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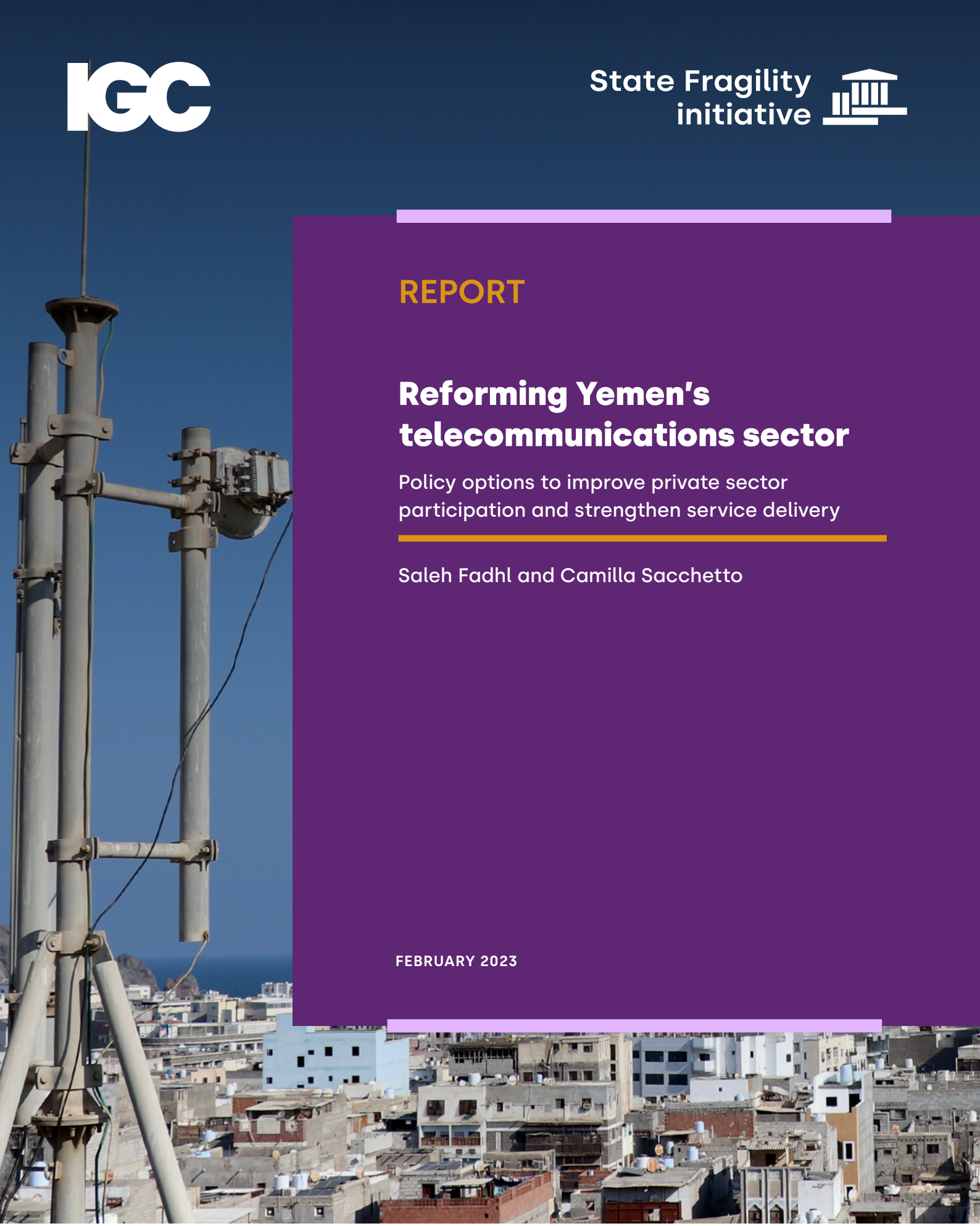

REPORT

Reforming Yemen's telecommunications sector

Policy options to improve private sector participation and strengthen service delivery

Saleh Fadhl and Camilla Sacchetto

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List of abbreviations

AoA	Articles of Association
ARPU	Average Revenue per User
COCA	Central Organization for Control and Accounting
DFA	De Facto Authority
ETC	Emergency Telecommunications Cluster
EWS	Early Warning Systems
GNI	Gross National Income
GSMA	Global System for Mobile Communications
HATC	High Authority for Tender Control
ICANN	Internet Corporation for Assigned Names and Numbers
ICT	Information and Communications Technology
IRG	International Recognized Government
ISP	Internet Service Provider
ITU	International Telecommunication Union
IVR	Integrated Voice Recording
JOA	Joint Operation Agreement
LEO	Low Earth Orbit
LRIC	Long-Run Incremental Cost
MENA	Middle East and North Africa
MIGA	Multilateral Investment Guarantee Agency
MOTIT	Ministry of Telecommunication and Information Technology
MPT	Myanmar Post and Telecom
NGO	Non-governmental Organisation
OECD	The Organization for Economic Cooperation and Development
PGII	Global Infrastructure and Investment
PPPs	Public Private Partnerships
PTC	Public Telecommunication Corporation
UN	United Nations
USD	The United States Dollar
USSD	Unstructured Supplementary Service Device
VSAT	Very Small Aperture Terminal
WTO	World Trade Organization
YER	Yemeni Rial
YOU	Yemen Oman United Company

About

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The International Growth Centre (IGC) works with policymakers in developing countries to promote inclusive and sustainable growth through pathbreaking research. The IGC is a global research centre with a network of world-leading researchers and a set of country teams and policy initiatives engaged in Africa, South Asia, and the Middle East. Based at LSE and in partnership with the University of Oxford, the IGC is majority funded by the UK Foreign, Commonwealth and Development Office (FCDO).

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The State Fragility initiative (SFi) is an IGC initiative that aims to work with national, regional, and international actors to catalyse new thinking, develop more effective approaches to addressing state fragility, and support collaborative efforts to take emerging consensus into practice. SFi brings together robust evidence and practical insight to produce and promote actionable, policy-focused guidance in the following areas: state legitimacy, state effectiveness, private sector development, and conflict and security. SFi has financial support from the FCDO and The Rockefeller Foundation.

Cover photo by Ahmed Mohammed Bafaqih.

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Girls use computers at a school in Sana'a, Yemen. Photo: World Bank/Dana Smillie.

For any inquiries about this work or further engagement, contact the IGC State Fragility initiative team at sfi@theigc.org.

Executive summary

1 **Telecommunications are a vital pillar of Yemen's economy.** The sector's contribution to economic output has been growing steadily at an average of 7% between 2015 and 2018, with a large number of jobs being directly or indirectly linked to the sector. Its impact on public finances is considerable: fiscal receipts from telecommunications (mostly fees and taxes levied from mobile carriers) make up the largest share of public revenues. While lacking official figures, multiple sources suggest that telecommunications sector revenue are likely to exceed USD 150 million, the majority of which is controlled by the Houthis de-facto Authorities (DFA). Further, in Yemen's conflict context, a remarkable feature of the sector has been its resilience. Similar to other fragile settings such as Afghanistan, Iraq, and Somalia, mobile operators have largely continued to provide a basic level of services to the population throughout the conflict years, despite facing huge challenges. Critically, a functioning telecommunications sector has enabled and sustained economic activity over time by linking firms to markets and consumers. It has also supported and reinforced societal ties by connecting communities within Yemen and individuals inside Yemen with the diaspora. Additionally, it has enabled vital humanitarian operations. These contributions highlight the multi-dimensional value of information and telecommunications technologies (ICT).

2 **Notwithstanding their economic and social importance, Yemen's telecommunications acutely underperform regional and global trends in terms of access, quality, and costs.** Access to telephone services, particularly mobile-based services, has slightly contracted since the start of the war. As of 2017, only 27% of the population had access to some form of Internet connectivity, which compares very poorly to the averages for the Middle East and Northern Africa (MENA) region (65%) and the world (49%). Not only is access limited, but quality is also among the poorest in the world, given the abysmally low speed of Internet services and the low bandwidth capacity available to users. Additionally, the costs of telecommunications services, especially Internet, are prohibitive: a data-only mobile broadband package cost 10% of monthly GNI (gross national income) per capita, well above the UN 2% affordability target for entry-level broadband services to be reached by 2025.

3 **These weaknesses have not prevented the sector from gradually becoming increasingly central to conflict dynamics, with control of its resources being a key driver of the war today.** Telecommunications are also actively leveraged by DFA in military operations as a target of frequent military attacks, a key source of financing for the war efforts, or as a tool to engage in spying, surveillance, censorship, and propaganda activities.

The impact of the war on telecommunications has been deeply felt at the level of public institutions, assets and infrastructure, operators, the wider private sector, and citizens. At the institutional level, a process of fragmentation has been taking place between Aden and Sana'a. Most telecommunications institutions and state-owned enterprises are now duplicated and controlled by either IRG or DFA. This has resulted in separate revenue flows (with the largest share captured by DFA), regulatory gaps and inconsistencies, and the creation of new government bodies. Damage to the telecommunications infrastructure, already weak prior to the conflict, has been substantial with over 25% of it being irreversibly impaired and international connectivity being left dependent on only a few, inadequate gateways. These elements, in addition to the challenges faced by the private sector discussed next, have critically deteriorated the quality and affordability of telecommunications for Yemeni citizens and businesses.

4 **A combination of long-standing issues and new, conflict-related challenges makes Yemen's telecommunications market one of the hardest and riskiest in the world for private operators.** Obstacles are multi-faceted and relate to institutional, regulatory, economic, and political economy dimensions. From a regulatory perspective, frameworks are incomplete and outdated, having failed to keep up with recent technological advancements. The institutional split has also led to duplicate sources of authority and instances of inconsistent rules or regulatory gaps, posing high legal risks and uncertainty to companies. Safeguards against anti-competitive practices are lacking. This contributes to the absence of a level playing field for market players and poor transparency in government decision-making. It is also evident in the way authorities assign, renew, and upgrade spectrum[1] and operating licenses, with providers often operating on expired licenses or failing to get approval for applications for 4G services. A cumbersome bureaucracy and a very extractive and unpredictable fiscal regime have stifled private sector development and operators' profitability has plummeted due to these factors, in addition to the growing energy bill, the devaluation of the Yemeni rial (YER), and high security and maintenance costs. Furthermore, private carriers, originally based in Sana'a, have either exited the market, been nationalised by DFA, or forced to relocate to Aden after facing financial looting and asset confiscation. Furthermore, private companies must also navigate the complex political economy that has traditionally characterised the sector. Due to their high financial and strategic value, telecommunications are highly politicised and exploited by political elites as a source of rent extraction. Vested interests of entrenched elite networks tend to shape decision-making by undermining, blocking, and distorting competition and forward-looking, market-based reforms and policies, thereby hindering the sector's sustainable development

5 **Without denying the huge structural and policy-related challenges that inhibit telecommunciations development, opportunities to unlock its potential do exist.** Yemen has a large and growing market for telecommunications services, especially high-speed Internet connectivity. This large and underserved demand has potential to attract sizable private investments if and when key market risks and challenges are addressed. Scope for greater private sector participation is especially evident in satellite-

1 Spectrum refers to the invisible radio frequencies that wireless signals travel over. Those signals are what enable calls, SMSs, and the use of internet.

based Internet and community networks connectivity, financial technologies such as mobile money, and through public-private partnerships for the delivery of country-wide infrastructure.

6 **To realise these and future opportunities, IRG will need to commit to, develop, and implement a genuine, realistic, and long-term reform agenda that can effectively support private sector participation in the telecommunications sector and promote its development.** It is paramount that future reform efforts and policy decisions are anchored on a few key grounding principles, some of which will require a considerable change in the way the government has traditionally interacted with the sector. For example, government should aim to limit its hands-on control and participation in service delivery and move towards a regulatory and policy-setting role. In turn, this will require policymakers to view telecommunications, first and foremost, as an essential service to the population and a critical enabler of economic activity and sustainable development, rather than merely as a source of revenue. This perspective shift would come from the recognition that the long-term, indirect economic benefits of a strong telecommunications sector far outweigh any short-term gains from higher revenues. Moreover, efforts to improve and uphold greater transparency and accountability in government decision-making will be essential to retain and attract investments. The strength and resilience of any national communications network depends on enhanced interconnection and open access across geographical and regulatory areas, which have deteriorated notably with the sector's fragmentation. To this end, IRG should work in cooperation with bilateral and multilateral partners to de-politicise, de-escalate, and neutralise key sectoral issues by addressing them as technical as much as possible. Finally, policy reform should be designed and delivered in an inclusive, step-by-step fashion and should enjoy sustained, multi-party support.

7 **Sequencing of reforms will be a key element of successful implementation:**

- **In the short term (6 months to 1 year),** potential government objectives to consider include restoring local and international connectivity, for example by reinstating and upgrading licenses of public providers or unlocking capacity of newly built gateways; de-politicising key issues by establishing a multi-stakeholder technical working group and by facilitating a dialogue across national private operators; mobilising external support for technical assistance, training, and infrastructure development; and strengthening the technical capacity of public institutions that were recently re-established in Aden.

- **In the medium term (1 to 3 years),** efforts should target the strengthening of regulatory oversight of telecommunications institutions, for example by empowering existing government bodies with regulatory responsibilities. Additionally, legislative and policy bottlenecks should be tackled by revising and updating current sectoral legislation and fiscal rules, country-wide access could be expanded through the negotiation of national roaming agreements with operators and by facilitating the adoption of mobile money, and international diplomacy should be leveraged to address key bottlenecks such as unfreezing TeleYemen's funds and regaining control over international gateways from DFA.

- **As peace will hopefully materialise and the sector stabilises over the long term (3+ years),** the government should focus on adopting a modern, independent regulatory framework that is conducive to private investment and healthy market competition by establishing an independent regulator, and through a comprehensive digital development strategy.

8 **Long-term reform outcomes will ultimately hinge on the future developments of the conflict.** Notably, the failure to renew an agreement to extend a nationwide truce, as announced on October 2, 2022, risks dragging the country into yet another cycle of war, with the prospects of peace becoming significantly more distant. Yet, the ongoing UN-led negotiations of the peace process, including the recently established economic track of negotiations, offer a space to address the urgent issues faced by the telecommunications sector in Yemen and to implement a few, tangible policy changes that could deliver quick wins and kickstart sustained reform process. Telecommunications have been severely affected by the war but have also shown unique resilience. As a result, while developing the sector, especially in terms of attracting private capital, presents sizable challenges, there are also visible opportunities to be seized as telecommunications could – and should – play a central role in supporting future reconstruction efforts, bolstering economic recovery and growth, and rebuilding national cohesion.

Summary of policy recommendations

To strengthen and develop Yemen's telecommunications sector, IRG will need to develop and implement a clearly sequenced reform agenda over the short, medium, and long term. The agenda should be firmly grounded in a set of underpinning principles that would form the basis against which policy decisions are assessed and designed. **Section 11** discusses these principles and recommended policy actions in detail. Here, we provide a summary of the main policy objectives and recommendations that have been identified in this report.

Short term (6 months to 1 year)
Objective 1 – Restore local and international connectivity
Action 1 – Reinstate and upgrade licenses of Aden-based operators to long-term 4G or technologically-neutral licenses, potentially made conditional on the companies achieving set performance indicators.
Action 2 – Scale local community networks that could provide connectivity to remote communities in relatively peaceful regions. To overcome the need for parliamentary approval of new licenses (which is currently unfeasible due to parliamentary activity being suspended), state-owned enterprises in the telecommunications sector could be allowed to sub-license local community network companies for these services.
Action 3 – Channel funds (public and private) towards network rehabilitation, prioritising the restoration of mobile broadband coverage. The rehabilitation of domestic fibre-optic and international cable networks should follow. With regards to the latter, IRG should focus on maximising the use of the Aden-Djibouti cable and activating the AEE-1 link (section 11 suggests strategies to achieve this).
Action 4 – Strengthening state-owned institutions that have been fully re-established in Aden should also be considered as a key area where to allocate available financing, with a focus on upgrading their core infrastructure, hiring qualified technical staff, capacity building, and revising regulations and legislation.
Action 5 – Link the domestic network to the SEA-ME-WE-6 cable, whose infrastructure is currently being developed along Yemen's coastline, as part of the USD 600 billion G7 Partnership for Global Infrastructure and Investment.
Action 6 – Review the security embargo on telecommunications equipment to ensure that it prevents cross-border smuggling of military devices and that it does not (inadvertently) hinders humanitarian and private sector actors in carrying out ordinary import activities.
Action 7 – Scale satellite-based Internet services, especially through low earth orbit technology, to rapidly deploy connectivity to communities that have been cut off from the national network or that are in remote parts of Yemen. To do so, IRG should promptly engage with international investors that have expressed appetite to enter Yemen's market.
Objective 2 – De-escalate and de-politicise selected issues
Action 1 – Establish technical working groups among the parties, as well as among operators, to address and negotiate key sectoral issues that are linked to conflict dynamics (e.g., revenue sharing mechanisms, market fragmentation) to de-escalate tensions, de-politicise the sector, and improve peace prospects. These efforts could fall within or be parallel to the UN-led economic track of the wider peace process.
Objective 3 – Mobilise external support
Action 1 – Reconnect with international institutions working on telecommunications sector development issues such as ITU, OECD, ICANN, and GMSA, to leverage support towards technical assistance, training, and infrastructure development.
Objective 4 – Build greater transparency by leveraging quick wins
Action 1 – Launching an ICT data initiative to collect and publish key telecommunications sector data is a low-cost, high-value effort for IRG's MoTIT to consider. In addition to promoting transparency and trust in telecommunications institutions, the availability of data could also strengthen private sector investment, as operators would be better equipped to conduct feasibility studies, assess risk, and make business decisions.

