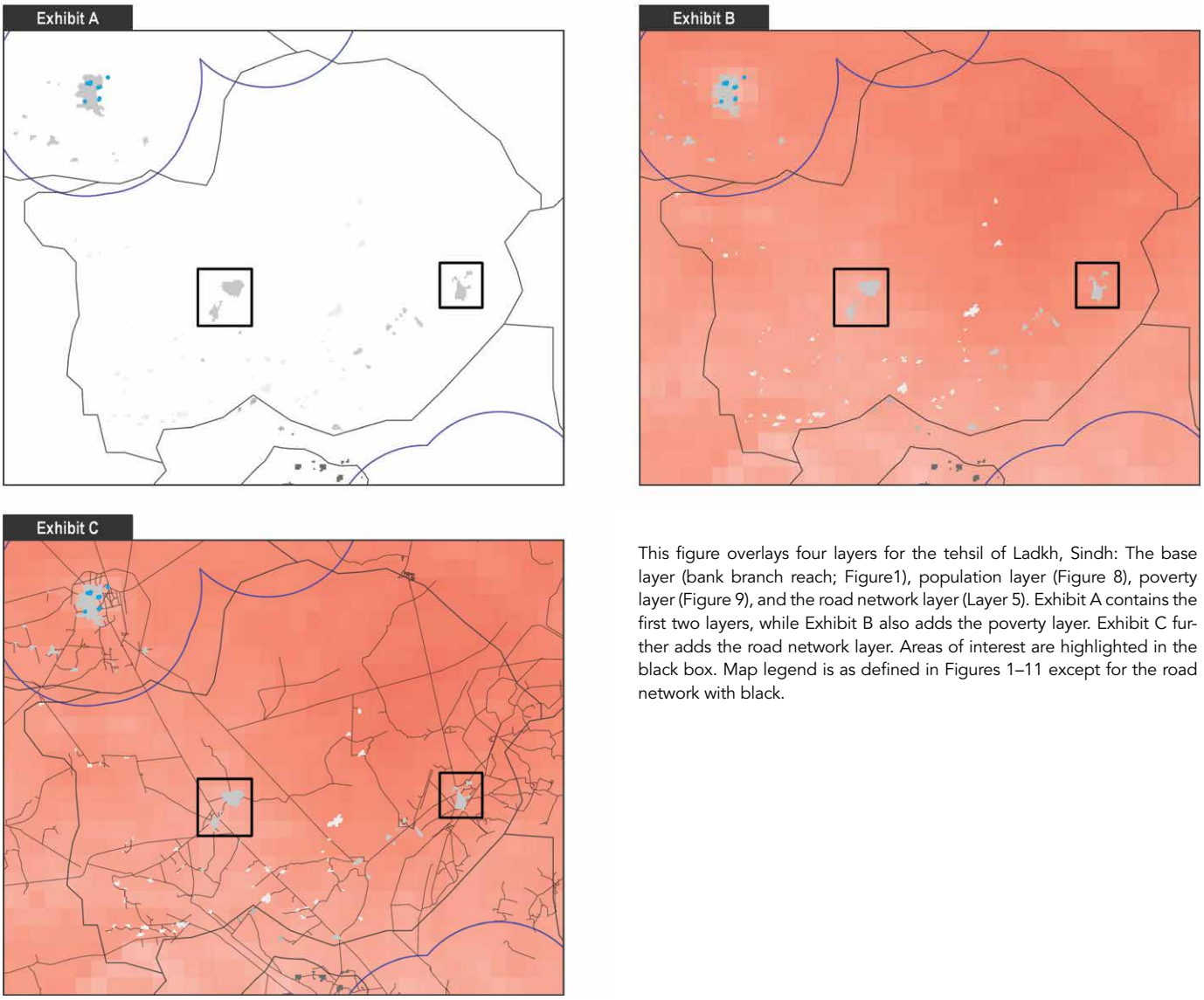
This figure overlays five layers for the tehsil of Ahmedpur Sial, Punjab: The base layer (reach of bank branches; Figure1), settlements layer (Figure 4), population layer (Figure 8), natural disaster layer (Figure 11). Exhibit A contains the first three layers, while Exhibit B also adds the risk layer (settlements layer removed for easier visualization). Exhibit C adds the road network layer. Areas of interest are highlighted in the black box. Map legend is as defined in Figures 1–11 except for the road network with black.

layers are used in this case: the base layer (reach of bank branches, figure 1), settlements layer (figure 4), population layer (figure 8), and the natural-disaster risk layer (figure 11). Exhibit A contains the first three layers, while exhibit B also adds the last layer (settlements layer removed for easier visualization). An additional layer for road network is also added to assess road connectivity (exhibit C). Such an analysis can help identify communities (spotlighted by black squares) that can benefit greatly from even basic financial services in the face of high consumption volatility due to the prevalence of aggregate natural shocks. This can support policies designed to increase financial resilience of individuals through financial inclusion.

4.2.2. SELECTED CASE STUDY 2: Opportunities in Lakhi, Sindh

A more common objective in financial inclusion is to target poor households. Such a policy can also benefit from a geospatial analysis, as demonstrated by a third case study. Four layers are used here: the base layer (bank branch reach, figure 1), population layer (figure 8), poverty layer (figure 9), and the road network layer (figure 5) to check for connectivity. This combination is used to identify dense, poor subpopulations with no access to FAPs. Figure 13 identifies two such communities (in black boxes) with road access in the tehsil of Lakhi in the district of Shikarpur, Sindh. Policy makers

Figure 13: Identifying Poor Populations with No Access to Financial Access Points in Pakistan