Medium term (1 to 3 years)
Objective 5 – Strengthen transparency and oversight
Action 1 – Empower existing institutions with regulatory oversight responsibilities as an interim solution to an independent regulator for the telecommunications sector, which is currently not a politically nor practically viable option. In particular, bodies such as the Central Organization for Control and Accounting (COCA), the High Authority for Tender Control (HATC), the Anti-corruption Commission, and the Central Bank could be well placed to perform specific regulatory functions for the sector.
Action 2 – Establish a legal framework for AdenNet to help develop and expand the company's services to all IRG territories while ensuring transparent operations and fair competition with other players.
Action 3 – Remove overlaps in responsibilities and functions among public institutions such as TeleYemen and AdenNet, ensuring that each is acting in accordance with its mandate, as a way to limit governance risks and operational inefficiencies.
Action 4 – Entrust a neutral body (such as Internet Society Yemen Chapter) with authority over the country's top-level domain, domain, .ye, that is currently controlled by DFA.
Objective 6 – Tackle legislative and policy bottlenecks
Action 1 – Revise the tax policy to make it less extractive on private sector operators and more aligned with international good practice. This process should be conducted in consultation with operators and other relevant stakeholders.
Action 2 – Review the current telecommunications law (which is highly outdated) to better meet needs of the telecommunications market, enhance the role and partnership of the private sector, encourage competition, and align with technolgical developments.
Action 3 – Develop transparent and adequate licensing regulatory frameworks to ensure that licenses are rolled out in a fair and symmetrical way across operators and that issues such as certainty in licensing contracts and risk of corruption are adequately addressed.
Action 4 – Negotiate domestic roaming agreements with operators and develop the relevant regulations. This would allow consumers to switch across partners networks in areas where a device's primary carrier does not have coverage, ultimately improving overall accessibility for consumers throughout the country.
Action 5 – Tackle political and economic risk indicators given the sensitivity of infrastructure investors to improvements in country risk ratings in conflict-affected countries. Based on the World Bank's Doing Business report, crucial areas to tackle through targeted policies include construction permits, access electricity, and cross-border trade.
Action 6 – Scale the adoption of mobile money to strengthen financial inclusion and support private sector development by upgrading the legislation for electronic payments, improving the necessary telecommunication infrastructure to guarantee reliable connectivity, and allowing mobile operators to use ad-hoc technologies needed to provide these services.
Objective 7 – Unlock key bottlenecks through diplomacy
Action 1 – Seek to unfreeze TeleYemen's USD 300 million, currently held in a Saudi bank since 2015. This will likely require negotiations with the Saudi government and lobbying from IRG's bilateral and multi-lateral partners. The release of the funds could be made conditional on it being allocated to development and politically-neutral projects. Alternatively, the funding could be placed in an escrow account to be unfrozen at a later stage, once prospects for peace and a political process materialise.
Action 2 – Regain access to most international gateways to deliver high-speed connectivity to Yemen and improve the sector's resilience. In particular, IRG should seek recognition for TeleYemen-Aden from the cable consortia of both FALCON and SEA-ME-WE-5. For Africa 1, IRG should understake investments to connect the national network to the cable by building a landing station in Mocha and purchase internet capacity from the cable.
Action 3 – Negotiate with foreign governments to re-route international calls through Aden rather than Sana'a (as it mostly happens today), via the Aden-Djibouti cable. This would only apply to calls towards Aden-based operators. The re-routing of calls would not only increase revenues but also carry security benefits at it may mitigate DFA's espionage and interception activities over international calls.

Long term (3 years onwards)
Objective 8 – Develop a modern and independent regulatory framework that is conducive to private investment and healthy market competition
Action 1 – Establish an independent regulator to ensure the separation of regulatory powers and responsibilities from IRG as well as stabilise and de-politicise the sector's policy.
Action 2 – Formalise the structure of operating licenses and spectrum licenses to improve certainty for operators over future use and act as a guarantee of interference requirements. This would encompass spectrum access, backhaul, sensors, broadcasting, navigation, and emergencies.
Action 3 – Implement regulated termination rates to manage the risks associated with natural monopolies that excessively favour large operators over small ones. The aim of such regulation is to ensure that there can be multiple viable operators with reasonable market shares, leading to the regulation no longer being needed in the future
Action 4 – Monitor the level of competition to ensure that one operator does not take over any short-term state-run network, raising risks of predatory pricing or margin squeeze, and that there can be there can be multiple viable operators with reasonable market shares. To achieve this, in the short-to-medium term, some level of price regulation is likely to be required through a price cap or price floor, depending on the market context.
Action 5 – Implement good practice regulation, as the industry settles, to maintain competition and incentivise investment in networks. Barriers to consumers switching networks should be removed through the implementation of mobile number portability, removal of penalties for leaving, and improved information and comparison tools.
Objective 9 – Develop a long-term, national vision for the telecommunications sector
Action 1 – Develop a digital strategy to provide a vision for the sector and guide long-term government decision-making. Areas of focus may include e-governance services, development of financial technologies, and so forth. Critically, the strategy should be developed in consultation with local communities, civil society, political parties, and private sector representatives from multiple sectors.

1 Introduction

Developing modern, reliable, and accessible telecommunications services in Yemen is key to the country's sustainable socio-economic development. This report aims to support the efforts of Yemen's IRG in telecommunications sector policy and regulatory reform, with a focus on ways to improve private sector participation and strengthen service provision, in alignment with the 2021 IRG draft general programme.

Yemen's telecommunication sector is poorly developed, with only 27% reporting to have access to Internet services. Internet connectivity is also abysmally slow and unstable by world and regional standards, although affordability has been improving with the recent introduction of 4G services. Poor connectivity has had negative consequences for both economic productivity and social interactions. While social norms and unfavourable geographic conditions have played an important role in excluding marginalised communities from access to these services, a traditionally weak regulatory environment and inefficient, often highly politicised policymaking have held back private investment in the sector over the years.

The conflict has undeniably exacerbated structural issues and long-standing policy challenges and created new ones. In large part, this is directly driven by the increasingly pivotal role that the sector plays in conflict dynamics due to its strategic importance for military operations and its large contribution to public revenues, now mostly controlled by DFA. These factors have contributed to an extremely hostile environment for private sector development. The institutional bifurcation of the main government agencies between Sana'a and Aden, in addition to being highly inefficient, poses huge legal uncertainties and policy incompatibilities, with operators frequently incurring legal disputes with either parties, being subject to double taxation, or deciding to relocate or exit the market. The ultimate victims of these factors are Yemen's people. Indeed, in addition to the hardship already imposed by years of war, they have experienced a deterioration in telecommunication services that are essential to daily economic and social activities.

Notwithstanding this dire scenario, opportunities to improve the sector do exist, highlighted by the large yet latent demand for connectivity across the country. Given the huge capacity challenges faced by IRG and in line with international good practice, it is the private sector (that has largely demonstrated significant resilience) that should be enabled to realise these opportunities, provided that the required enabling conditions are in place. They include, but are not limited to, localised community networks, satellite internet, and mobile money.

Successfully implementing a reform agenda for the sector should begin with a sound set of policy principles guiding government decisions. In the short term, government efforts should prioritise the restoration of local and international connectivity, with support from international actors where possible, and undertake multi-stakeholder efforts to de-escalate tensions over disputed issues, including through the UN-led peace negotiations. Legislative reform at the level of both policies and institutions will need to be tackled in the medium term, in addition to diplomatic efforts by IRG and its partners to unlock international gateway capacity, frozen funds held abroad, and more. Depending on the evolution of the conflict, IRG should undertake efforts to build a modern, efficient, private sector-led, and independently regulated telecommunications sector, which will ultimately deliver high quality services to all Yemenis.

From a methodological standpoint, this paper relies on a multiple sources and approaches. These include an in-depth desk-based literature review, case studies from comparable contexts, secondary data analysis, and semi-structured interviews with senior and mid-level policymakers, executive staff in private mobile operator companies, researchers, sectoral experts, and representatives of the private sector, development agencies, and the media, whose contributions have been critical to the report and its findings.

The remainder of this report provides in an in-depth analysis of the telecommunications sector in Yemen, including historical trends, current challenges and opportunities for private sector development, and suggested areas for government reform. Given the level of detail of this paper, certain sections may be of greater interest than others, depending on the reader's contextual and technical knowledge, expertise, and role. To navigate the document more effectively, in accordance with your needs, please consider that:

- **Section 2** provides an overview of the role of telecommunications fragile and conflict-affected settings, based on the international evidence and literature;

- **Sections 3** to **6** focus on Yemen's historical dynamics in terms of access, quality, and costs to telecommunications services, the country's telecommunications infrastructure, the sector's institutional and regulatory frameworks, and the current market structure;

- **Sections 7** and **8** describe the economic, social, and conflict-related impacts of the telecommunications in Yemen.

- **Sections 9** to **11** discuss the challenges and opportunities faced by private sector operators and propose a policy recommendations to support the sector's development in over the short, medium, and long term.

2 The role of the telecommunications sector in fragile settings

2.1 Economic, financial, institutional, social, and humanitarian dimensions

> **Telecommunications – including fixed- and mobile-telephone services, Internet connectivity, and relevant infrastructure – are a critical sector in fragile and conflict-affected settings for economic, institutional, social, peace-related, and humanitarian reasons.**

Economic and financial dimensions

Empirical evidence confirms that the direct and indirect economic impact of a reliable and high-quality telecommunications sector – particularly one that enables Internet connectivity – is significant. Key economic variables positively impacted by telecommunications include workers and firms' productivity, skills, access to markets through greater exports, poverty reduction, and household consumption at the microeconomic level, as well as improved employment and GDP growth rates at the macroeconomic level.[1]

Importantly, telecommunications technologies are essential enablers of basic economic activity as daily financial operations and commercial transactions increasingly rely on them. These include sending or receiving remittances and performing financial transactions via mobile banking or mobile money. In addition, ICT can help ensure that sellers and buyers have equal access to information (e.g., on product quality or supply) and improve transparency and trust, particularly if individuals find themselves in remote areas or are distant from one another.[2] Therefore, telecommunications can critically connect firms to consumers, other businesses, markets, and cities, improve firm-level productivity and profits, and enable markets to function.

In the post-conflict phase, ICT can have resilience-enhancing impacts on livelihoods. Access to affordable communication services can help individuals rebuild their livelihoods by providing information on job opportunities, enabling individuals to reconnect with family and communities from whom they had been separated due to conflict, or

1 See for example Hjort, J., and Poulsen, J. (2019), Katz, R., and Callorda, F. (2019), Anderson and O'Connor (2020), O'Connor et al. (2020a, 2020b, 2020c, 2020d, 2020e), Hjort and Sacchetto (2022).

2 Halewood and Decoster, 2017

sharing information on product price and quality.[3] All of these factors contribute to the necessary conditions needed to sustain and grow incomes, create jobs (directly and indirectly), support economic activity and socio-economic resilience and, ultimately, promote recovery.

Recent ICT-related innovations such as mobile money and digital banking, have also proven to be conducive to greater financial inclusion of marginalised groups such as women, youth, and microentrepreneurs.[4] This is particularly important in more remote locations or regions, as they enable money to be sent across considerable distances more cheaply, safely, and quickly than would otherwise be possible. They also support more diverse, informal risk-sharing, thereby having a notable impact on increasing the economic resilience of households.[5]

Institutional factors

The telecommunications sector can be an important direct and indirect source of public revenues: directly, through taxes and licensing fees from private operators, and indirectly through the trickle-down impacts that connectivity has on private sector development and economic activity more broadly.

With regards to direct revenue contributions, since fiscal capacity in fragile settings is often constrained, receipts from telecommunications can mitigate governments' budget deficit and strengthen capacity to deliver public services. In turn, effective delivery of essential services can improve government-citizen relationships and rebuild state legitimacy. However, an excessively oppressive fiscal burden on telecommunications operators will likely be passed onto consumers by mobile operators in the form of higher prices. Alternatively, to compensate for high licensing costs, private operators may look for strategies that achieve cost reduction in other areas, including reducing network rollout, curbing reinvestment, or degrading the quality of services. Therefore, governments should carefully consider the level of fiscal obligations and the need for interventions that mitigate the negative impacts of higher prices on consumers.

In addition to private sector applications, telecommunications technologies are increasingly leveraged by public administrations. E-governance systems have been successfully applied in a range of sectors such as health and education, and are allowing developing countries to upgrade to cutting-edge technologies more rapidly by leapfrogging intermediate technological stages. Furthermore, widely accessible and functioning telecommunications services reinforce governments' ability to communicate effectively and uniformly across

3 Halewood and Decoster, 2017
4 Halewood and Decoster, 2017
5 Logan, 2017

the national territory. This can be instrumental in rebuilding authority, legitimacy, and a sense of national unity among the population, laying the foundations for long-term resilience and nation-building.

Social dimensions

Telecommunications services fulfil citizens' basic need to connect with family members, their community, and the wider society. The need to communicate with one another is likely to be especially pressing as people face prolonged periods of uncertainty and risk due to conflict-related violence, military attacks, and forced displacement. Moreover, access to the Internet and to telephone networks allows individuals to stay informed about political, security, and economic developments in their country or region and enables informed decisions regarding movement from, within, and to conflict-affected areas. Access to mobile phone services, in particular, becomes critical in crisis situations, when information regarding military actions, medical assistance, food and water supplies, and the location of family members may mean the difference between life and death.[6]

In addition, access to reliable sources of information can have conflict-reducing effects. By mitigating the spread of fake news, misinformation, or false propaganda, access to reliable information can strengthen social cohesion and improve trust in government institutions. However, this must be carefully weighed against the potential for dissemination of false information which can, by contrast, fuel divisions and conflict.

Telecommunications also have an important social role to play in post-conflict reconstruction. In addition to supporting economic recovery (as discussed below), re-establishing connectivity can act as a powerful signal that a country is gradually returning to peace and normality. This, in turn, can strengthen citizens' support for and confidence in the authorities, rebuild intercommunal relationships and, ultimately, foster peace.[7]

Humanitarian factors

The scope for ICT technologies to support and amplify the impact of humanitarian relief in fragile and conflict settings is large and expanding. Telecommunications can enable better coordination and communications among humanitarian actors, NGOs, and development agencies, improving the delivery of aid. New generation early warning systems (EWS) that rely on information provided directly by communities can help identify areas at risk of violence or conflict outbreak, which in turn allowing to better plan the provision of relief more effectively.[8] Access to social media via mobile devices is also allowing citizens affected by conflict or natural disasters to

6 Kelly and Souter, 2014; World Bank, 2020a
7 Kelly and Souter, 2014
8 Kelly and Souter, 2014

rapidly reach out to humanitarian organisations and request and direct assistance. Increasingly, cash transfer programmes rely on ICT technology in their delivery phase such as through electronic vouchers directly sent to mobile phones.

It is beyond the scope of this paper to discuss in depth the challenges and opportunities that exist for telecommunications to support humanitarian projects. Nonetheless, we wish to highlight the need for more studies that assess the relative effectiveness of alternative ICT solutions interventions in humanitarian settings, their viability in the Yemen context more specifically, and the actions needed from all stakeholders, including the government and the private sector, to achieve the desired outcomes.

2.2 Telecommunications and conflict dynamics

Telecommunications are often central to conflict dynamics. Their strategic importance from military, security, and economic standpoints makes telecommunications infrastructure and assets a frequent target of military attacks, as in the case of the conflicts in Timor-Leste and Liberia. Nonetheless, the public nature of the services offered by mobile and Internet operations, coupled with the fact that international investors often operate with local partners – and so may acquire a "local identity" – makes attacks on telecommunications assets quite unpopular, compared to, for example, assets of foreign-affiliated oil and mining investments or international banks.[9] Mobile and Internet technologies can often also be leveraged by warring factions to coordinate attacks, disrupt services, recruit, surveil, censor, and spy on enemies and the wider population, and build a support base among citizens. For example, governments or groups in control of the telecommunications infrastructure can impose widespread and prolonged blackouts or outright bans on the use of technology in conflict zones, as in the case of Indian-administered Kashmir Valley. Parties to a conflict are also likely to fight over the control of the sector in order to secure much-needed revenue streams to finance war efforts.

In spite of these challenges, telecommunications tend to show high resilience and adaptability to conflict and fragility, compared to other sectors.[10] In post-conflict settings, while foreign direct investment (FDI) recovers after the end of hostilities, this does not happen simultaneously across sectors. For instance, energy generation and distribution and transportation investments, or water and sanitation projects tend to materialise only after a few years of sustained stability, once investment conditions are right.[11] The telecommunications sector behaves differently. First,

9 Bray, 2005
10 Halewood and Decoster, 2017
11 Schwartz, Hahn, and Bannon, 2004; Mueller, Piemontese, and Tapsoba, 2017

telecommunications companies are often able to provide services in areas that are *still* in conflict.[12] Afghanistan, Iraq, and Somalia offer examples of this, where private mobile services have managed to expand their coverage on a competitive and cost-efficient basis.[13] Notably, Somali investors developed viable and unregulated mobile-phone networks even in the absence of government and in a context of long-term conflict between warlords.[14] Second, evidence shows that the sector attracts the largest number of projects soon after the end of a conflict.[15] International aid agencies and non-governmental organisations (NGOs) are typically the first new clients, followed by the local population.[16] Indeed, in post-conflict contexts, new telecommunications investment is often an important first signal of economic recovery. By demonstrating commercial viability, pioneering investors pave the way for others to enter the market and provide the essential services for businesses to operate.[17] According to World Bank analysis, the contribution to economic output of the communications sector (together with transport and storage) is the second largest in the post-conflict phase, coming after the construction sector (which often respond to urgent reconstruction needs). Once these initial infrastructure weaknesses are overcome, other essential sectors can step in. The manufacturing sector is typically the last to pick up, as conditions for it to restart and develop take longer to materialise.[18]

The high resilience of the telecommunications sector to conflict and fragility also highlights greater risk-acceptance by mobile and Internet service operators, compared to other infrastructure investors. Reasons for this include:

- **Low costs –** Once the basic infrastructure is in place, the investment costs of establishing and running telephone and Internet networks are relatively low and highly standardised, with minimal country-specific engineering requirements and rapidly deployable infrastructure.[19] Specifically, the initial investment of mobile networks is estimated to be in the hundreds of thousands of USD, as opposed to the multi-billion USD start-up requirements of extractive industries.[20] Indeed, as long as investments are not aiming at a large-scale coverage, the main costs of the network are normally (i) land to raise mobile masts and (ii) spectrum license.

- **Quick returns –** Network operators are able to make positive returns very rapidly, virtually as soon as customers begin using their

12 Schwartz et al., 2004; Bray, 2009; Jackson and Beswick, 2014; Mills and Fan, 2006
13 World Bank, 2005
14 Kelly and Souter, 2014
15 Kelly and Souter, 2014
16 Bray, 2005
17 Bray, 2005
18 Ragoussis and Shams, 2017
19 Bray, 2009; Mills and Fan, 2006
20 Bray, 2009

services, i.e., making calls, sending texts, or using Internet data.[21] This allows investors to recover the initial (limited) outlays and make a profit in a relatively short amount of time (even two or three years) and much earlier than in the oil or mining sectors.[22]

- **Large and growing demand –** As opposed to saturated markets in the global north, there is often a large, unmet demand for telecommunications services in developing countries and fragile settings. This creates significant business opportunities to capture new customers in a context of limited competition.[23]

3 Access, costs, and quality of telecommunications services in Yemen

Historically, Yemen's telecommunications sector has faced acute structural challenges, many of which persist today. These include limited access, poor quality and expensive services, weak infrastructure, and a constraining regulatory and institutional environment for private sector development. This notwithstanding, access to telecommunications services has been expanding steadily since the 2000s, highlighting a high latent demand by the population and improved affordability. As of 2014, 90% of the population was covered by a mobile network and nearly half of Yemenis had a mobile telephone subscription by 2020 (based on unique SIM card counts). Quality of services has lagged considerably behind, however, especially by regional and global standards.

The current conflict has exacerbated existing issues and triggered new ones, resulting in many key ICT development indicators deteriorating or stagnating. Despite these challenges, telecommunications have shown remarkable resilience, as operators have continued to provide services to the population throughout the war.[24] Indeed, resilience is a frequent and rather unique feature of telecommunications in contexts undergoing conflict or experiencing state fragility, as in the case of Afghanistan or Iraq. Today, even if the quality and diffusion of telecommunications is slowly recovering, Yemen still underperforms regional and global averages across most indicators and sizable geographical and gender-based disparities remain.

21 Schwartz and Halkyard, 2006
22 Bray, 2005
23 Bray, 2005
24 Gressman, 2016

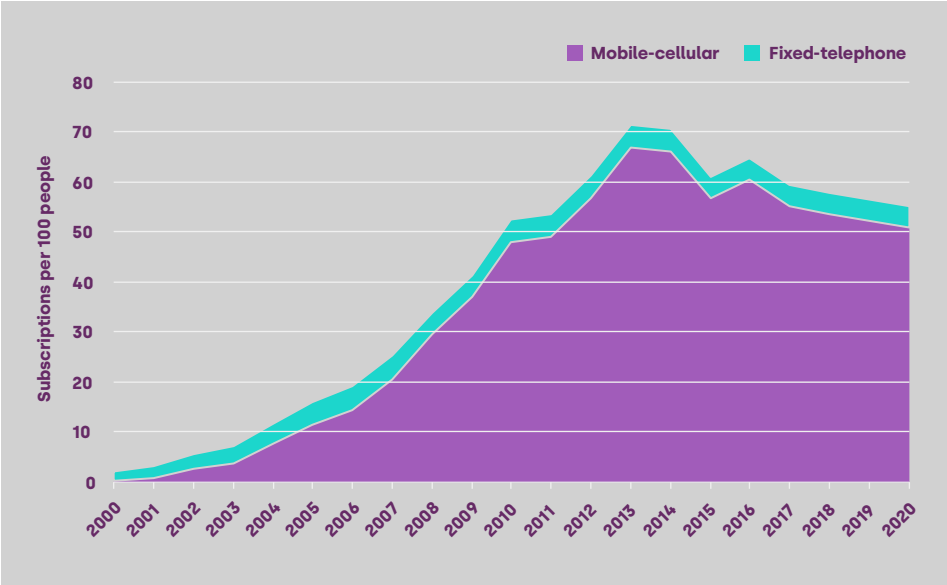
3.1 Telephone services

Access

Access to mobile-telephone services in Yemen has grown steadily over the last two decades but abruptly deteriorated with the beginning of the current conflict as a large share of the core infrastructure was damaged or destroyed. On average, mobile telephone subscribers (per 100 inhabitants) grew by 75% per year between 2000 and 2013, going from 32 thousand to 17 million users in total.[25] The start of the conflict coincided with a halt to the sector's expansion and total subscribers decreased yearly by 4% between 2014 and 2019, on average, with a negative peak of -14% in 2014. Subscriptions are still declining today, although less steeply, signalling the persistent challenges faced by sector, and usage is yet to recover to pre-war levels (**Figure 1**).[26]

In common with many countries worldwide, fixed-telephone services have shown more limited growth. As of 2020, they accounted for just over 1.2 million subscribers. Similarly, subscriptions per 100 people declined with the start of the conflict and, to date, have failed to fully recover (**Figure 1**). It should be noted that, with the increasing capabilities of mobile networks, many consumers across the world are in fact opting to disconnect fixed line telecommunications and are switching to mobile devices, especially given higher access costs often associated with fixed line telecommunications.

Figure 1: Access to telephone services in Yemen, 2000-2020[27]



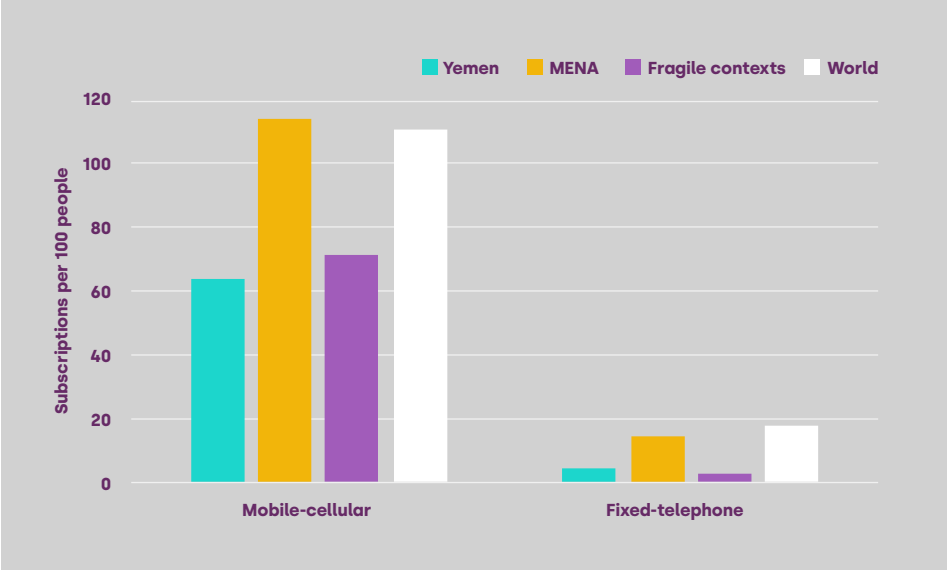
25 Throughout this report, it should be noted that subscriptions data as a measure of access to telecommunications is likely to overestimate real figures because it may capture users with more than one subscription. Unfortunately, the authors do not have access to comprehensive and comparable data on unique subscriptions, to date.

26 ITU, 2021a

27 ITU, 2021a; ITU, 2021b. Given the missing data point for fixed-telephone subscriptions in 2018, the authors estimate this figure by calculating the arithmetic average between 2017 and 2019.

Notwithstanding growing access to mobile-based telecommunications services over the last two decades, Yemen underperforms the global, regional, and fragile-context averages. Notably, MENA and global average mobile subscriptions (per 100 people) are more than double rates in Yemen, whose performance is closer to, but still lower than, that of other fragile settings. Gaps, although more moderate, also exist for fixed-landline subscriptions (**Figure 2**).

Figure 2: Access to telephone services as of 2019, mobile and fixed[28]



Costs

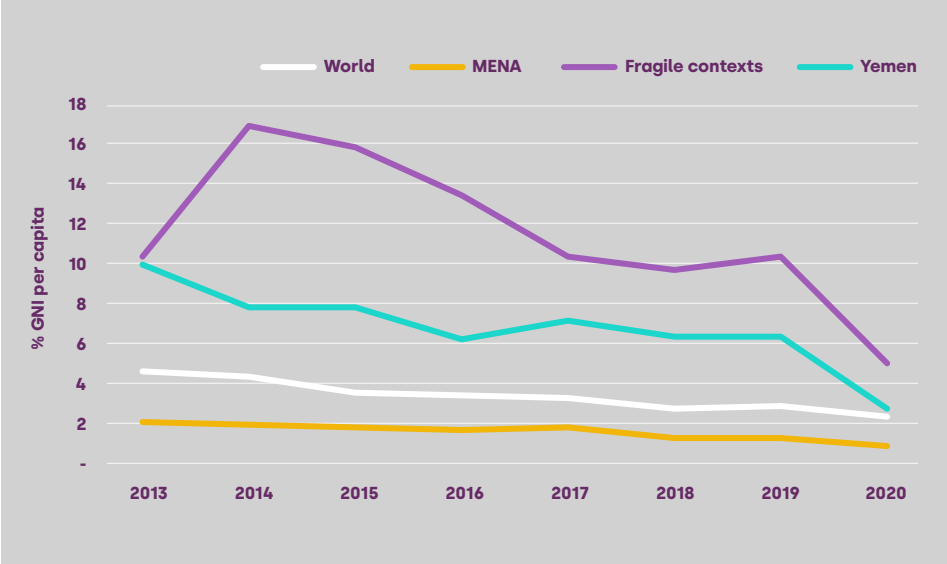
Prices of telephone services such as calls and SMS, remain high, notwithstanding significant reductions in recent years (Figure 3). The cost of telecommunications services has fallen by over 70% since 2008, approximating the world median of 1.1% of income per capita and the UN Broadband Commission's 2% affordability target to be reached by 2025.[29] As of 2020, a low-usage mobile-cellular basket in Yemen cost USD 4.40, or 2.8% of monthly income per capita, still higher than MENA's median at 0.6%.[30]

28 ITU, 2021a; ITU, 2021b; ITU, 2021c; ITU, 2021d. Throughout this report, the authors adopt the World Bank Group classification of fragile and conflict affected situations to calculate, relevant to the year(s) of interest, to calculate the average for fragile context (World Bank Group, 2021).

29 Vertesy, 2020; Broadband Commission for Sustainable Development, 2021

30 This is cheapest plan providing at least 70 minutes of voice and 20 SMS.

Figure 3: Cost of a low-usage mobile-cellular basket (as a % of GNI per capita), 2013-2020[31]



3.2 Internet services

Access

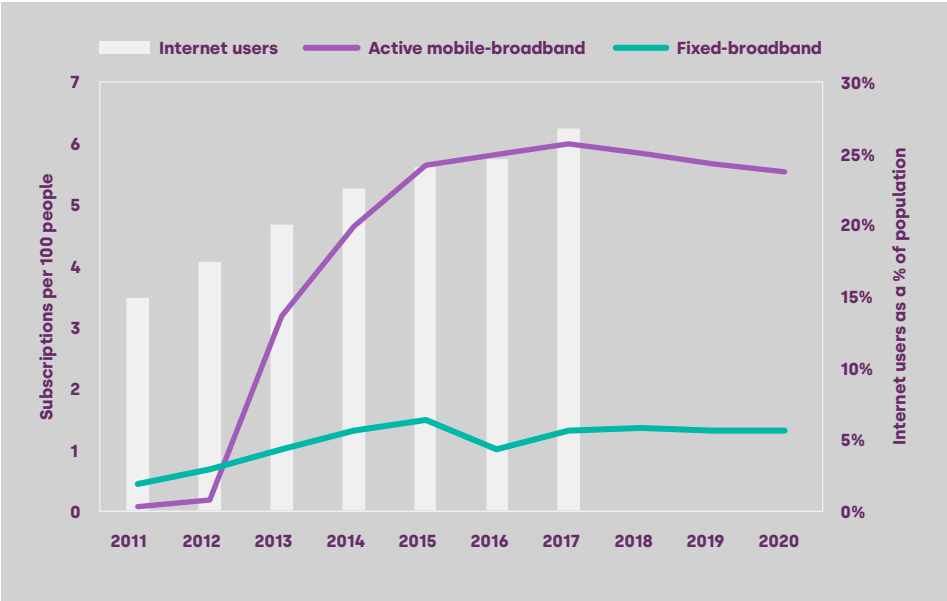
With regards to Internet access, the share of users in Yemen has been growing steadily since the Internet was first introduced in the country in 1996 (**Figure 4**, right-hand side vertical axis). Between 2011 and 2017, the share of Yemenis using the Internet grew from 15% to 27%. Internet access has continued to improve, although more moderately, throughout the conflict due to the notable degree of resilience and adaptability of this service to fragility and war as well as high demand. To confirm these trends, Internet subscriptions (fixed and mobile) and IP transit consumption have largely been on a positive trajectory year-on-year, albeit remaining low (**Figure 4**, right-hand side vertical axis).[32] In particular, mobile-broadband subscriptions have been growing steadily over the years but remain small, at 6 per 100 people. Similar to fixed-telephone services, demand for and access to fixed broadband is significantly limited, with less than 2 subscribers per 100 inhabitants, or only 391 thousand people in 2019.[33] Today, Internet is available in most urban areas, despite frequent reliability issues, while remote and rural regions are deeply underserved.

31 ITU, 2020. Values for comparison groups correspond to medians. Medians for country groups were only calculated for the subset of economies with data available for all years in the dataset (2008-2020).

32 Bahia, K., Arese Lucini, B., and Stryjak, J., 2015; Halewood and Decoster, 2017

33 MoTIT-DFA, 2019

Figure 4: Access and subscriptions to Internet services in Yemen, 2011-2020[34]



Yemen acutely underperforms regional and global trends with regards to the use of Internet services. When looking at subscriptions data (mobile-broadband), Internet subscribers per 100 people are nearly four times lower than the mean for fragile settings and over 10 times lower than that of the region (**Figure 5**). Internet access figures are higher and more in line with the average for fragile states, as 27% of the population reported using the Internet in 2017 (**Figure 6**). The difference between Internet access and subscription data may be due, among other things, to the fact that a significant part of the population only occasionally accesses the Internet, for example through Internet cafés, rather than more regularly through their own smart phones. This is likely to be the case for rural communities, low-income households, women, and youth. Internet access figures are still very low compared to the global average and are less than half that of MENA. Notably, among its regional peers, Yemen only outperforms Libya.

34 ITU, 2021c; ITU, 2021d; ITU, 2021e. Given the missing data point of active mobile-broadband subscriptions in 2018, we calculate the arithmetic average between 2017 and 2019. Data on Internet users in Yemen for the years 2018, 2019, and 2020 is not available.

Figure 5: Subscriptions to Internet services as of 2017, mobile and fixed[35]

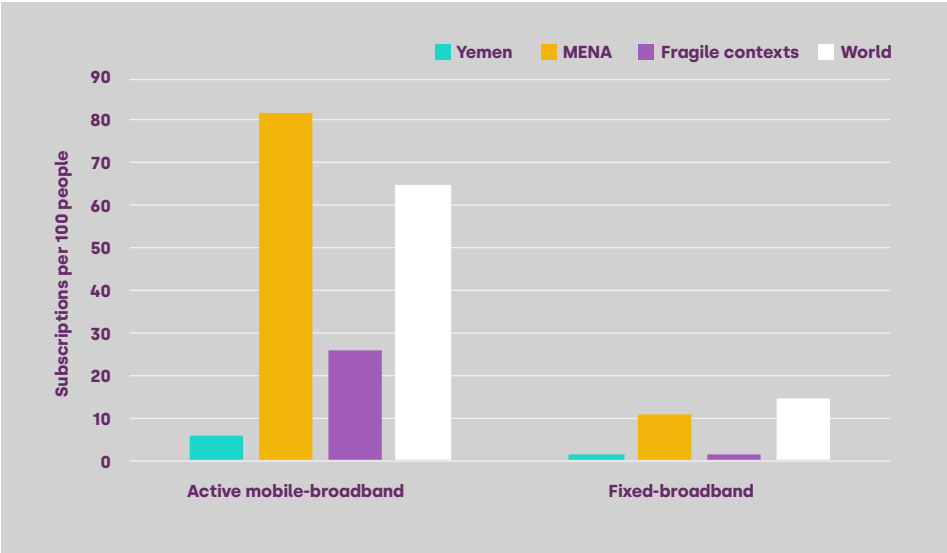
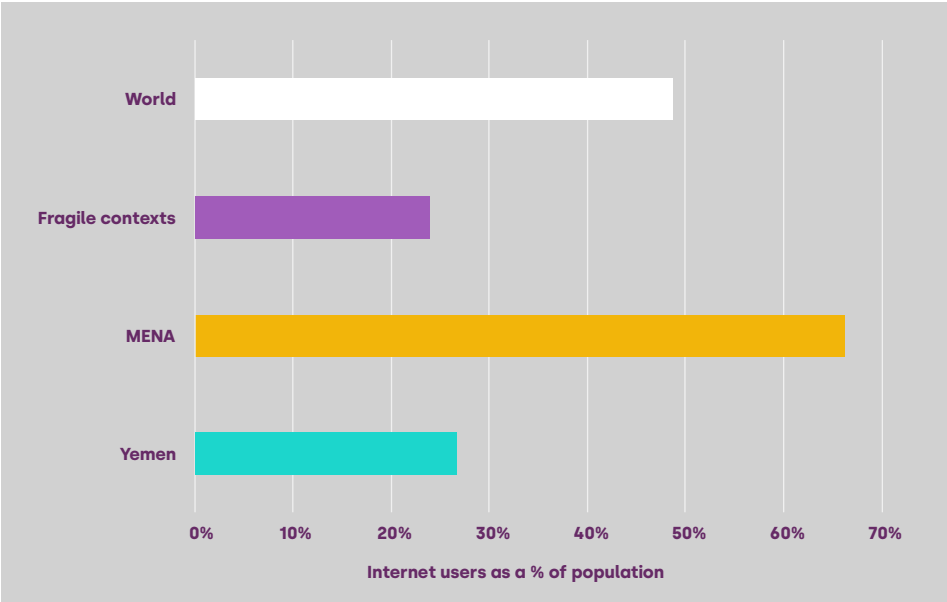


Figure 6: Internet access as of 2017[36]



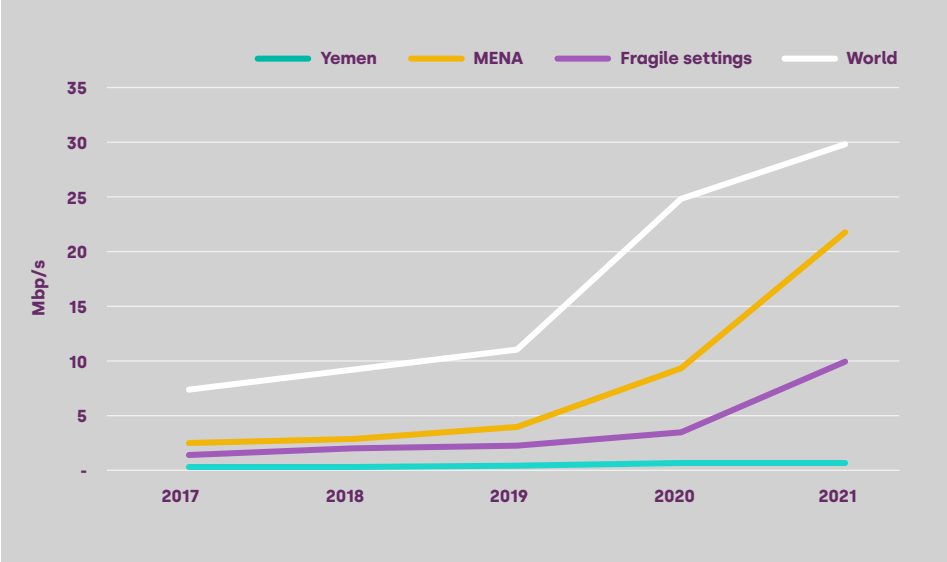
With regards to access modality, a recent survey found that mobile devices are the most common way of accessing the Internet for Yemenis (42% of respondents). By contrast, 18% of respondents declared to access Internet from their homes, 34% from Internet cafés, and only 6% from their workplaces, highlighting the limited connectivity available to conduct day-to-day activities.[37]

35 ITU, 2021a; ITU, 2021b; ITU, 2021c; ITU, 2021d
36 ITU, 2021e
37 Arabian Brain Trust, 2022

Quality

Despite the improvements in access, quality of Internet in Yemen is among the poorest in the world. To analyse this, we focus on the following indicators: download speed and bandwidth[38] (or the amount of data that an Internet connection can handle at a given time). The speed of mobile-broadband connections in Yemen is low and stagnating, compared to global, regional, and fragile contexts trends (**Figure 7**). This is in large part driven by the limited availability of 4G and 3G technologies, until recently. In 2021, download speed was estimated at 0.7 (Mbp/s) against a world average of 29.8 and a regional average of 11.7, which means that it takes about 17 hours to download a 5 GB movie.[39] This places Yemen 223rd in the global ranking, better only than Turkmenistan. Importantly, low Internet speed limits the potential services that users can access, with time-critical services, large software, and media downloads being outside the capabilities of the connections.