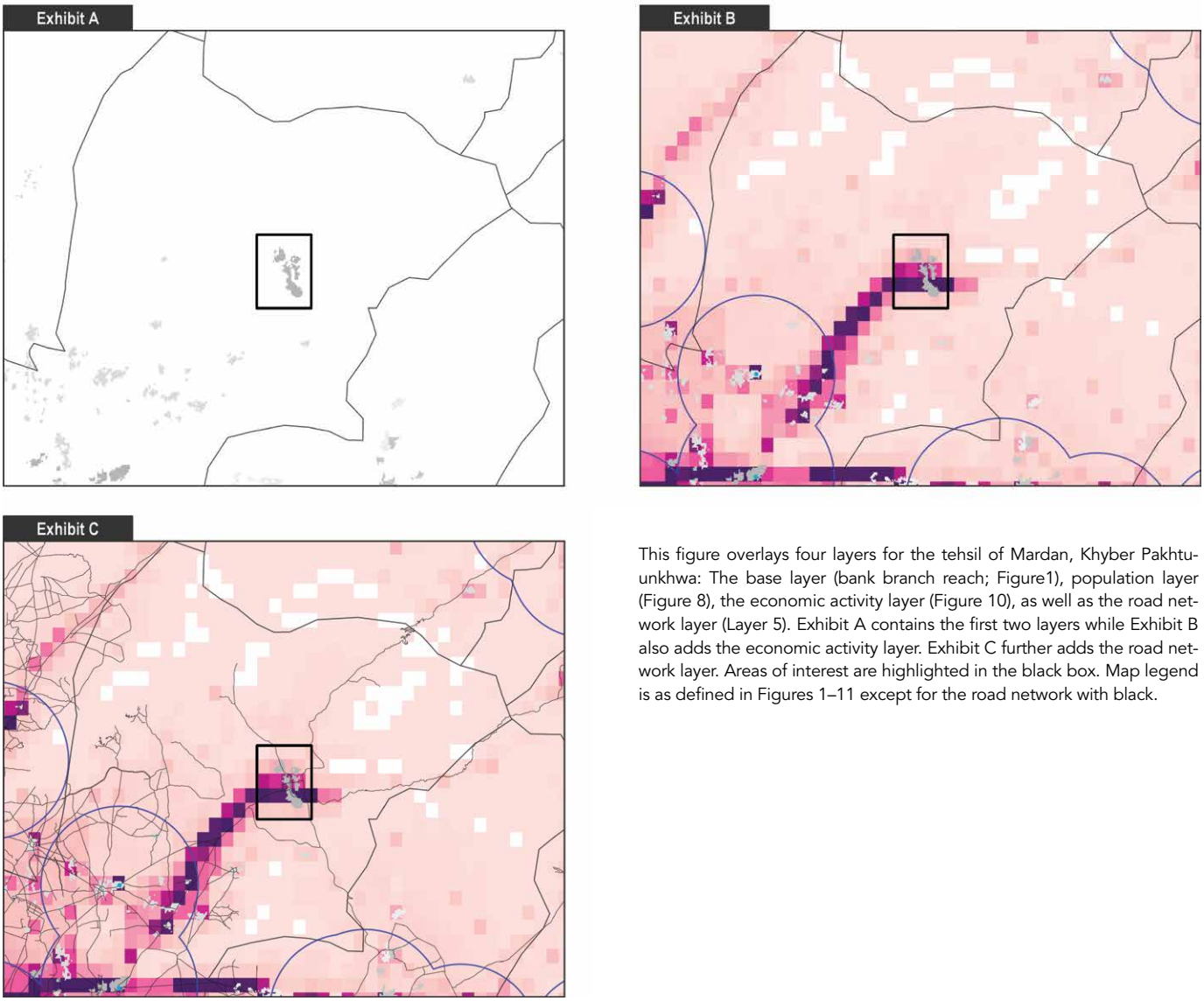
This figure overlays four layers for the tehsil of Ladkh, Sindh: The base layer (bank branch reach; Figure1), population layer (Figure 8), poverty layer (Figure 9), and the road network layer (Layer 5). Exhibit A contains the first two layers, while Exhibit B also adds the poverty layer. Exhibit C further adds the road network layer. Areas of interest are highlighted in the black box. Map legend is as defined in Figures 1–11 except for the road network with black.

should prioritize such areas for expansion, as poor people constitute one of the most financially excluded groups. Non-traditional access points may want to be considered in such cases, as the high set-up costs of brick-and-mortar branches may not be justified from a business perspective.

4.2.3. SELECTED CASE STUDY 3: Opportunities in Mardan, Khyber Pakhtunkhwa

Policy makers may want to focus on areas of high economic productivity as easier-opportunity areas for encouraging providers to expand coverage of access points. Populations in such areas may be more likely to convert into regular users of financial services, as the marginal benefits are relatively higher. To identify these opportunities, four layers are used: the base layer (bank branch reach, figure 1), the population layer (figure 8), the economic activity layer (figure 10), and the road network layer (figure 5). Figure 14 depicts this analysis for the area of Mardan, Khyber Pakhtunkhwa. Exhibit B highlights (in black) a potential gap for FSPs to serve a populated area exhibiting high economic activity.