Figure 7: Mean download speed (in Mbp/s) as of 2021[40]



Even in areas where access speeds are reasonable such as those with 4G connections, the quality of Internet access is impaired by the low level of international bandwidth capacity. With low capacity, users may experience video buffering or web pages taking a long time to load. When compared against regional peers and other comparison groups, the bandwidth available per Internet user is miniscule in Yemen, meaning that networks can support only very few

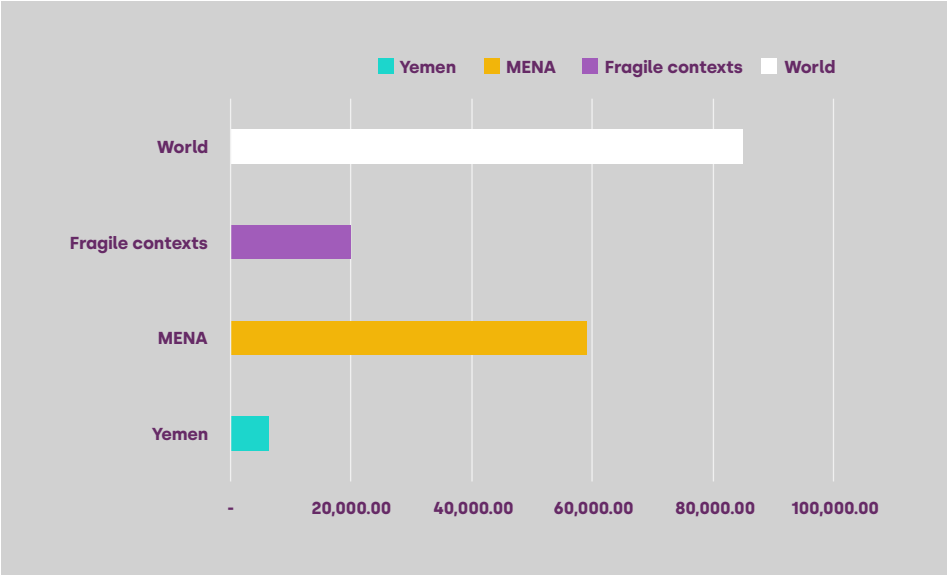
38 An Internet connection with a larger bandwidth can move a set amount of data (say, a video file) much faster than an Internet connection with a lower bandwidth.

39 Cable.co.uk, 2021; Speedtest, 2021

40 Cable.co.uk, 2021

connections at once (**Figure 8**). With international Internet services being only as good as the worst connection, this will again inhibit the population from accessing high quality services.

Figure 8: International bandwidth per Internet user, 2017 (bit/s)[41]



Costs

Internet services, especially for mobile phones, are expensive relative to local incomes and underperform global and MENA medians (Figure 9). In 2021, the average price of 1 GB was estimated at USD 15.98 – the most expensive in the region and 26.2% of average monthly income. Further, a data-only mobile broadband basket amounts to 10% of monthly gross national income (GNI) per capita as of 2020.[42] This is well above the median for the world, MENA region, and fragile contexts, and is five times higher than the UN Broadband Commission's 2% target for affordability to be reached by 2025.[43] The cost of fixed broadband Internet services[44] is more moderate and closer to UN targets, at 4% of monthly GNI per capita. Overall, affordability for both Internet, voice, and SMS services has consistently improved over time (**Figure 10**).

41 ITU, 2021f. International bandwidth refers to the maximum quantity of data transmission (rate) from a country to the rest of the world. International Internet bandwidth (bit/s) per Internet user is calculated by converting to bits per second and dividing by the total number of Internet users. Averages for country groups are weighted by population.

42 This is the cheapest plan providing at least 1.5 GB of high-speed data.

43 ITU, 2020; Broadband Commission for Sustainable Development, 2021

44 This is estimated as the cheapest bundle offering 5GB of monthly high-speed Internet.

Figure 9: Prices of telecommunications baskets (as a % of GNI per capita), 2020[45]

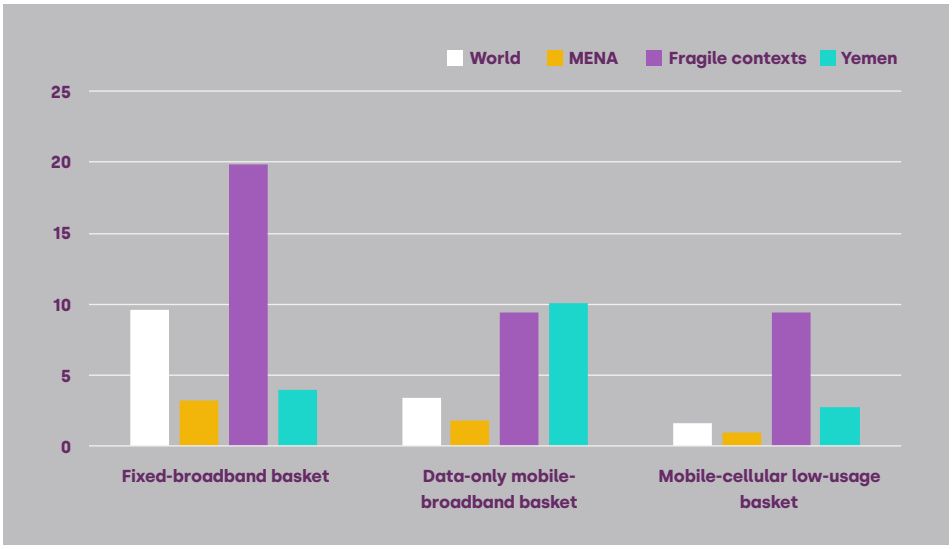
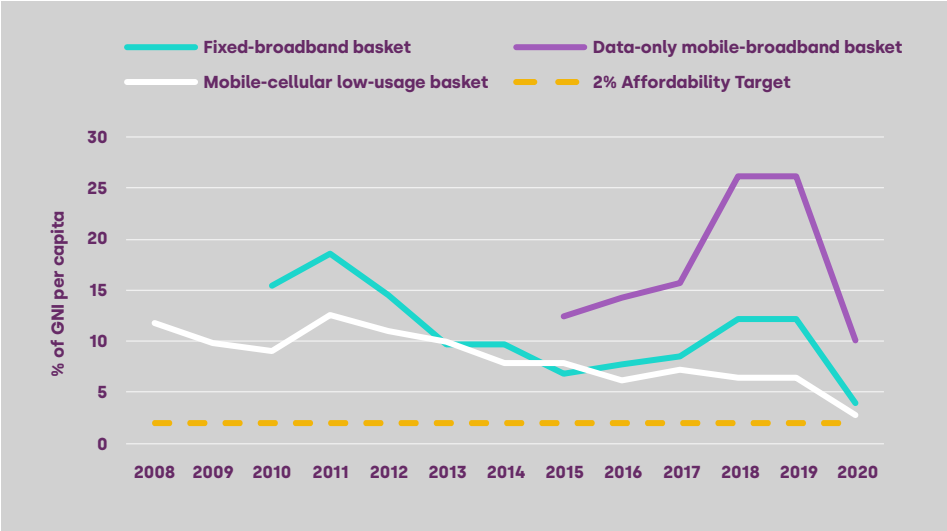


Figure 10: Prices trends of telecommunications baskets in Yemen (as a % of GNI per capita), 2008-2020[46]



45 ITU, 2020; ITU, 2022a. Medians for country groups were only calculated for the subset of economies with data available for all years in the data set (2008-2020).

- The **fixed broadband basket** refers to the cheapest plan providing at least 5GB of monthly high-speed data (>= 256 Kbit/s) over a 30-day period of time from the operator with the largest market share in the economy.
- The **data-only mobile-broadband basket** is the cheapest bundle offering 2GB of monthly high-speed Internet on a mobile phone.
- The **mobile-cellular low usage basket** refers to the cheapest plan providing at least 70 minutes of voice and 20 SMS over a 30-day period of time from the operator with the largest market share in the economy.

46 ITU, 2020; The authors excluded Haiti and Niger from the calculation of the World average of the fixed-broadband basket because the relative values were distorting the resuts by being outliers. The World mean including both countries rises to 27.2. 2021 Telecommunications basket data for for Yemen is not available in GNI per capita terms, due to the missing data point of 2021 GNI per capita from the UN World Development Indicators dataset. For reference, in 2021:

- A fixed-broadband basked cost USD 1.72 in 2021 and USD 6.29 in 2020
- A data-only mobile-broadband basket cost USD 4.91 and USD 15.98 in 2020
- A mobile-cellular low-usage basket cost USD 1.07 in 2021 and USD 4.4 in 2020
- These price drops (in USD terms) are probably due to the introduction of 4G packages by YOU and Yemen Mobile. While lacking official GNI per capita figures, we would expect prices in GNI per capita terms to also have decreased substantially.

3.3 Causes of low penetration rates

Limited use of Internet and telephone services is in great part an access issue. Several factors contribute to this, in addition to high costs discussed earlier, and include:

- **Culture and norms –** Surveys from Hajjah, Taiz, Abyan, and Aden show that Yemenis (especially women) in more conservative, rural areas consider using the Internet as "haram" i.e., forbidden. Approximately 95% of female respondents in rural areas and 89% in urban areas reported that the Internet is rarely or never accessible, as opposed to 88% and 83% respectively for men. Moreover, 30% of rural and 27% of urban women reported never having access to a telephone; 49% of rural women have phone access rarely or never. The data also highlights how large gaps in the adoption of telecommunications exist between rural and urban areas, which is confirmed by other recent surveys.[47]

- **Affordability and digital literacy –** In the same surveys discussed above, women indicated lack of financial resources to buy hardware and limited experience in using smartphones as reasons for low adoption rates.

- **Geography –** Yemen's rural and mountainous territory contributes to high costs of network rollout. High investment costs (when borne by the operators) or high service costs (if passed to consumers) contribute to low penetration of mobile- and fixed-line telecommunications, therefore constraining Internet access.

It is worth stressing that, even if structural factors undeniably play a role in inhibiting access to telecommunications services, addressing the acute and long-standing challenges in the regulatory and policy environment as well as new conflict-related challenges would go a long way in unlocking the telecommunications sector's development. **Section 10** discusses these challenges in detail, while **Section 11** presents policy recommendations to address them.

47 Gressmann, 2016; Arabian Brain Trust, 2022

4 Telecommunications infrastructure

4.1 International connectivity: Submarine cables, terrestrial cables, and satellites

Five submarine fibre-optic cables could provide international connectivity to Yemen (**Figure 11**). These are Aden-Djibouti, Africa-1, Asia-Africa-Europa 1 (AAE-1), FALCON, and SEA-ME-WE 5. IRG controls landing points in Aden (for Aden-Djibouti and AAE-1), Al Ghaydah (for FALCON), and Mocha (for Africa-1). DFA controls landing points in Al-Hodeidah (for FALCON and SEA-ME-WE 5) (**Table 1**).[48]

Besides FALCON and Aden-Djibouti, all other cables are not operational. This is due to natural disasters, military attacks, and the political and institutional fragmentation that has resulted from the conflict. In particular, state-owned TeleYemen (the country's wholesale operator responsible for providing international connectivity) has no access to SEA-ME-WE 5 and AAE-1. These were recent (and now wasted) investments, designed to land in Yemen, and capable of providing the country with modern, high-quality connectivity. Participation in the cables' consortia cost Yemen USD 70 million in prepaid membership fees (USD 40 million for AAE-1 and USD 30 million for SEA-ME-WE 5), which would grant the right to 200 Gbp/s of capacity, expandable over time.

The only two operational cables – especially Aden-Djibouti – are old, inadequate to sustain modern broadband growth, and have limited capacity. Current demand from operators exceeds the capacity of international cables. In the case of Aden-Djibouti, AdenNet requires 40 Gb/s, Y-Telecom applied for 20 Gb/s, and Sabafon-Aden may apply for up to 40 Gb/s, and while the cable has a potential of 80 Gbp/s, it currently uses only 10 Gbp/s.[49] Given the very low capacity of the Aden-Djibouti gateway, whose services do not extend beyond the Aden region, capacity from FALCON is used to supply the entire country with international connectivity.[50] Importantly, FALCON is under DFA control while IRG oversees Aden-Djibouti.

Land-based international connectivity is also weak. The only operational land cable is the one passing through Al Wadea, in Hadramout, and is under IRG control. IRG also controls the cable passing through the Oman border in Shahin, Al Mahra governorate, that is inactive due to damage caused by the 2018 Laban hurricane.

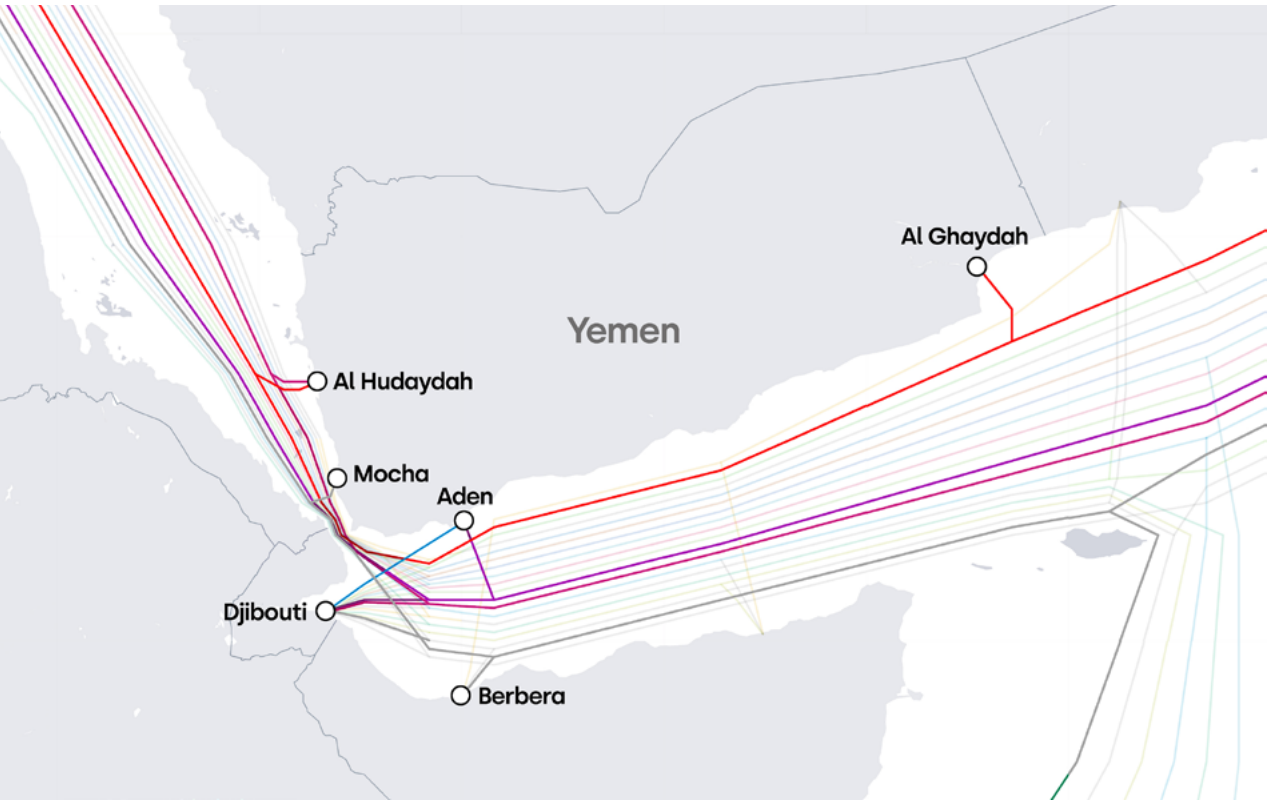
48 Bannerman, 2021
49 Interview with MoTIT-IRG official; Oxford Business Group, 2016; Djibouti Telecom, 2022
50 Arabian Brain Trust, 2022

DFA controls two terrestrial links passing through the north-western border with Saudi Arabia, both of which are not operating due to the conflict (**Table 1**).

Relying on only a few links for international connectivity is risky and sub-optimal. First, it exposes the system to concrete risks of single-point failure. For example, in January 2020, unintentional damage to FALCON by a vessel passing through the Suez Canal led to an 80% percent drop in the Internet capacity for almost a week across the country. Second, the quality of telecommunications services is likely to be reduced due to lower redundancy and resilience.

Yemen receives coverage by more than 9 satellites in the Ku, Ka, and C bands. These are operated by Intelsat, Arabsat, Amos, and others. As we discuss later, despite the significant potential that satellite terminals could have in terms of expanding Internet access, especially in remote regions, imports and operations are significantly restricted by the security embargo on telecommunications equipment. Costs for satellite-based Internet are also prohibitive and state-controlled YahClick controls the entire market.

Figure 11: Submarine cable landings in Yemen[51]



51 Telegeography, 2021

Table 1: Status and control over submarine and land cables landings in Yemen[52]

Cable	Location	Type	Control	Status	Causes of inactivity
Aden-Djibouti	Aden, Aden	Submarine fibre-optic	IRG	Operating	
AAE-1	Aden, Aden	Submarine fibre-optic	IRG	Not operating	Conflict & institutional fragmentation[53]
FALCON	Al-Hodeidah, Al-Hodeidah Al Ghaydah, Al Mahrah	Submarine fibre-optic	DFA	Operating	
SEA-ME-WE 5	Al-Hodeidah, Al-Hodeidah	Submarine fibre-optic	DFA	Not operating	Conflict & institutional fragmentation[54]
Africa-1	Mocha, Taiz	Submarine fibre-optic	IRG	Not operating	Not linked to Yemen
Haradh land port	Haradh, Hajjah Alab, Sa'dah	Land fibre cable (KSA)	DFA	Not operating	Damaged by conflict
Al Wadeha land port	Al Wadeha, Hadramout	Land fibre cable (KSA)	IRG	Operating	
Shahin land port	Shahin, Al Mahrah	Land fibre cable (Oman)	IRG	Not operating	Damaged by 2019 Laban Hurricane

4.2 National backbone and inter-city network

Yemen's domestic telecommunications infrastructure has been poor since before the conflict. Prior to it, Yemen's Public Telecommunication Corporation (PTC) controlled 32,135 km of copper line network and 12,181 km of fiber-optic cables, connecting all major cities and cable landing stations. The national fixed backbone network consists of copper networks and underground and aerial fibre, both of which are outdated and not suited for high-speed Internet.[55] With the war, the network has suffered severe damage and only partly functional.[56] As of 2018, only 50% of the fixed lines providing telephone and Internet in the country were active.[57] Lack of resources to restore and expand the fixed network, especially through more effective fiber-optic cables, and ongoing military attacks have resulted in low quality and unreliable telecommunications services for citizens and businesses. Notably, the state retains a monopoly over all international and backbone infrastructure.

Due to the infrastructure weaknesses discussed in this section, coverage of telecommunications services is limited, which constrains access. With regards to Internet services, 2G coverage is quite widespread across the national territory, with the exception

52 Noaman, 2020

53 According to interviews with MoTIT-IRG staff, IRG requested support from Sana'a-based engineers to activate the cable. The engineers allegedly encrypted the system which prevents the cable's activation.

54 The Saudi-led coalition prevented TeleYemen-DFA to access capacity in the cable (Shaker, 2020; Bawabatii, 2020).

55 Othman, 2019

56 Arabian Brain Trust, 2022

57 World Bank, 2020a

of the sparsely populated areas in the North, North-west, and West (with the exception of the coast). 3G and 4G services are provided by a few public and private providers and their geographical coverage is limited but expanding (see **Table 2** for a summary of these technologies).

Table 2: Telecommunications technologies and services

Generation	Network	Key services
2G	GSM	• SMS, voice calls, and MMS • No video calls • Limited broadband speed (236 kbps)
3G	WCDMA	• SMS, voice calls, video calls, MMS • Medium broadband speed (21 Mbps)
4G	LTE	• SMS, voice calls, video calls, MMS • High broadband speed (1 Gbps)

5 Institutional and regulatory framework

Yemen's telecommunication infrastructure and institutions have historically been highly centralised in Sana'a. The government saw its role in the sector as one focused on service delivery as well as management and regulation, resulting in state-owned enterprises outcompeting the private sector through inefficient concessions.[58] These dynamics continue today, holding back the sector's development. In particular, the PTC is responsible for operating, maintaining, and developing the national communication networks, through its companies/subsidiaries, and has been the sole authorised provider of Internet services in Yemen up until the creation of AdenNet, in 2018, which however has significantly less capacity and is also state owned. PTC subsidiaries include YemenNet, a provider of fixed broadband services; TeleYemen, that has oversight over international connectivity through submarine and terrestrial cables and satellites; and finally, Yemen Mobile, a government-owned retail mobile operator. **Table 3** summarises the key state-owned enterprises in the telecommunications sector in Yemen.

58 Arabian Brain Trust, 2022

Table 3: State-owned enterprises in Yemen's telecommunications sector

Name	Established in	Control	Services	Ownership
PTC	1981 (North Yemen); 1982 (South Yemen)	Split control (IRG and DFA)	• Controls infrastructure backbone • Fixed line network	MoTIT (100%)
TeleYemen	1972	Split control (IRG and DFA)	• International connectivity (submarine & terrestrial cables, satellite) • Web hosting, data transmission, domain name & IP address services • International calls	PTC (75%) Post Authority and postal savings accounts (25%)
YemenNet	2001	DFA	• Fixed broadband • Hosting and domain • Data transmission	PTC (100%)
Yemen Mobile	2004	DFA	• Fixed & mobile broadband	PTC (59%) Other public stakeholders (17%) Private stakeholders (23%)
AdenNet	2018	IRG	• Wireless broadband • International calls	MoTIT-IRG (100%)

Lacking an independent regulatory authority, the main regulatory institution is the Ministry of Telecommunications and Information Technology (MoTIT). MoTIT is responsible for granting licenses to establish and operate private and public telecommunications networks, formulating policies and plans for the sector, managing the frequency spectrum for mobile broadband services[59], pricing, and maintaining the national numbering plan.[60]

Telecommunications Law no. 38/1991 Pertaining to Wired and Wireless Telecommunications (later rectified by Amendment Law no. 33/1996) is the only law regulating the sector. Among other provisions, it establishes the following:[61]

- **Art. 3 –** MoTIT is responsible for securing and improving telecommunications service, building and operating networks, issuing licenses, determining tariffs and fees, organising the utilisation of frequencies, approving imported equipment, and planning and conducting research.

- **Art. 3k –** MoTIT has the power to grant a license to any ministry, department, governmental corporation, or private institution.

59 Cabinet Decree No. 77 of 2002 assigns to MoTIT responsibility for the management all spectrums.

60 Republican Decree on Law Pertaining to Wired and Wireless Telecommunications, 38 C.F.R. (1991); Law No. 33 of 1996 Amending Certain Provisions of Republican Decree No. 38 of 1991 Pertaining to Wired or Wireless Telecommunications (1996)

61 Republican Decree on Law Pertaining to Wired and Wireless Telecommunications, 38 C.F.R. (1991)

- **Art. 4a –** Created and authorised the PTC to own and manage the national infrastructure networks.

Furthermore, **cabinet decree no. 77/2002** regulates and organises the use of frequencies and radio equipment, falling under the responsibility of MoTIT (Article 3), and determines the pricing structure for the use of frequencies.

Prior to the outbreak of conflict, the government had been laying the foundations for forward-looking reforms to restructure the telecommunications market. This included a new telecommunications law that planned the establishment of independent regulators and steps towards market liberalisation. MoTIT was preparing to award 4G licenses to increase competition for high-speed mobile Internet services and the Central Bank of Yemen had issued mobile money regulations in 2014. Furthermore, the parliament's ratification of the WTO accession agreement had triggered telecommunications-specific WTO obligations, including:

- Establishing competitive safeguards to prohibit suppliers from engaging in anti-competitive conduct.
- Undertaking efforts to implement universal service programmes to serve the unserved.
- Making licensing criteria publicly available.
- Establishing an independent regulator tasked with ensuring a level playing field among operators and providing oversight on licensing, allocation of frequencies and channels, rights-of-way, arbitration and dispute resolution, and other issues.
- Developing a fair, systematic approach for resource use and allocation (e.g., frequencies, channels, and rights-of-way).

Due to the war, reform efforts have largely stalled. The regulatory fragmentation and vacuum that followed the takeover of MoTIT by DFA in Sana'a caused significant setbacks in the sector's institutional and legislative development and has produced an uncertain regulatory environment for operators to navigate, with two sources of authority, namely IRG and DFA. For example, in 2015, DFA issued Cabinet Resolution No. 7 that regulates policies and mechanisms to renew and license mobile phones and mobile broadband operators. DFA also issued the Decision of the Chairman of the Supreme Revolutionary Committee No. 168/2016 regarding the regulation and management of telecommunications numbering which established rules and procedures to allocate numbers to telecommunications operators, required mobile operators to keep records of all subscriptions, and determined fees for allocation and usage of numbers.

Consequently, legislative frameworks are incomplete, increasingly inconsistent across Yemen, outdated, misaligned with international best practice, and thus not conducive to private sector development. The legislation is especially outdated with regards to current mobile service activities and modern technology development. An illustration of this is the fact that the word "Internet" does not appear once in the relevant legislation. Moreover, there are no provisions to regulate mobile network operators, including providers' responsibilities and obligations, tariffs, consumer protection, conflict disputes, competition, or investment in advanced technologies.

Private mobile telecommunications operators are regulated through individual (and asymmetrical) licensing agreements with the authorities that last about 15 years. The process of drafting, renewing, and upgrading licensing agreements lacks transparency and consistency. Frequent failure to sign new agreements on time has resulted in carriers operating on expired licenses, only to be granted short-term contract extensions by either IRG or DFA. The fragmented regulatory framework and the lack of standard regulatory policy means that re-licensing mobile operators is an especially complex task, with huge risks borne by the companies that lack certainty around investments and operations.

6 Market structure

Yemen's telecommunications sector is made up of a wide range of actors, including public institutions and private players. Similar to other network industries such as electricity, water, and sanitation, the state has traditionally been heavily involved in service provision, holding monopolies in fixed-line telephone and international telecommunication services and, until recently, high speed Internet provision, leaving little space to the private sector. High levels of state control, centralisation, and participation in the sector continue today, except for mobile telephone and broadband Internet service provision, in which private operators have been playing a growing role (**Box 1**).

BOX 1: LIBERALISATION OF YEMEN'S TELECOMMUNICATIONS

Government efforts to liberalise mobile telecommunications services and encourage private sector participation began in the late 1990s.[62] Until then, mobile networks were fully controlled by state-owned TeleYemen, which offered analogue services. Private sector investment was incentivised through:

- **Structural reform packages**, sponsored by the IMF and the World Bank in 1997, that aimed to reduce state participation in the economy, and

- **Government-led licensing agreements**, with exclusivity clauses of up to 4 years, that allowed firms to operate GSM networks (2G).[63]

Private companies started entering the market in the early 2000s, with MTN Yemen in 2000 and Sabafon in 2001, followed by Y-Telecom in 2007. In 2004, TeleYemen's cellular network was taken over by majority government-owned Yemen Mobile, which replaced analogue services with CDMA and became the first and only provider in the country to offer 3G technology and data-enabled mobile devices (e.g., smartphones, tablets, computers). Waiting on license renewals to be upgraded to faster technologies, private providers were only able to obtain short-term contractual arrangements with the government. Until recently, this limited them to providing 2G (no data access) and 2.57G (limited data access) services, notwithstanding their readiness to upgrade to 3G since as early as 2012.[64]

62 Zavazava et al., 2018
63 Al-Bashiri, 2021
64 Halewood and Decoster, 2017; World Bank, 2020a

Yemen's telecommunications providers can be classified into four categories: fixed telephone, mobile networks, international calls, and Internet service providers (ISPs), and includes the actors described in **Table 4**.

Table 4: Telecommunications service providers in Yemen

Fixed telephone	Mobile network	International calls	Internet
• Public Telecom Corporation	• Yemen Mobile • Sabafon • Y-Telecom/HudHud (or former Y-Telecom, in DFA territories) • YOU (former MTN)	• AdenNet • TeleYemen	• YemenNet • TeleYemen • AdenNet

6.1 Fixed-telephone providers

Landline telecommunications services under the management of state-owned Public Telecom Corporation (PTC). PTC owns and oversees Yemen's backbone infrastructure (copper and fiber-optic lines), as described in **Section 4.2**. Moreover, it owns 100% of YemenNet, 75% of TeleYemen, and 59% of Yemen Mobile. PTC and its assets in Sana'a fell under the control of DFA which led to IRG establishing a new Aden-based PTC.

6.2 Mobile-network providers

Mobile-network providers in Yemen include private operators Sabafon, Y-Telecom, and Yemen Oman United Company (YOU, formerly MTN) and state-owned Yemen Mobile (Table 4). Yemen Mobile has the largest market share (40% or 7.4 million users) and is fully controlled by DFA. The combined market share of the private sector share is 60%. Until recently, Sabafon was the largest private provider (28% or 5.2 million subscribers), followed by YOU (27% or 5 million users), and Y-Telecom, a smaller provider with more limited geographical coverage (5% or 930,000 users).[65]

With regards to cellular network operating lines, as of 2019, Sabafon and YOU control over 55% of the total, followed by Yemen Mobile (40%) and Y-Telecom (5%).[66]

The institutional fragmentation at the institutional level that resulted from the war has trickled down to operators. Just like government entities, carriers now fall under rival spheres of control opposing DFA and IRG. Consequently, lines of authority and responsibility (e.g., for tax collection) are often blurred and uncertain. In particular, Sabafon

65 MoTIT-DFA, 2019. Current figures on operators' market shares are not available publicly.
66 MoTIT-DFA, 2019

and Y-Telecom have both virtually split into separate companies in Sana'a and Aden. Sana'a based branches have been nationalised by DFA. Also in Sana'a, Y-Telecom's name was changed to HudHud in 2022. Furthermore, while Yemen Mobile services are available across the national territory, Sabafon-Aden has been prevented interconnection with the countrywide network by DFA and YOU's services have been blocked in IRG territories. **Section 8** discusses these dynamics in greater detail.

6.3 Internet service providers

Internet services provision has traditionally been a prerogative of the state. Fixed-line Internet was introduced in 1996 and has since been provided by government-owned TeleYemen and YemenNet. In 2018, in response to DFA's seizing control of key telecommunications institutions and assets, IRG established AdenNet. AdenNet provides 4G wireless Internet services through modem devices, in addition to international calls to and from a limited set of countries. It does this by controlling a new gateway – independent from TeleYemen – through the Aden-Djibouti cable (see **Section 8.2** for more details).

Mobile broadband high-speed Internet used to be exclusively provided by state-owned Yemen Mobile, but this is changing (Table 5). Until recently, private operators were only allowed to operate on 2G licenses, with significantly lower speed and quality of services.[67] Since early 2022, the high-speed Internet service market has seen greater private sector participation, with IRG and DFA both granting 4G licenses to most operators. In early 2022, YOU and Yemen Mobile started offering 4G Internet services in the Sana'a region and are now expanding to several cities and governorates in both DFA- and IRG-controlled territories.[68] In mid-2022, IRG granted Y-Telecom a 4G license, but the company only became operational in 2023..[69] Sabafon is the only large-scale carrier that still only operates on a 2G license. Finally, due to the unreliability and limited geographical coverage of telecommunications services from standard operators, humanitarian agencies rely on services provided by the Emergency Telecommunications Cluster (ETC), as described in **Box 2**.

67 Al-Bashiri, 2021

68 However, YOU's services have recently been suspended in IRG-controlled territories. Saba Net, 2022; Al-Nabba, 2022; NewsYemen, 2022; Yemen Time, 2022

69 Y-Telecom plans to roll out 4G to the population in the near future, starting with Aden, Hadramout, and Marib areas (Aden Hura, 2022).

Table 5: Retail mobile operators[70]

Operator	Market share & subscribers (mln)	License	Coverage	Spectrum allocations	Ownership
Yemen Mobile	40.2% 7.47	4G	National	824–834 MHz (uplink) 869–879 MHz, 1032 MHz (downlink)	• PTC (59.3%) • Other government shareholders (17.1%) • Private shareholders (23.5%)
Sabafon-Aden/ Sabafon-Sana'a	28.1% 5.23	GSM (2G, 2.75G)	IRG-territories (Sabafon-Aden) DFA-territories (Sabafon-Sana'a)	2x11.2 MHz 900 MHz 2x10 MHz 1800 MHz	_Sabafon-Aden • Al-Ahmar Group (60%) • Batelco (26.9%) • Others (13.1%) _Sabafon-Sana'a • Controlled by of DFA's Judicial Guard[71]
YOU	26.7% 4.96	4G	DFA-territories	2x11.2 MHz 900 MHz 2x10 MHz 1800 MHz	• Emerald International Investment LCC (97.8%)[72] • Others (2.2%)
Y-Telecom / HudHud	5.0% 0.93	4G	Not yet operational (Y-Telecom) DFA-territories (HudHud)	2x8 MHz in 900 MHz (mainband)	_Y-Telecom-Aden[73] • Yemeni businespeople _HudHud Sana'a • Controlled by of DFA's Judicial Guard[74]

70 World Bank, 2020a; MoTIT-DFA, 2019. Market share as of 2019; subscribers as of 2019; spectrum allocations as of 2020; ownership as of 2022.

71 A recent report provides a different ownership structure for YOU, namely: 52% DFA, 30% Al Baloshi (an Omani business), 11% Ibrahim Al Swedi, 4% Al Zomord company, 3% Hayel Abdullhaq. However, the authors have not be able to verity this information (Regain Yemen, 2022).

72 Kelly, 2022

73 Prior to being purchased by Yemeni businessmen, Y-Telecom was owned by Kuwaiti and Saudi investment companies and investors from the private sector in Yemen, the United Arab Emirates, and Syria until declaring bankruptcy in Sana'a's Commercial Court in 2020.

74 Regain Yemen, 2022

BOX 2: EMERGENCY TELECOMMUNICATIONS SERVICES[75]

In 2015, the Emergency Telecommunications Cluster[76] (ETC) was activated to provide emergency coordination, security telecommunications, and connectivity services to staff conducting humanitarian operations on-the-ground in Yemen. ETC is currently active in 17 sites across 10 operational areas. As of 2022, ETC supports 47 partner organizations (17 UN agencies and 30 I/NGOs), 900 humanitarian workers with connectivity services, 2,600 humanitarians with security communications services (e.g., radio programming, training), and eight UNDSS-managed Security Operations Centres (SOC).

Key challenges affecting ETC'S services include:

- **Funding –** Resources for 2022 only cover 51% of estimated needs (USD 3.4 million) and fundraising activities remain ongoing.