Figure 14: Identifying Excluded Populations with High Economic Activity in Pakistan



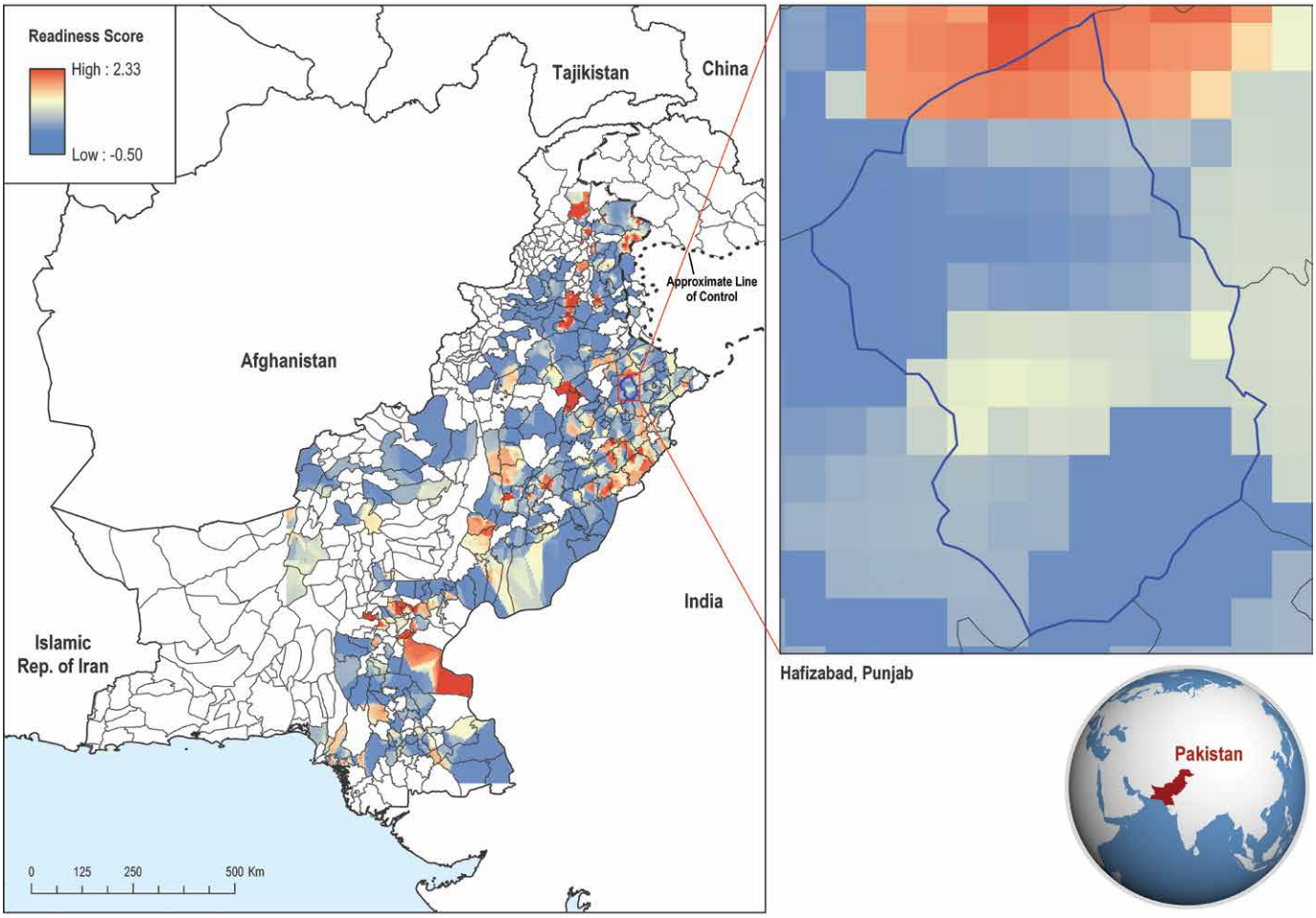
This figure overlays four layers for the tehsil of Mardan, Khyber Pakhtunkhwa: The base layer (bank branch reach; Figure1), population layer (Figure 8), the economic activity layer (Figure 10), as well as the road network layer (Layer 5). Exhibit A contains the first two layers while Exhibit B also adds the economic activity layer. Exhibit C further adds the road network layer. Areas of interest are highlighted in the black box. Map legend is as defined in Figures 1–11 except for the road network with black.

4.3. PREDICTING READINESS FOR FINANCIAL ACCESS POINTS IN PAKISTAN

Although access plays an integral role in enhancing financial inclusion, it alone is not sufficient to promote financial inclusion. Several other factors are also important and should be considered. In some cases, opening a new FAP may achieve little due to demand-side issues such as low financial literacy or a lack of trust in FSPs. Hence, it may be more optimal for policy makers to consider not just existing gaps but also the probability of uptake of financial services in these areas. Incorporating both these elements will ensure maximum impact of any policy designed to advance financial inclusion. Therefore, it is important to use the aforementioned geospatial analysis to identify dense populations that warrant prioritization (like those that have high economic activities) or tehsils that may be more "ready" than others for formal financial services. It is equally important to note that other areas should not be ignored but approached with a different set of policy solutions, such as demand-side interventions or monetary incentives.