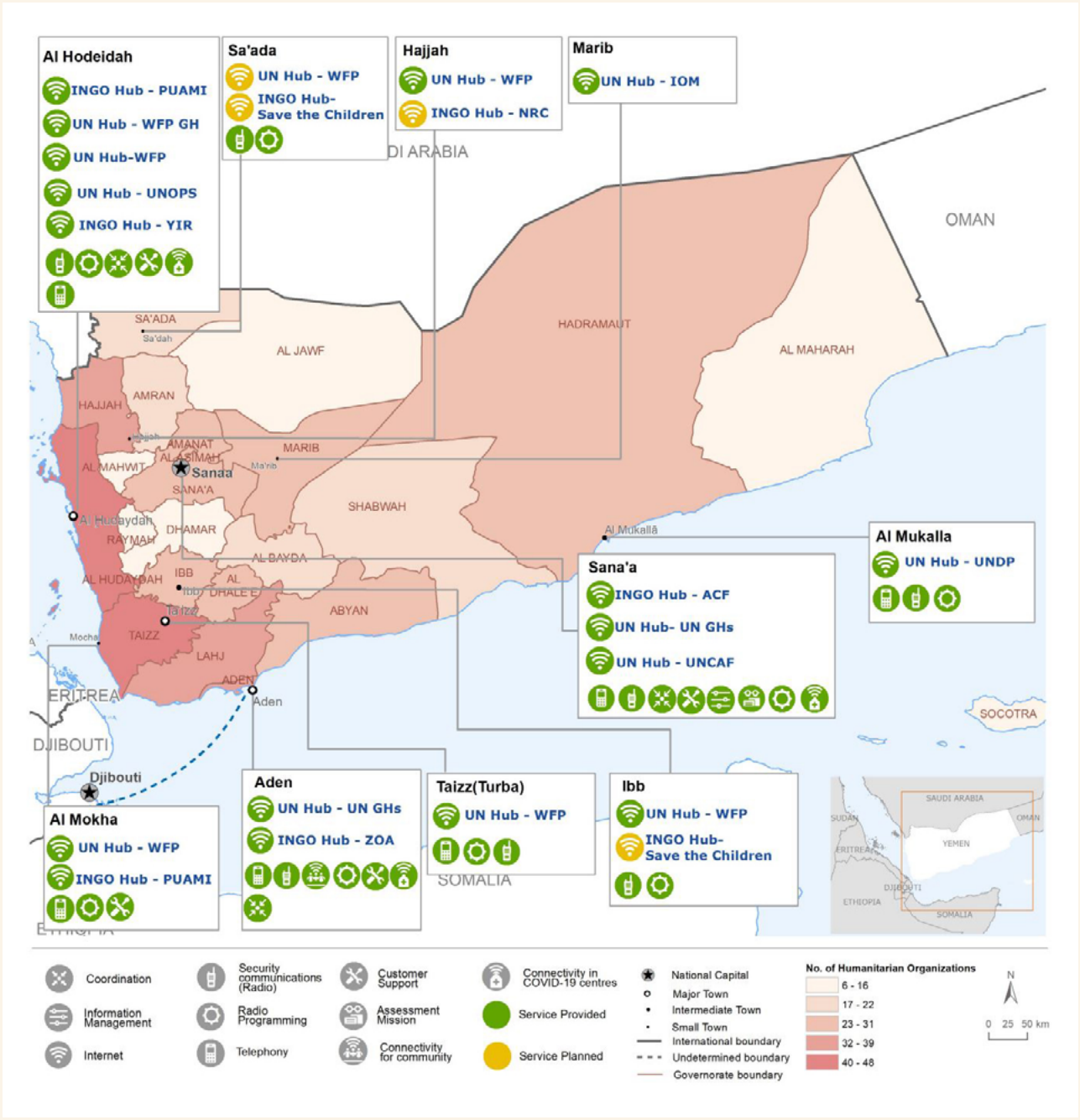
- **Import restrictions –** Severe restrictions on imports of telecommunications equipment through Aden port have negatively impacted ETC's capabilities in Yemen, with negative implications for the ongoing humanitarian operations. Since 2021, ETC has been unable to obtain pre-import approval for the shipment of two consignees from Djibouti to Aden. Critically, the same equipment cannot be sourced locally.

The reliance on ETC services by the international aid community critically highlights the weakness and unreliability of existing networks in Yemen to support humanitarian operations.

75 ETC, 2022

76 A global network of organizations that work together to provide shared communications services in humanitarian emergencies

Figure 12: Emergency telecommuncations services



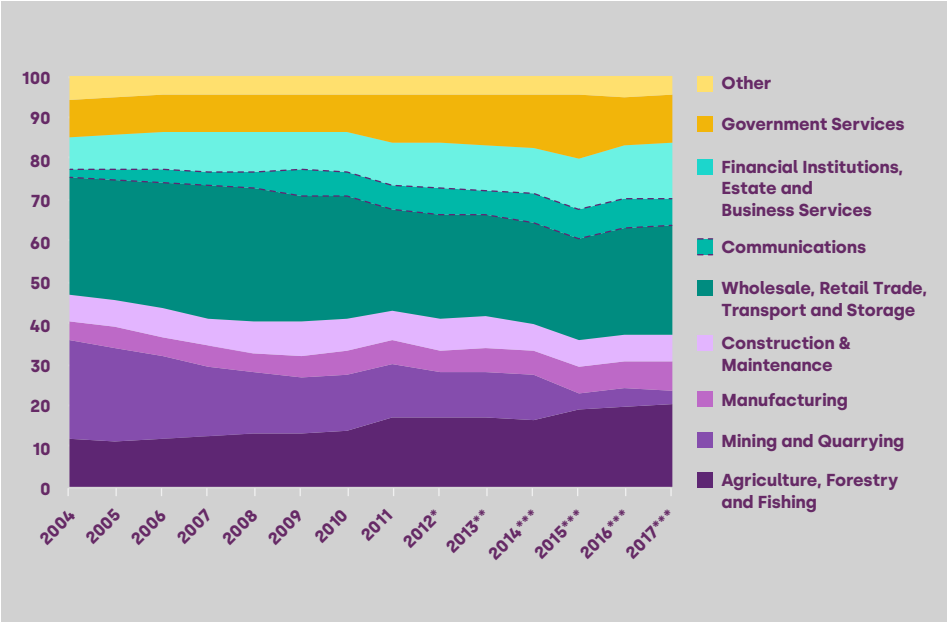
7 Socio-economic implications of telecommunications in Yemen

> **Telecommunications are a key pillar of Yemen's economy and infrastructure and have large economic and social impacts.**

7.1 Direct economic contributions

Historically, the telecommunications sector has had large macroeconomic and fiscal impacts in Yemen. Its direct contribution to GDP has been substantial, at about 7% between 2015 and 2018, and has mostly increased year-on-year (**Figure 13**).[77] In addition, the sector represents an important source of employment. It is estimated that in 2013 telecommunications generated 29,000 direct jobs, including mobile service distributors and retailers. While we lack more exact figures, the World Bank stated that the sector is the largest employer in the country today.[78]

Figure 13: Structure of GDP by economic activity (constant prices 2000=100), 2004-2017(%)



77 Yemen Central Statistical Organisation, 2017. The ICT sector's share (including both the public and private sectors) of national real GDP in 2015, 2016, and 2017 is 6.69%, 6.96%, and 6.88% respectively.

78 UNESCWA, 2013; World Bank, 2020c

Telecommunications are also a key source of public revenue, second only to (declining) oil receipts. Telecommunications revenues are mainly composed of licensing fees and taxes charged to operators. On the tax side, this includes a 50% and 35% corporate tax rate on mobile service and international telecommunications service providers, respectively, and a 10% sales tax on domestic and international mobile phone calls.[79] Unlike taxes, telecommunications fees such as spectrum and operating licensing fees are denominated in foreign currency (mostly USD). Thanks to this, fees have historically had a stabilising effect on the YER.

Today, DFA captures most revenues from telecommunications. While lacking official statistics, MoTIT-DFA declared that mobile telecommunications companies transferred YER 98 billion rials (USD 264.8 million) to DFA's accounts in the first 20 months of its take-over of MoTIT in Sana'a. On a yearly basis, it is thought that total revenues are no less than USD 159 million.[80] Sources in PTC claimed that telecommunications sector revenue amounted to USD 280 million in 2018 (YER 140 billion).[81] Moreover, DFA is thought to collect tens of millions USD in licensing fees from each operator.[82] Critically, IRG's lack of control over the sector and levy taxes and fees contributes to its already constrained fiscal capacity.

DFA's control over the largest share of telecommunications revenue is a consequence of several factors, including:

- **Control over key infrastructure –** DFA has direct and indirect control over key telecommunications institutions, infrastructure, and core networks, including the international gateway for voice traffic. In particular, control over FALCON allows DFA to collect fees in international calling services from foreign countries for calls passing through that cable.[83] Importantly, the traffic going through the Aden-Djibouti cable, controlled by IRG, is significantly lower.

- **Control over the largest operators –** Sana'a-based companies control most of the market. This is because: (i) most Yemenis live in DFA-controlled governorates, (ii) YOU and Yemen Mobile provide significantly higher-quality Internet services (4G) compared to Aden-based operators, thanks to their recent licensing upgrade, and (iii) Yemen Mobile offers services nationwide, while Sabafon-Aden has been denied interconnection with the countrywide network. This translates into larger revenues for YOU and Yemen Mobile and, therefore, larger tax payments towards DFA. For example, according

79 Law No. (19) of 2001 concerning the general sales tax and its amendments; World Bank, 2020a; Deloitte, 2020

80 Himmiche, Carvajal, Gunaratne, Johnsen, and Wilkinson, 2018

81 Amin, 2022; Salah, 2019. The increase over previous years could be a result of new fees, including undisclosed ones, imposed by DFA.

82 According to a local newspaper, in 2016, MTN renewed its license for USD 36 million, which expired in 2017 (Amin, 2022).

83 Amin, 2022

to Yemen Mobile's financial reports, the company's revenues accumulated to USD 1.2 billion between 2016 and 2020 (with DFA owning over 70% of the company).[84]

- **New and higher fiscal duties –** There are reports of DFA imposing higher tax rates and introducing new fees, both of which are likely to expand their revenue share.

7.2 Indirect economic contributions

Telecommunications are also a critical enabler of economic activity in other sectors. Despite significant challenges, Internet access is allowing citizens to perform daily business tasks such as transfer of documents and financial transactions by money exchange companies, especially during prolonged electricity blackouts. The combination of high demand and an unreliable national backbone network is also fuelling the spread of small-scale local networks in major cities, towns, and villages and thus to a growing number of businesses linked to telecommunications services.[85]

Structural sectoral weaknesses and consequences of the war hold back telecommunications' direct and indirect economic potential. Importantly, lack of connectivity is keeping Yemeni businesses from integrating in local, regional, and global trade networks and value chains, while preventing the diaspora from leveraging business opportunities in the country.[86] This is exacerbated by the unreliability of electricity services that prevents businesses from carrying out daily activities, particularly those dependent on Internet connectivity. Ultimately, Yemen's long-term digital development, which would involve government service delivery through e-governance (such as e-education, and e-health), mobile money, cash transfers, digital identification, and energy provision through smart power grids – will rely heavily on the availability and robustness of the national telecommunications infrastructure.

7.3 The social role of telecommunications

Telecommunications also play an important social role in Yemen. Notably, the adoption of technological devices (e.g., smartphones), Internet access, and the use of social media is rising.[87] In the context of the war, voice and SMS communications and access to the Internet are allowing Yemenis to stay informed and updated about relevant

84 Yemen Mobile, 2020

85 According to SMEPS' 2019 Rapid Business Survey (unpublished), 26.4% of the total enterprises operating in Yemen's telecommunications, information, and related services were established during between 2015 and 2019.

86 Arabian Brain Trust, 2022

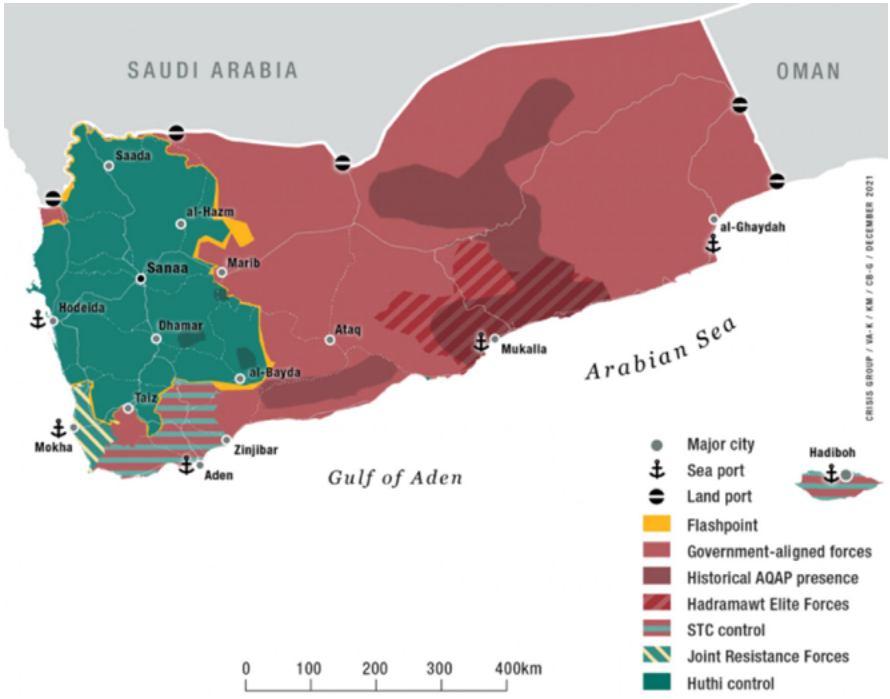
87 For example, the number of social media users in Yemen increased by 700 thousand (+28%) between 2020 and 2021.

political and security developments, connect with relatives and communities (including the diaspora), and overcome challenges in communication, partly created by absent or weak postal services. Further, the effectiveness of humanitarian and emergency relief operations critically hinges on reliable communications across the country.

8 Impacts of the conflict on telecommunications

Yemen's ongoing war has triggered a deep economic, social, and humanitarian crisis. Following the failure to extend a nationwide truce on October 2, 2022, the pathway to peace is as uncertain as ever. From a geopolitical perspective, the country remains split into multiple areas of political and economic control. DFA controls most northern and western governorates where over 70% of the population lives, whereas IRG and its aligned forces retain control over southern and eastern governorates, parts of Al-Hodeidah, Taiz, and Marib (**Figure 14**).

Figure 14: Territorial control in Yemen[88]



88 Geographic control as of 2022. International Crisis Group, 2022

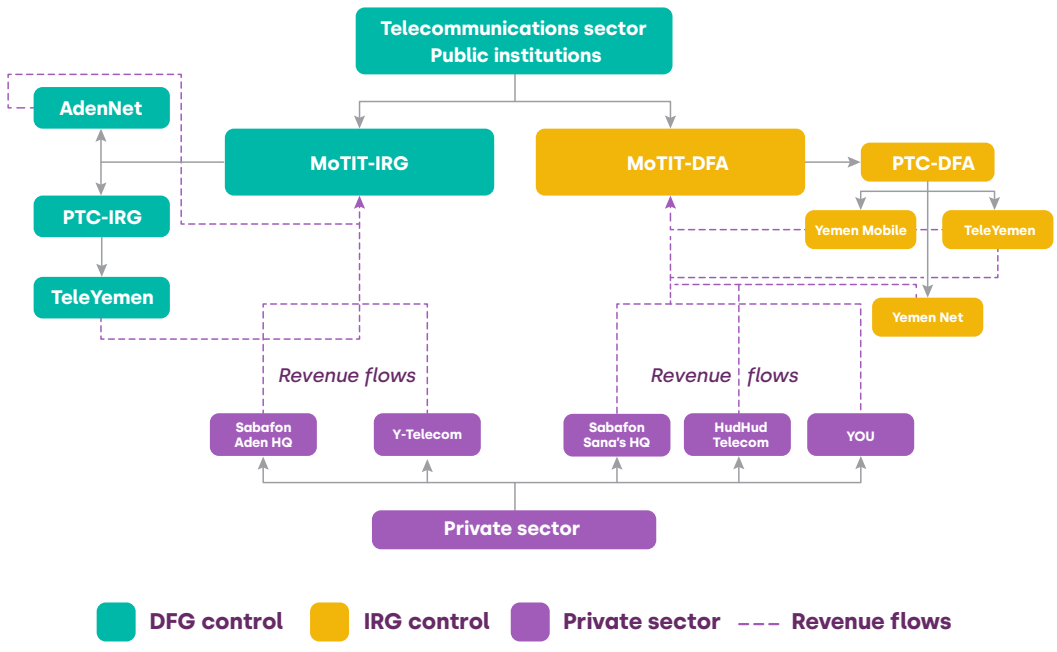
The war has had a severe impact on Yemen's economy, crippling its key sectors. The IMF estimates that economic output contracted by 48% from the start of the conflict in 2014 to end-2020, with per capita income falling from over USD 1,500 to about USD 580 over the same period. In 2021, GDP suffered a slight contraction at -1%.[89] For 2022, a mild recovery is expected, with a projected GDP rate of +2%.

The telecommunications sector has played a central role in conflict dynamics. Telecommunications infrastructure has been a frequent target of systematic military attacks, both cyber and physical. Additionally, DFA telecommunications authorities have leveraged their control over the sector to censor websites, carry out cyber-attacks on IRG and industrial websites, and spy or track IRG officials and ordinary citizens. Due to its economic and strategic importance, telecommunications have become increasingly "weaponised" and deeply entangled with the war. Consequently, efforts to rebuild and expand the sector and to implement urgent reforms and legislation have been limited.

8.1 The weaponisation of telecommunications

Telecommunications have gained great economic, military, and security importance for the conflict parties. The sector has become increasingly linked to conflict dynamics and have been actively leveraged by the parties as a tool of war. There has been growing fragmentation and duplication at the institutional and organisational level, with negative implications for assets and infrastructure, private sector operations and investments and, ultimately, the availability, quality, and reliability of services to consumers (**Figure 15**).