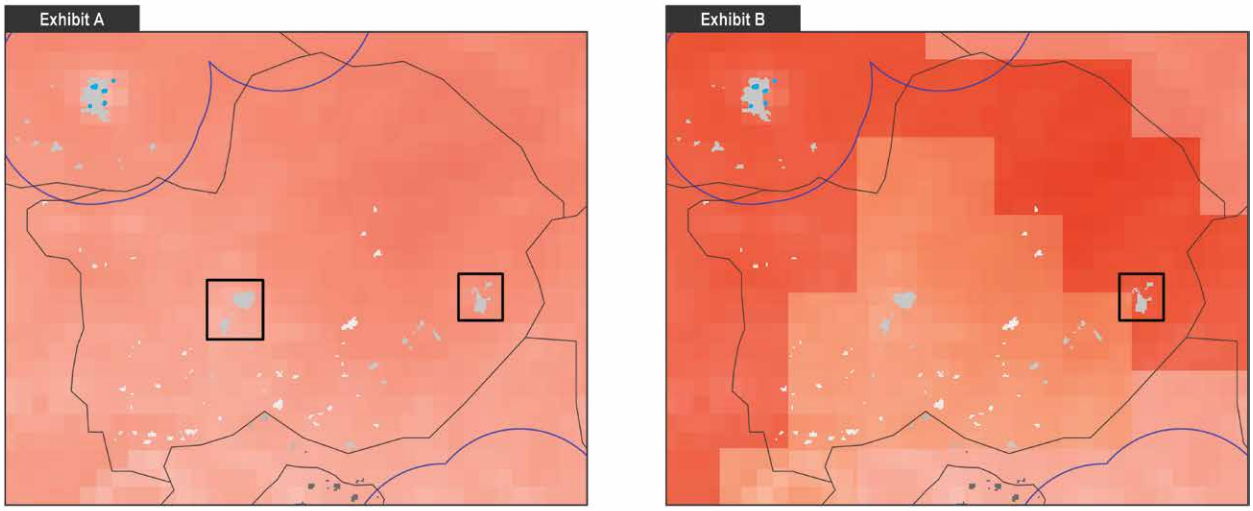
The World Bank developed a score[18] to help represent the "readiness" of an area for the introduction of a new FAP (called the "readiness score"). This is based on demand-side financial inclusion indicators, for which the data is captured through geotagged demand-side surveys. The score developed is only one of many ways to predict demand or "readiness," and authorities may also want to consider utilizing other predictors. Figure 15 demonstrates a tehsil's "readiness," according to financial inclusion score used in this report, demonstrated in darker red.[19] This score can be used by policy makers and FSPs to prioritize gaps for targeting. Over time, as new tehsils receive access points, the score will change and shift, highlighting new opportunities for access-point placement.

Figure 15: Readiness Score



Note: The boundaries, colors, denominations and any other information shown on this map do not imply, on the part of the World Bank Group, any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries.

Figure 16: Applying Readiness Score to Case Study 2



This figure extends the analysis of Case Study 2 (Figure 13). Exhibit A is similar to Exhibit B in Figure 13 and identified two poor, populated arreas without access to financial services. Exhibit B adds an additional layerr for the Readiness score (calculated as in Figure 15). Areas of interest are highlighted in the black box.

Figure 16 illustrates how this can be applied to the second case study in section 4.2.2 (for the tehsil Lakhi in Shikarpur, Sindh). The case study earlier identified two areas for potential expansion (exhibit A). Including the readiness score layer (exhibit B) indicates which communities (highlighted in black) may be more affected by the introduction of a FAP or are ready to take up formal financial services.

The readiness score can assist in determining the right policy mix to address gaps, as it can distinguish between communities that require supply-side interventions and those that require demand-side interventions. Existing gaps with high readiness scores should be targeted for expansion of FAPs. Higher readiness scores reflect higher predicted demand for financial services, and such gaps should be prioritized for introducing access points. Doing so can help optimize distribution of financial infrastructure to maximize clientele and impact given limited resources.

However, it is important *not* to overlook communities with low readiness scores, for it is often these communities that are more vulnerable. For instance, such communities may consist of low-income households that have low awareness of the benefits of financial inclusion and therefore exhibit low demand for financial services. Hence, existing gaps with low readiness scores should be targeted for demand-side interventions (for example, financial literacy initiatives) to reduce such barriers. The aim here would be to help communities transform and be prepared for the introduction of future access points.

At times, an altogether different policy approach may be required. For instance, authorities may decide to introduce monetary incentives (for example, subsidies or lower licensing fees) for FSPs if the public benefit of access to FAPs in some areas is perceived to be high despite low readiness scores. This might be the case for populations with high poverty that may be candidates for government transfers and hence will benefit from access to formal financial services. The overall objective should be to identify the correct mix of policy solutions to serve the needs of different communities.

4.4. GAPS IN ACCESS TO FINANCIAL ACCESS POINTS IN ETHIOPIA

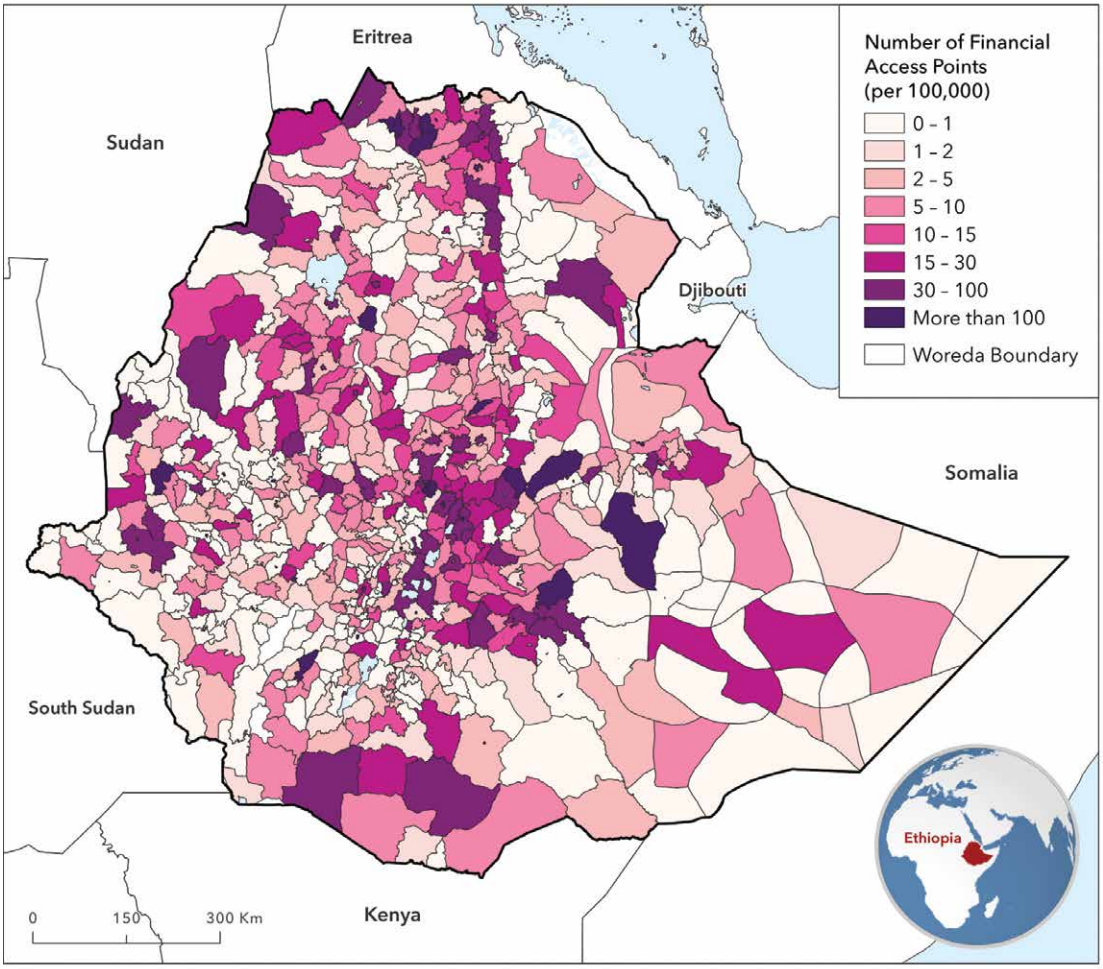
Ethiopia provides a good example of how to tailor a geospatial analysis to countries with limited geospatial data. The geospatial analysis outlined in the previous section was modified to adapt to the case of Ethiopia due to differences in the granularity of the available locational data. While GPS coordinates were provided for access points in Pakistan, only partially complete addresses were available for Ethiopia. This did not allow access points to be mapped as precisely as in Pakistan; instead, locational data for FAPs is limited to addresses at the woreda level.[20] Mapping at the woreda level (for all FAPs) is shown in figure 17. Such coarse mapping does not allow for an analysis as detailed as in the case of Pakistan. Instead of identifying precise communities and neighborhoods for expansion of access points, only woredas of interest can

be identified. Within such woredas, neighborhoods with potential for expansion (for example, densely populated areas with physical connectivity) can be highlighted, but the level of access to FAPs for these cannot be determined. Nevertheless, such analysis can also prove to be valuable to authorities for financial inclusion, as is demonstrated in the following section. Authorities should, however, promote collection of precise locational data of FAPs given that geospatial analysis is most useful when granular data is available (especially for FAPs).

Ethiopia did have locational data available for a more comprehensive set of FAPs, however. These included bank branches, bank agents, microfinance institution branches, microfinance institution agents, ATMs, and M-BIRR (mobile money) agents. This allows for a more complete mapping of access to FAPs throughout the country, especially outside of urban centers, where access points other than bank branches may be more prevalent. More types of FAPs also offer greater flexibility in utilizing a geospatial analysis for different policy objectives, such as the expansion of credit for micro enterprises (for which only microfinance institution branches and agents would be analyzed).

Bank branches in Ethiopia are clustered in the largest urban centers, such as Addis Ababa, Mek'ele, and Adama. Banks are particularly clustered in the megacity of Addis Ababa, which accounts for almost 35 percent of all the bank branches in the country. Only about 14 percent of woredas in Ethiopia have more than 10 bank branches, while 37 percent have none. Mapping all FAPs (including bank branches) yields a relatively more balanced distribution. Nevertheless, variation in access to FAPs remains great throughout the country, including when adjusting for population differences across woredas.

Figure 17: Financial Access Points Density at Woreda Level



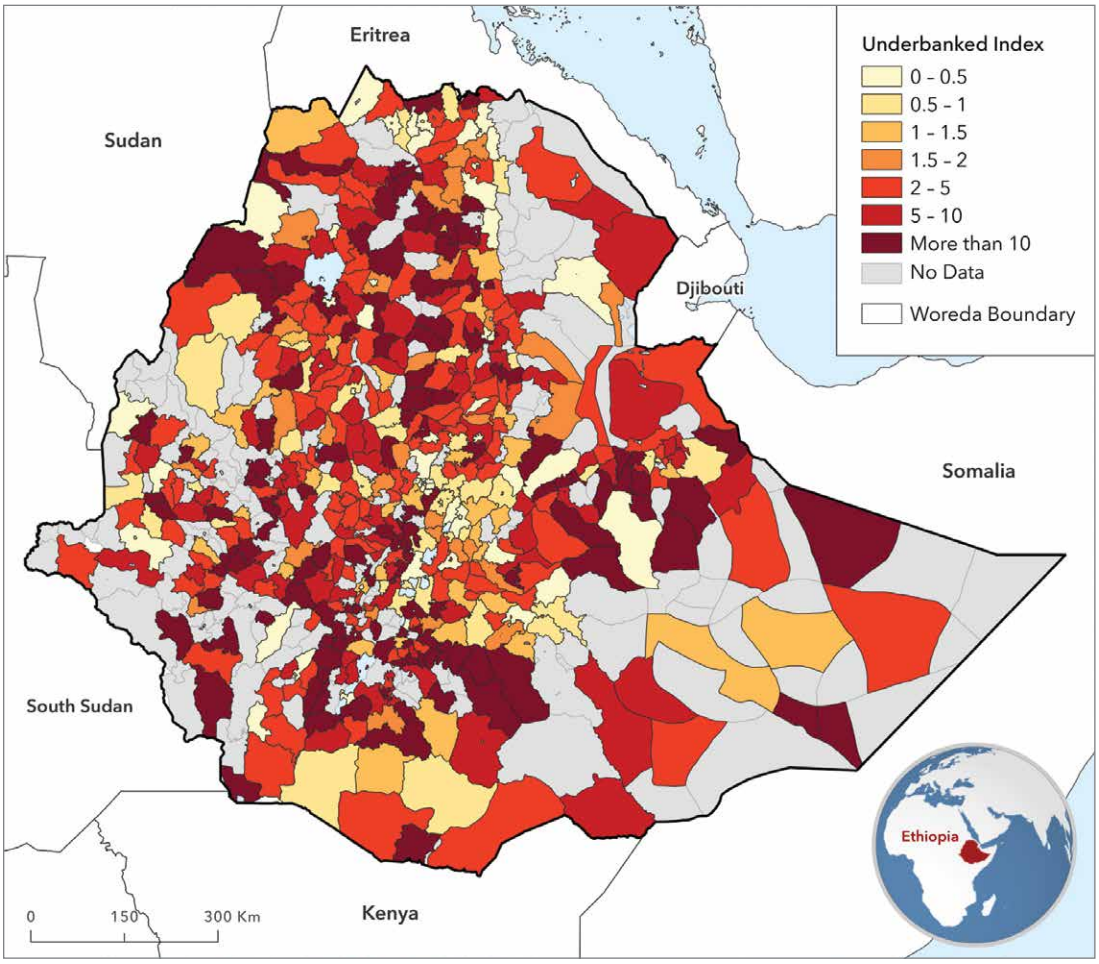
Note: The boundaries, colors, denominations and any other information shown on this map do not imply, on the part of the World Bank Group, any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries.