Figure 15: The fragmentation of Yemen's telecommunications sector



89 IMF, 2021a

8.2 Impacts on the public sector

Institutional fragmentation and duplication – Since DFA seized Sana'a and IRG relocated to Aden, key telecommunications institutions have become increasingly fragmented and sometimes duplicated. MoTIT is now split into two separate bodies controlled by IRG and DFA. Given the high centralisation of the sector prior to the war, by taking over Sana'a, DFA also gained control of state-owned enterprises PTC, Yemen Mobile, and TeleYemen, as well as key public and private assets and infrastructure. Furthermore, technical expertise and human capital have also largely remained in Sana'a, where most MoTIT employees live, thereby preventing IRG from accessing much-needed technical skills to manage the sector from Aden. In response to DFA's take-over, IRG created duplicate institutions for PTC and TeleYemen in Aden, whose market power and influence are limited by their lack of control over assets, infrastructure, and sector revenues. Further, due to the war, TeleYemen's foreign bank accounts in Saudi Arabia, which are estimated to hold approximately USD 300 million, have been frozen since 2015, thereby hampering the company's operational capabilities.[90] IRG's diplomatic efforts to unlock these resources have been unsuccessful to date.[91]

Regulatory gaps and fragmentation – The institutional split has led to a regulatory vacuum and existing frameworks are often no longer adhered to across the national territory. Further, the regulations imposed by different authorities lack consistency and unform application and several operators have stopped reporting to IRG and international organisations.[92]

Loss and fragmentation of telecommunications revenues – Due to the institutional split, tax and fee payments now flow separately to Sana'a and Aden. YOU, Yemen Mobile, HudHud Telecom, and Sabafon-Sana'a pay all taxes and fees to DFA, even from activity in IRG-controlled territories. IRG levies fiscal duties from Sabafon-Aden, AdenNet, and, soon, from Y-Telecom, once the company restarts its operations. Telecommunications revenues to IRG have declined considerably, but make simultaneously the single largest contribution to DFA's budget (at over USD 150 million per year).[93] As discussed in **Section 7**, the market for Aden-based providers is small and shrinking as they are not allowed to operate in DFA-controlled territories (where over 70% Yemenis live) and do not yet offer 4G Internet (unlike YOU and Yemen mobile).[94] Lower sales have limited tax contributions to IRG, which has also lost access to hefty licensing fees from operators headquartered in Sana'a. Control over key infrastructure has also

90 Regain Yemen, 2022.
91 Salah, 2019; World Bank 2020b
92 World Bank, 2020c
93 Himmiche et al, 2018
94 Sabafon-Aden is also prevented from allowing interconnection with other operators.

opened other revenue-generating opportunities for DFA, including mining cryptocurrencies.[95]

Surveillance, censorship, and espionage – Telecommunications services and assets have actively been drawn upon to support war-related activities. In DFA-controlled territories, DFA reportedly engages in control, surveillance, investigation, censorship, and disruption of Internet services, with prolonged Internet shutdowns and blocked access to social media and websites such as those reporting on DFA troop movements.[96] In IRG-controlled territories and conflict zones, DFA, through its control over YemenNet, frequently slows down or disables the Internet and taps phones for spying and surveillance activities over IRG officials as well as ordinary citizens.[97]

The launch of a new operator – To build greater independence from DFA and regain control over Internet service provision, international communications, and the related revenues in IRG-controlled territories, IRG established a new ISP – AdenNet – in 2018.[98] The investment was financed by IRG, with support from the UAE. Its infrastructure was built from scratch with equipment from Chinese technology firm Huawei and relies on the submarine Aden-Djibouti cable and the Al Wadea land port. AdenNet faces significant challenges due to which the company has only been able to secure approximately 14,000 subscribers to date. The main issues include:

- **Scarce financial resources**, which limit the supply of modems and SIM cards. This also led to prohibitively high Internet costs and a growing black market for the sale of modems and SIMs. These factors contribute to keeping subscriptions very low.[99]
- **Weak legal framework**, as AdenNet is yet to be fully registered as a company and still lacks a board of directors, articles of association, and rules of procedure (as required by the law).
- **Limited geographical reach**, mostly confined to the Aden area.[100]
- **Low capacity**, as AdenNet relies only on the Aden-Djibouti cable, whose current use (10 Gpb/s) is well below the operators' needs (20-40 Gbp/s).

95 Mining cryptocurrency consists in solving the computationally intensive maths problems that form the basis of such currencies. In exchange, the computer that completes that calculation is rewarded with currency (Recorded Future, 2018; Groll, 2018).
96 Al-Arabiya News, 2017; Recorded Future, 2018
97 Coombs, 2020
98 Al-Bashiri, 2021; Mahmood, 2018
99 Al-Bashiri, 2021
100 Aden Net, 2021; Al-Batati, 2020

- **Political instability and reported mismanagement, in addition to limited in-house technical expertise**, which compounded the company's challenges.[101]

The case of AdenNet also highlights the historical tendency of the Yemeni government to centralise telecommunications services in the capital and participate heavily in the sector. This is due, at least in part, to the fact that telecommunications are primarily seen as a source of government rents rather than as an essential service and enabler of economic activity. Indeed, some interviewees argued this was a key factor behind IRG's decision to keep AdenNet publicly owned, as opposed to issuing an international tender for private operators to provide the same services, likely at lower costs. Similar factors may lie behind the choice AdenNet's anti-competitive practices such as the decision not to allow private firms to engage in retailing SIM card and modems. Nonetheless, AdenNet holds potential to build Internet resiliency within IRG-controlled territories and strengthen private sector participation in the sector if the challenges described above can be addressed, genuine competition is allowed, and a comprehensive legal framework for the company is developed.

8.3 Impacts on assets and infrastructure

Damage to the telecommunications sector due to the fighting has been substantial, with over 25% of the sector's infrastructure being irreversibly impaired. Wartime losses for the sector amounted to USD 4.1 billion as of March 2022, accordIng to MoTIT-DFA.[102] As a result, services are frequently disrupted for prolonged periods of time, with patchy and unstable access, shrinking geographical coverage, and soaring reconstruction and service restoration costs, amounting to tens of millions of dollars. In particular:

- **Mobile network damage –** The mobile network has been severely damaged, causing the (already weak) national mobile footprint to contract by 40% and making inoperable 200 of the 850 national fibre transmission stations.[103] Total recovery and reconstruction costs (including infrastructure reconstruction and service delivery restoration) of the mobile segment of the sector in 16 cities assessed by a World Bank study are estimated between USD 6.1 million and USD 7.5 million.

- **Fixed network damage –** Damage to the national fixed backbone infrastructure, on which mobile networks rely, accumulated to over USD 47 million as of end-2017. This figure increases to USD 603 million if revenue losses and higher operating expenses are factored in.[104]

101 Coombs, 2020
102 Al-Bashiri, 2021
103 Al-Bashiri, 2021
104 World Bank, 2020a; World Bank, 2020c

Aerial cables have been especially exposed to attacks because they are more visible targets.[105] There are frequent reports of cables being severed (intentionally or not) in Aden and other major cities by the parties, with negative consequences in terms of connectivity. For instance, in July 2018, Internet services were disrupted for about 80% of Yemen after DFA forces damaged a fiber-optic cable while fortifying their defences in the Red Sea port of Al-Hodeidah.

- **International connectivity infrastructure damage –** Only a portion of the international connectivity infrastructure is functional. Due to physical attacks, natural disasters, or disputes between the parties, only two out of the five submarine and one out of the three land cables are currently operational, namely FALCON, Aden-Djibouti, and Al Wadea. As discussed in **Section 4**, relying on only a few links for international connectivity has negative implications for the quality of telecommunications services as it exposes them to the risk of a single point of failure, reducing redundancy and resilience. This became evident in January 2020 when unintentional damage to the FALCON cable by a vessel passing through the Suez Canal led to an 80% percent drop in the Internet capacity for almost a week across the country.

The cities of Al-Hodeidah, Sada'a, and Dhamar have suffered the greatest losses: 32% of their telecommunications infrastructure have been fully damaged and 23% partially damaged.[106]

Maintenance, improvement, and expansion of existing infrastructure and services have been limited since the beginning of the conflict. Operators cannot safely or economically service, repair, replace, and upgrade damaged infrastructure, and the ongoing import blockage acts as a further hindrance to sourcing new equipment.

In addition to physical damage, inter-party disputes over the management and authority of the sector and its assets contribute to poor functioning and unreliability. For instance, due to the conflict, a new landing station at Al-Hodeidah, which would unlock Internet capacity purchased in 2017 for the SEA-ME-WE 5 cable, is still not operational. On the other hand, TeleYemen-DFA and the cable's consortium prevent IRG from activating the AAE-1 cable in Aden.

8.4 Impacts on the private sector

Relocation, fragmentation, and exit – Following violent actions taken by DFA and formal requests from IRG, a few operators chose to relocate from Sana'a to Aden in recent years. Sabafon announced

105 Halewood and Decoster, 2017

106 These figures are likely to underestimate actual damages, as the analysis was based on satellite imagery, which may miss certain assets, especially mobile ones.

the decision in August 2019 and re-started operations soon after.[107] Y-Telecom followed in March 2020, after declaring bankruptcy and leaving behind its equipment in Sana'a.[108] It has taken Y-Telecom two years to rebuild its infrastructure and the company plans has recently re-started operations. For Sabafon and Y-Telecom-Sana'a (now called HudHud Telecom), separate headquarters are still operational in Sana'a (under new management) but lack recognition from IRG. Given the increasingly challenging environment, in November 2021, South Africa's MTN Group announced its exit from all operations in Yemen, selling its majority shares to Emerald International Investment, an Omani Company, which then changed the carrier's name to YOU.[109] While MoTIT-IRG officially rejected the decision due to the lack of consultations with the authorities and failure to pay legal fees, YOU was active across the entire national territory until recently.[110] These dynamics contribute to growing market division, including in firms' activities, subscribers, assets, management, tax payments, and control, further raising the challenges and risks of doing business in Yemen.

Physical damage and financial looting – Since the beginning of the conflict, companies have reported physical damage and arbitrary confiscation of assets and revenue by DFA officials and the replacement of senior personnel with figures associated with DFA in Sana'a headquarters. Prior to its relocation, Sabafon-Aden claimed that DFA looted its revenue, pursued the company through legal action to enforce the payment USD 72 million in (allegedly) unlawful tax exemptions dating back to 2007 and 2008, and forcefully appointed a new management team.[111] These actions tiggered Sabafon's decision to move to Aden. In the case of Y-Telecom, DFA retaliated violently to the firm's decision to move headquarters to Aden through targeted damage to assets and harassment of workers, ultimately taking over control of the company in Sana'a.[112]

Nationalisation of Sana'a-based operators – In 2014, following the relocation of Sabafon and Y-Telecom to Aden, DFA nationalised the companies' branches in Sana'a and placed them under control of DFA's Judicial Guard, headed by Saleh Mosfer Saleh Alshaer.[113] In 2017, Alshaer appointed his brother as chairman of Sabafon's board, and the company remains under the Judicial Guard's control today. In 2022, Y-Telecom's ownership was transferred to individuals closely associated with DFA and its name was changed to HudHud

107 Sana'a Center for Strategic Studies, 2019

108 Askar, S. 2020

109 MTN Group Limited, 2021

110 In a recent Cabinet decree, YOU's operations were in fact suspended in IRG territories. Aden Press, 2021

111 Sana'a Center for Strategic Studies, 2019; Al-Batati, 2020; Al-Ghabri, 2020; Sana'a Center for Strategic Studies, 2020

112 NewsYemen, 2020

113 Regain Yemen, 2022

Telecom.[114] However, very limited information is currently available on this new operator.

Lack of interconnection – Due to its dispute with DFA, its decision to relocate, and practice of paying fees and taxes to IRG rather than DFA, Sabafon-Aden has been disconnected from its telecommunications network and subscriber base in the north of the country and virtually excluded from the entire countrywide network. Consequently, the company's clients cannot place calls to the mobile networks operated by all other carriers.

Fragmented and rising taxes and fees – The institutional fragmentation of the telecommunications sector has generated large uncertainties and complexities with regards to fiscal responsibilities. IRG formally requires all operators to comply with their fiscal obligations. However, most operators, regardless of where they or their clients are based, pay taxes and fees to DFA. These include YOU, Yemen Mobile, HudHud Telecom, and Sabafon-Sana'a. Sabafon-Aden and Y-Telecom pay taxes and fees to IRG instead. DFA's control over the majority of the sector's revenue does not only constrain IRG's fiscal capacity, but also creates a challenging and uncertain regulatory environment for companies, with risks of causing legal disputes with the parties.[115] For example, Sabafon-Aden was requested to pay licensing fees outstanding since 2015 to IRG – there is an ongoing legal dispute between the company and IRG on this given that, before its relocation to Aden, DFA had already levied those duties from Sabafon. There are also reports that operators have been subject to double taxation and that higher fees and taxes have been introduced by both parties.[116]

Declining profitability – Retail network operators have experienced significant financial disruption (see **Box 3**). Operating costs have been rising steeply, with some companies incurring financial losses and some deciding to exit the market. High costs are fuelled by a wide array of factors including:

- Excessive and rising tax and fee obligations enforced by DFA and IRG, in addition to newly introduced fees.

- The security embargo on imports of telecommunications equipment, which is making it complex and time-consuming for companies to import tools and equipment needed for network repairs and upgrades.

114 Regain Yemen, 2022
115 Al-Bashiri, 2021
116 World Bank, 2020c

- Rising fuel prices, worsened by inefficiencies arising from damage to the electricity infrastructure, which are forcing operators to rely on more expensive power generators.[117]

- Increasing conflict-related and security costs, with the north-south movement of equipment, personnel and communication becoming increasingly complex.

- Macroeconomic instability, particularly currency devaluation. This is because revenue earnings are denominated in YER but expenditure (particularly government fees and imports of equipment) are denominated in foreign currency (mostly USD).[118]Small and shrinking market for Aden-based operators who have been disconnected from consumers in the north and still lack a 4G license (e.g., Sabafon-Aden).[119]

- Reports of operators being ordered not to raise prices by the authorities, despite facing an increase in costs.[120]

BOX 3: MTN'S FINANCIAL CHALLENGES

While we lack comprehensive and reliable historical data on operators' financial performance, MTN's financial statements exemplify well the challenges faced by the private sector in the country. Notably, MTN's operating revenues grew steadily from 2008 to 2014, but declined by 40-55% from 2015 to 2018, down to pre-2008 levels.

Earnings before interest, taxes, depreciation, and amortization, or EBITDA (a rough measure of a company's financial performance and of the available net operating cash from which operators can finance capital expenditures, debt service, taxes and return on equity) reached a financially sound 52% of revenue in 2014, but declined to 30% of revenue since the beginning of the conflict, likely due to rising fiscal obligations. Importantly, a lower EBITDA translates into a lower operator capability to undertake capital expenditure to improve their networks, and borrow or attract new equity capital.

117 According to the Ministry of Planning and International Cooperation (MoPIC), diesel and petroleum prices increased in November 2019 compared to 2014 by 192% and 140% respectively.

118 World Bank, 2020a; World Bank 2020c

119 Interviews with private sector companies.

120 World Bank, 2020c

8.5 Impacts on consumers

Impacts of the conflict and the wider economic crisis have had large, negative repercussions in terms of access, affordability, and quality of telecommunications technology and related services for citizens. For instance, the takeover of Sana'a led to a widespread drop in bandwidth and an Internet "siege" across much of southern Yemen. Today, citizens face frequent Internet blackouts in both IRG- and DFA-controlled territories, blocked access to websites, and surveillance and tracking from DFA. Moreover, Sabafon-Aden clients are unable to connect with clients of other operators. Furthermore, the fragmentation of companies' headquarters between Aden and Sana'a (as for Sabafon and Y-Telecom) poses the concrete risks of operators issuing identical mobile numbers to different clients, which could create additional issues in terms of connectivity.

Higher operational costs of companies are being passed onto consumers, resulting in higher prices. For example, in late 2019, YemenNet imposed significant price increases on popular wholesale data packages that are normally purchased by community network providers in rural areas.[121]

War-related damage to electricity infrastructure is also hampering connectivity at the household level, while increasing household costs. Internet services rely on electricity supply that is subject to frequent and prolonged interruptions (especially if sourced from the underdeveloped national grid) and blackouts can last from 12 to 23 hours a day.[122] Switching to diesel-powered backup generators to charge ICT appliances is prohibitively expensive given the high fuel costs. Moreover, only a small portion of households owns generators, with 35% of Yemenis living without any access to electricity.[123]

Currency depreciation, growing inflation, and scarcity of decent jobs have eroded the average level of real incomes, reducing affordability of telecommunications services. The affordability rate, i.e., price of telecommunications services as a percentage of monthly GNI per capita, deteriorated significantly, reaching 26.2% in 2019, compared to 7.8% in 2014.[124]

121 By purchasing these packages, community providers provide wireless Internet access to customers that would remain unconnected otherwise. However, price hikes – unless revised down – risk putting these companies out of business. An Internet package of 450 gigabytes for USD 115 was replaced by two options: USD 160 for 400 GB (+56%) or USD 105 for 200 GB (+105%) (Coombs, 2020).

122 Arabia Brain Trust, 2022

123 Arabia Brain Trust, 2022

124 Schaaper, 2019; The price of telecom/ICT services is often cited as a barrier to using telecom services, but what really matters is the "affordability" or ease of purchasing a service, relative to consumer income. Prices can be expressed as a percentage of Gross National Income (GNI) per capita to show prices relative to the size of the economy of each country, thus pointing to the affordability of each ICT service at country level (ITU, 2022b).

High prices, poor services, and the lack of maintenance and new investment contribute to a deterioration of key indicators of Internet and telecommunications access and digital inclusion. For example, mobile phone penetration has fallen by 11% since 2015, indicating that some citizens are in fact losing access to telecommunications services.[125]

9 Opportunities for private sector engagement

Enhancing the telecommunications sector through greater private sector participation presents large challenges which are likely to worsen as the conflict continues and the sector's fragmentation deepens (see **Section 10**). Nonetheless, opportunities to better support the private sector in upgrading and expanding the provision of services do exist (see summary in **Table 6**).

Importantly, the sector's resilience throughout conflict indicates that telecommunications is a segment of the economy that can see some development even as hostilities continue, and as such should be prioritised in any reconstruction efforts. Indeed, as seen in other conflict-affected and fragile settings, including Afghanistan, Iraq, Myanmar, Northern Pakistan, and Somalia, private telecommunications operators tend to show a resilient willingness to grow and invest, provided that challenges and bottlenecks are eased and that they are allowed to realise available opportunities. The findings in this report suggest that operators in Yemen are no different.