Inequality in access to FAPs across woredas can be further identified by constructing an Underbanked Index.[21] This index, developed by the World Bank, measures how underbanked each woreda is given its population weight. For instance, Mekele Town would be classified as an overbanked woreda, as it houses only 0.3 percent of Ethiopia's population but accounts for over 1.5 percent of the country's FAPs. Figure 18 represents woredas according to this index and areas that are proportionately underbanked or proportionately overbanked relative to population. Higher values denote greater underbanking (red), and values less than one indicate overbanking (yellow). However, when a woreda is considered to be overbanked by this index, it **does not mean it is overbanked in absolute terms** (that is, it has more FAPs than required), but that it is overbanked relative to the population (that is, it contains a greater share of the country's FAPs than its population share).[22]

4.5. IDENTIFYING OPPORTUNITIES FOR ACCESS-POINT PLACEMENT IN ETHIOPIA

This section illustrates how coarse geospatial data can used in the case of Ethiopia to identify regions of interest for expansion of access to FAPs. The underlying approach to identification is similar to that presented in section 3.2 for Pakistan. Due to the lower precision of locational data, however, only woredas and broad regions within those can be identified as areas for expansion. While this may prove to be sufficient to draft policy,[23] it is possible to identify more precise targets through follow-up ground visits to scout optimal point placements within the broad regions identified through the analysis.

Figure 18: Underbanked Woredas (Relative to Financial Access Points in Ethiopia)



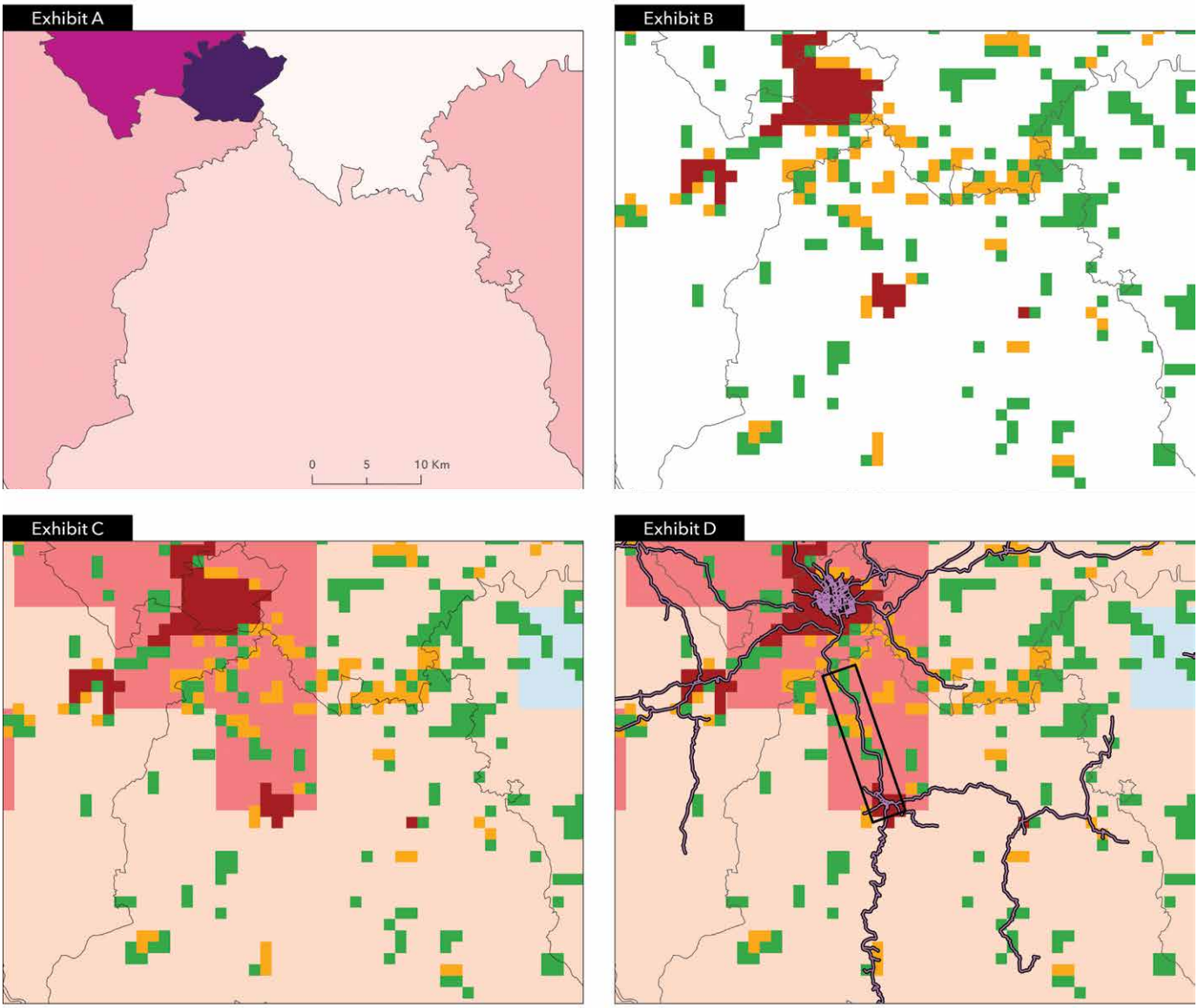
Note 1: The boundaries, colors, denominations and any other information shown on this map do not imply, on the part of the World Bank Group, any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries.

Note 2: Woredos with no access points have no Underbanked Index score and are represented in gray (No Data).

4.5.1. SELECTED CASE STUDY 1: Opportunities in Dedo, Oromiya

Similar to the first case study (section 3.2.1) in Pakistan, this case study also targets areas of financially excluded rural populations that are also highly exposed to natural-disaster risks. The woreda of Dedo in Jimma, Oromiya, has a high average risk of natural disasters. It also has low access to FAPs (fewer than five FAPs per 100,000), is mostly rural, and has decent road coverage. This makes it a good woreda to target if the policy objective is to improve access to FAPs for vulnerable communities. Figure 19 represents high-resolution data on areas for FAP growth within the woreda; areas of interest are outlined in the black box. These areas of interest have population communities that face high natural-hazard risks but are also connected via roads. In cases where populations may be more disbursed or when natural-disaster risks are higher, policy makers can consider more innovative types of FAPs, such as agents.

Figure 19: Identifying Excluded Settlements with High Risk Exposure in Ethiopia



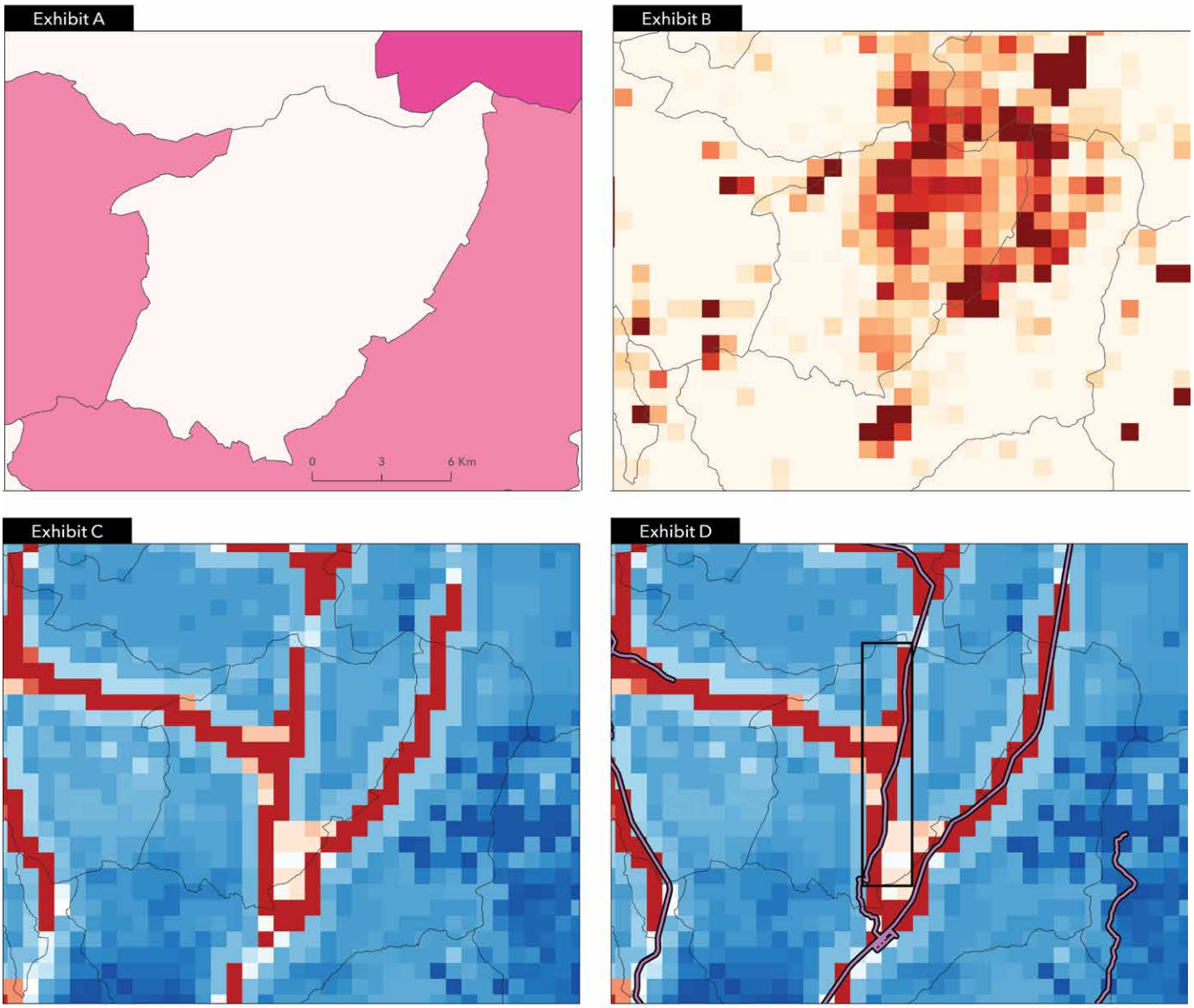
This figure displays four layers for the woreda of Dedo, Oromiya. Exhibit A depicts FAP density for the woreda. Exhibit B shows the settlements layer while Exhibit C adds the risk layer. Exhibit D adds the road network layer. Areas of interest are highlighted in the black box. Map legend is as defined in Figures 4–17, with the exception of roads (which are depicted in purple) and settlements (which depict high-density urban clusters in red, low density urban clusters in yellow and rural clusters in green).

Note: The boundaries, colors, denominations and any other information shown on this map do not imply, on the part of the World Bank Group, any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries.

4.5.2. SELECTED CASE STUDY 2: Opportunities in Damot Pulasa, SNNPR

Areas of high economic productivity are likely to experience higher adoption and usage of financial services if access is introduced. Geospatial analysis was used to identify such opportunity areas for expansion in Ethiopia. Damot Pulasa in Wolayita, Southern Nations, Nationalities, and People's Region, is one woreda with relatively high economic productivity but low access to FAPs (fewer than five FAPs per 100,000), making it an ideal target for expansion of FAPs. The woreda also has relatively high population density, although road connectivity is weak. Figure 20 maps high-resolution data for the economic activity layer as well as the road network layer. The black box (exhibit D) highlights a potential gap for policy makers to serve a populated area exhibiting high economic activity.

FIGURE 20: Identifying Excluded Populations with High Economic Activity



This figure displays four layers for the woreda of Damot Pulasa, SNNPR. Exhibit A depicts FAP density for the woreda. Exhibit B shows the population layer. Exhibit C maps the economic activity layer and Exhibit D adds the road network layer. Areas of interest are highlighted in the black box. Map legend is as defined in Figures 4–19, with the exception of population (higher population density represented in darker color) and economic activity (high economic activity depicted in red and low economic activity depicted on blue).

Note: The boundaries, colors, denominations and any other information shown on this map do not imply, on the part of the World Bank Group, any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries.

CONCLUSION

In conclusion, geospatial technology can help authorities improve access to FAPs, a critical prerequisite for financial inclusion. Policy makers can leverage geospatial analysis for evidence-based policy, monitoring and evaluation, and supervision of the financial sector. Additionally, they can also create a public good to share geospatial data, possibly enabling greater innovation and efficiency in the financial sector. To adopt geospatial technology, policy makers need to build capacity and infrastructure, especially around data collection. Often, however, authorities already collect basic locational data on FAPs, and this can be leveraged for insights.

FSPs stand to benefit from adopting geospatial analysis on multiple fronts, such as profitability, operations, and customer satisfaction. Geospatial analysis can help optimize an FSP's service network, including identifying growth areas to open new branches and low-demand areas to shut down branches. Liquidity management can be improved by predicting liquidity issues spatially as well as identifying relevant distributional partners in the field. It is also possible to better predict deposits, withdrawals, and demand for other services when the spatial element is included in modeling. It can also help to improve customer service by identifying any spatial patterns in customer feedback, especially complaints.

This note illustrates the role geospatial technology can play in advancing access to FAPs by providing greater visibility of the existing gaps and building a business case to address priority areas. Its offering is well aligned with the objectives of both policy makers and FSPs, and hence both should strive to develop internally the capacity to use geospatial analysis to ensure optimal expansion of financial infrastructure. This note also builds the motivation for a future impact evaluation study to quantify the benefits of leveraging geospatial technology on financial inclusion as more countries adopt these tools and results become available with time.

NOTES

16. Additional geospatial data on branchless banking agents was subsequently collected by the State Bank of Pakistan. This can be leveraged in a manner similar to ATMs for a comparable analysis.
17. Tehsils are the second smallest administrative unit in Pakistan.
18. Details on the scoring methodology are available in appendix A.
19. The granularity of the score values depends on the density of the number of observations in any area.
20. Districts, or woreda, are the third-level administrative divisions of Ethiopia.
21. The Underbanked Index is constructed for each woreda as follows:

$$\text{Underbanked Index} = \frac{\text{(Population in Woreda as Proportion of Total Population)}}{\text{(FAPs in Woreda as Proportion of Total FAPs)}}$$

22. The Underbanked Index does not work for woredas with zero FAPs. A modified version of the index can be used to rank these woredas: *Proportion of Population—Proportion of FAPs*.
23. Indeed, most banking expansion policies currently are at a high administrative division level. See footnote 3 for some examples.

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APPENDIX A:

FINANCIAL INCLUSION READINESS SCORE

The World Bank developed a Financial Inclusion Readiness Score to assess regions based on their predicted probability of financial inclusion. Any such prediction exercise relies on the availability of a large sample size of high-quality demand-side geotagged data that captures financial inclusion indicators. However, such data is often limited, as locational data is not captured in most existing demand-side surveys. This report should motivate the collection of such data by authorities.

Where available, data on financial inclusion that is geotagged can be used to predict financial inclusion over areas with no existing access to financial services. Such an exercise was carried out for both Pakistan and Ethiopia. For Pakistan, this analysis utilizes the Financial Inclusion Insights data, obtained from a nationally representative survey of 6,000 individuals across Pakistan. For Ethiopia, data from a nationally representative survey of 3,694 individuals (ESS Financial Inclusion Module 2015) was used.

To calculate the readiness score, a geospatial hotspot analysis was conducted on the financial inclusion geodata. More specifically, this is a geospatial analysis that incorporates spatial relationships to estimate clusters of high-inclusion and high-exclusion data points across space. The resulting data (Z scores) can then be interpolated to derive estimates across the entire space in the sample. However, for precision purposes, this interpolation was limited to only those tehsils/woredas for which at least 10 observations were available.

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