Table 6: Opportunities for private sector engagement in telecommunications services

- Large, growing, and underserved market
- Leveraging public-private partnerships
- Strengthening financial inclusion
- Scaling mobile money
- Scaling satellite-based Internet services
- Investing in localised community networks

125 World Bank, 2020a

Large, growing, and underserved market – Yemen has a large and growing market for telecommunications services, especially high-speed Internet connectivity, with growing adoption rates of technological devices (e.g., smartphones), widespread use of social media (e.g., Twitter, WhatsApp), and an increasing number of businesses linked to the telecommunications sector. Due to the poor quality of the main national networks, higher demand has also fuelled the spread of small-scale local networks in major cities, towns, and villages.[126] These trends highlight a large demand for connectivity that is not adequately met today: less than a third of Yemenis have access to the Internet and, prior to the launch of 4G services in the country, 3G Internet had reached only 1.7% of the population.[127] Private investors would normally be attracted by the business opportunities that the market presents, provided that they are adequately supported from regulatory, fiscal, and practical perspectives, given the high risks.

Leveraging public-private partnerships – Relying on private funding and financing from development finance institutions to rebuild and develop high-cost telecommunications infrastructure could help overcome IRG's fiscal capacity constraints while creating a way to concretely engage the private sector, and, ultimately, improve service quality. Different models of public private partnerships (PPPs) could potentially deliver this (**Table 7**).[128] In Yemen, PPPs could be leveraged for ultra-fast broadband infrastructure, new submarine cable landings, and potentially a public-private substitute of TeleYemen in charge of international Internet capacity provision. Several developing countries have relied on PPPs to deploy national telecommunications infrastructure such as fiber-optic cables, including Burundi, Jordan, Malawi, Congo, and Lebanon. IRG could seek to explore the trade-offs of different PPP frameworks and learn from other countries' experiences to identify a model that may be successful in Yemen.

Table 7: PPP models

Project finance	Debt-facilitation	Debt-guarantee	Public service delegation
The private sector lends finance based future cash flows from the project and hold collateral against the project's assets.	The government provides the private company access to tax incentives, public land, or other assets, but does not commit any public funds, while private sector participants make capital investments, commit to provide jobs, contribute technological expertise, and assume financial risk.	The government guarantees private company's debt, provided by private sources, assuming financial risks.	The government sector leases the telecommunications asset (e.g., broadband infrastructure) to a private company, with or without a public subsidy, transferring the rights and responsibilities for the asset to the company.

126 According to SMEPS' 2019 Rapid Business Survey (unpublished), 26.4% of the total number of enterprises operating in Yemen's telecommunications, information, and related services were established during between 2015 and 2019.

127 Halewood and Decoster, 2017

128 Katz, 2014

Strengthening financial inclusion – The telecommunications sector can play a central role in achieving greater financial inclusion in Yemen. In 2019, only 10% of the population held a bank account, which is among the lowest rates in the world.[129] Across low-income countries, applications for mobile banking, credit, and insurance are playing a central role in expanding banking access to marginalised communities and unbanked populations. Given the size of the challenge in Yemen, mobilising and partnering with private operators to support the provision of mobile-based financial services could yield sizable development gains.

Scaling mobile money – The use of mobile money is still limited in Yemen, with only 4% of transactions relying on digital currencies, or the e-rial. By way of comparison, Somalia and Kenya have rates of 60% and 70%, respectively. Rather than due to a lack of demand, low uptake rates are likely due to a combination of poor telecommunications infrastructure coverage, unreliable connectivity, a weak regulatory environment, inadequate financial technology development, complexities related to the fragmentation of the Central Bank and YER between IRG- and DFA-controlled regions, and limited awareness. Indeed, as a recent report highlights, one in four respondents in Yemen indicated that they would switch from cash to mobile money if it were available and reliable.[130] The private sector could be well placed to address the demand gap and play a role in financial intermediation, similar to what is observed in other developing countries such as with Safaricom's M-PESA in Kenya. Given the prevalence of mobile phones among the Yemeni population, scaling access to mobile money may also generate large socio-economic gains by strengthening financial inclusion of minority groups and women and spurring trickle-down economic activity.[131] The e-rial could also be strategically leveraged to support humanitarian operations, as part of cash transfer programmes.

Scaling satellite-based Internet services – Satellite Internet technologies, particularly recent low-orbit innovations, could be especially effective in providing or reinstating telecommunications services in areas that are currently cut off such as conflict zones and rural or mountainous regions, and could provide small-scale network "hotspots" for individuals and businesses. Currently, satellite services are limited in scale and exclusively provided by the public sector TeleYemen (controlled by DFA) by YahClick and AdenNet (controlled by IRG). Moreover, due its high costs, satellite Internet is almost exclusively used by international organisations, large companies, and some government institutions. This highlights a promising opportunity to introduce private sector provision of satellite-based Internet, and

129 Al-Samawi et al., 2020. According to the World Bank's 2018 Financial Inclusion Report the percentage of adults who hold at least a bank account averages 68.5% worldwide, 43.5% in the Middle East region, 34.9% in low-income countries (World Bank, 2018).

130 Arabian Brain Trust, 2022

131 Arabian Brain Trust, 2022

interviewees indicated that international investors have already expressed interest to IRG to enter the Yemeni market. **Section 11** discusses this policy option in greater detail.

Investing in localised, community networks – Large-scale telecommunications networks in Yemen's context are highly vulnerable to conflict-related disruptions. In addition to satellite-based Internet, rolling out localised wireless connectivity (or community networks), especially in relatively peaceful areas away from the front lines could represent a more viable, low-cost, rapid, and effective way to provide connectivity to entire communities.[132] The potentially high uptake, low upfront costs, and lower vulnerability to the impacts of the war of these services suggest that this is an area where private sector providers (as well as donors) may be willing to engage.

10 Obstacles and risks to private sector engagement

Yemen's telecommunications market is an increasingly hostile, risky, and complex environment for private sector operations and investment. In part, this is due to long-standing, structural challenges of the economy and to weak regulatory and institutional frameworks that pre-existed the war. However, an element of consensus among the interviewees and the relevant literature is that the conflict has exacerbated these obstacles and created new, more complex ones. According to a senior executive of a private sector company, the conflict has caused the sector's development and related government policies to stagnate or even worsen in certain areas, since 2014.

Notwithstanding the fact that Yemen is one of the most challenging markets in the world, private telecommunications firms have shown remarkable resilience. Throughout the conflict, operators have continued to provide their services to most Yemenis, even if at a lower quality and reliability. Arguably, this has not been met by prompt and adequate support from IRG and DFA authorities who both maintain an extractive and competitive attitude towards operators, often introducing new obstacles through adverse policies and regulations.

The main obstacles and risks faced by private firms can be grouped into three categories: institutional and regulatory challenges, economic challenges, and obstacles related to the political economy – these are summarised in **Table 8**.

132 Arabian Brain Trust, 2022

Table 8: Summary of obstacles and risks

Institutional and regulatory	1. Outdated and incomplete legislative, regulatory, and institutional frameworks 2. Legislative fragmentation 3. Lack of safeguards against anti-competitive practices 4. Uncertain licensing frameworks 5. Opaque and fragmented fiscal frameworks 6. Cumbersome bureaucracy 7. Embargo on telecommunications equipment
Economic	8. Burdensome fiscal obligations 9. High electricity costs and fuel scarcity 10. Shrinking profits
Political economy	11. High politicisation and state interference

10.1 Institutional and regulatory challenges

Outdated and incomplete legislative, regulatory, and institutional frameworks – The main legislation regarding the telecommunication sector is 25 years old. The legal framework has failed to keep up with technological changes and the new needs of private operators. Notably, existing rules and regulations do not deal with issues of privacy, security, disputes, competition, network service providers' responsibilities and obligations, tariffs, consumer protection, and investment in advanced technologies, among others.[133] These gaps reduce certainty regarding the regulatory environment and the expected outcomes of potential investments, thereby reducing companies' incentives to scale or start-up activities in Yemen.

Legislative fragmentation – In addition to legislation being old and incomplete, the sector's fragmentation between DFA and IRG has generated a regulatory vacuum in which rules are often no longer adhered to.[134] Moreover, as new laws and regulations are being issued by MoTIT-DFA, operators must navigate duplicated or incompatible frameworks. The lack of a single, recognised source of authority to issue regulations poses huge legal risks and uncertainty to operators and undermines operation and maintenance of existing shared infrastructure.

Lack of safeguards against anti-competitive practices – The sector lacks solid regulatory and institutional frameworks that can ensure transparent and fair competition between operators such as an independent regulator. Under current regulations, MoTIT has exclusive powers to organise, supervise, and set policy and plans for the telecommunications sector. This has contributed to poor transparency and an uncompetitive environment, holding back private sector development. In particular, the negative effects of government

133 Al-Thawra News, 2014
134 World Bank, 2020c

monopolies have translated into high costs and barriers to entry for new investors.

Uncertain licensing framework – Yemen's licensing frameworks lack transparency. Licenses are not assigned, renewed, or upgraded in a timely or competitive fashion, and decisions are often arbitrary and not uniformly applied across operators, creating scope for mismanagement and corruption. For instance, while Sabafon re-started operations in Aden in late 2020, due to an ongoing legal dispute with IRG, it has not yet received a 4G license, which would significantly help the company to rebuild its market share and improve profitability.[135] In contrast, Y-Telecom-Aden has already been granted the upgrade despite not being operational yet.[136] The rationale behind these decisions remains unclear, but ongoing legal disputes and politics may play a role. Moreover, companies often operate on expired licenses or rely on short-term extensions from either IRG or DFA.[137] The sector's institutional split also has negative implications on licensing frameworks as licenses for Sana'a-based carriers are not recognised by IRG, or Aden-based carriers by DFA, resulting in companies being considered illegal by either authority. Lack of certainty over future licenses and authority to assign them, collect fees, allocate rights to use spectrum bands, a weak and opaque licensing framework, and a poorly competitive market reduce certainty over future use and rates of return for investors, thereby diminishing their willingness to enter the market or invest in further infrastructure. Relatedly, lack of information about future spectrum availability prevents operators from making long-term plans on network upgrades and rollout.

Opaque and fragmented fiscal frameworks – Due to the institutional fragmentation in the sector, companies face uncertainties regarding what authority to pay taxes and fees to. There are reports of companies incurring double taxation, getting embroiled in legal disputes, being levied with fines, being forced to terminate operations, or being prevented from interconnecting with other carriers. For example, in June 2022, based on Cabinet Decision No. 44, IRG suspended YOU's operations in the governorates of Aden and parts of Marib due to the company's failure to pay sales taxes. IRG now plans to seize the company's assets and use the proceeds towards funding a partnership with a new or existing mobile operator.[138] Yemen Mobile's activities were also officially suspended in Marib just weeks after they rolled out 4G in the area, although informal reports suggest that its services are still working.[139] IRG has also filed lawsuits against Sabafon

135 Interviews with private sector representative.

136 On June 8, 2022, Y-Telecom began testing 4G services in Aden. The company plans to roll out 4G services to the population in the near future, starting with Aden, Hadramout, and Marib (Aden Hura, 2022).

137 For example, former MTN Yemen reported a two-year license extension from January 2020 (MTN Group Limited, 2020).

138 Yemen Shabab, 2022

139 Aden Al-Ghad, 2022

and MTN for their failure to pay renewal fees.[140] Sabafon is negotiating its obligations with IRG, while MTN opted to exit the market. There are also reports of DFA and IRG arbitrarily increasing taxes and licensing fees or introducing new instruments such as a 1% fee on telecoms bills to be paid towards DFA's martyrs families' fund.[141]

Cumbersome bureaucracy – Telecommunication companies face complex and lengthy bureaucratic procedures such as registration and licensing, when doing business, which increases their costs. Yemen ranks 187th out of 190 countries in the World Bank's Doing Business report, which assesses countries based on ease of doing business.[142] Especially poor indicators for Yemen include "dealing with construction permits", "getting electricity", and "trading across borders". A case in point is the blockage on imports of telecommunications equipment.

Embargo on telecommunications equipment – The security embargo on telecommunications equipment continues to pose large challenges to operators today. These include longer time and higher costs to obtain import clearances and get access to parts or equipment needed for maintenance, repairs, and upgrading.[143] Ultimately, this has led to higher operating costs. Moreover, even though the embargo was aimed at Sana'a-based operators, interviews highlighted that all operators, regardless of their location, are impacted. Since 2021, restrictions have also prevented the Emergency Telecommunications Cluster (ETC) from obtaining pre-import licenses for the delivery of telecommunications equipment needed for humanitarian operations (see **Box 2**). It also appears that the blockade has not always been effectively enforced, with anecdotal reports of materials and tools for 4G technologies being smuggled across the Oman border.[144] This has allegedly allowed Yemen Mobile and YOU to roll out high-speed Internet services over the course of 2022.

10.2 Economic challenges

Oppressive fiscal burden – Telecommunications companies face the highest corporate tax rates in Yemen, with international telecommunications services being subjected to a 35% corporate tax rate[145] and mobile phone service providers subjected to a 50%

140 Noaman, 2020; Al-Marsad Newspaper, 2022

141 Regain Yemen, 2022

142 World Bank Group, 2020

143 The embargo on telecommunication equipment includes wires, transmitter and receiver towers and fortification stations, computer programs used in military and civil communications, mobile communications devices, satellite communications phones, communications encryption software devices, navigation tracking devices (AIS), and navigation radars. According to the Aden Customs authority, any incoming imports have been stored in the port due to this equipment being potentially used for civil, military, or security purposes (Al-Mahra Post, 2020).

144 Nagi, 2019

145 The same applies to oil, gas, and mineral companies and cigarette manufacturers.

rate, whereas the standard corporate tax rate for businesses is set at 20%.[146] Several countries impose above average corporate income tax rates when profits of telecommunications operators are far higher than those of other sectors.[147] While this approach may be justifiable in a normal context, Yemen's telecommunications sector has been enduring shrinking profits and has incurred losses which, on top of the conflict circumstances and deep uncertainty in the country, make the current tax policy towards operators quite extortionary. In addition, mobile companies are also subject to a 10% sales tax (compared to 5% for other sectors) and a 2.5% Zakat on net income, licensing, and other administrative fees.[148] On top of high rates, fees payable to IRG are denominated in foreign currency (mostly USD), which means that companies need to obtain foreign exchange to make these payments. This has translated into spiralling costs for operators given the YER's continued depreciation. In this environment, the current tax policy is proving to be especially oppressive towards operators, adding to their difficulties in staying afloat and constraining their investments. It is also likely that these dynamics act as a deterrent to prospective investors.

High fuel costs and electricity outages – Due to the unreliability of the national grid, operators often have to rely on fuel generators for electricity. This practice has become increasingly expensive due to growing fuel costs. Recurring blackouts and fuel shortages have led to a reduction in the number of operational power stations, weakening or eliminating mobile coverage in parts of the country. For example, in 2016, 30% of Sabafon coverage was out of service due to high fuel-related electricity costs.

Shrinking profits – Operators are experiencing increasing operating costs due to higher energy prices, security costs, costs for the rehabilitation and maintenance of damaged infrastructure, macroeconomic volatility (especially currency devaluation), and new or higher fiscal obligations.[149] The drop in value of the YER is hurting profits from both the revenue and expenditure side: revenue earnings are denominated in YER, while a large share of expenditure (notably government fees and imports of equipment), have to be paid in foreign currency (mostly USD). Moreover, from the revenue side, most Aden-based operators now serve a much smaller market (only about 35% of users live in IRG-controlled territories), but also one that is far more geographically extended. In turn, this requires larger investments to service their coverage areas. These factors have increased firms' expenditures and put pressure on their revenues and profits. For

146 Concession companies in oil and gas incur a rate of 3% during exploration phase, 15% applies to investment projects registered under the investment law, while small business face progressing rates ranging from 5-20% of turnover, with the exemption of microenterprises (Deloitte, 2022).

147 Matheson and Petit, 2017

148 PKF, 2017; Deloitte, 2020. Zakat is an annual religious duty under Islamic law devoted to charitable purposes.

149 An additional cost drivers include the rent of E1 links (fiber-optic transmission links that are laid underground), which according to operators twice as high as in Sana'a.

example, YOU's average revenue per user (ARPU) per quarter fell from USD 5.50 to USD 2.82 between 2014 and Q1 of 2020, with subscribers declining from 5.3 to 4.6 million. Interviews with private sector operators highlighted that ARPU has often been as low as less than USD 1. Sabafon's minority shareholder, Batelco, took an impairment provision of USD 67 million on Sabafon's carrying value in 2019.[150] **Box 3** describes some of the financial challenges MTN experienced in greater detail.

Challenges facing international banking transactions – The ongoing conflict and the fragmentation of monetary institutions has stressed international banking relations and made it difficult to perform international banking transactions for the private sector, including telecommunications companies. This is especially more complicated for companies such as Sabafon that are only able to work through banks headquartered in Aden, notably few and typically weaker in capacity. Alternatively, telecommunications operators may conduct international banking transactions through local money exchange companies, which can be costly and contribute to the expansion of the black market.

10.3 Obstacles related to the political economy

Telecommunications, like other strategic sectors in Yemen's economy, have traditionally been highly politicised. A 2013 Chatham House report claimed that over 80% of imports, manufacturing, processing, banking, transport of goods, and telecommunications were controlled by approximately ten families closely associated with the then-president.[151] Further, the sector's dynamics are also strongly linked to the war, as current and previous conflicts have been centred around key economic resources and dominance over strategic sectors.[152]

Ultimately, through direct or indirect state control, telecommunications continue to be managed as a source of rent extraction for elites rather than a provider of essential services to the population. Powerful groups often exploit their social and political influence to obtain import licenses, partner with international firms, win government contracts, and participate in the formal economy.[153] Today, all operators are either publicly owned or controlled by figures that are closely associated with different political groups.

Vested interests of entrenched elite networks undermine, block, and distort competition and forward-looking, market-based reforms and policies, thereby hindering the sector's sustainable development[154]

150 MTN Group Limited, 2020; MTN Group Limited 2014; Batelco, 2019
151 Hill, Salisbury, Northedge, and Kinninmont, 2013
152 Al-Akhali, 2017
153 Salisbury, 2011
154 World Bank, 2015

Relatedly, government decision-making processes such as those relating to the issuing or renewal of licenses, are often opaque, lacking both transparency and regulatory oversight.

Based on key stakeholder interviews, it emerged that government institutions view their role in the sector as service providers rather than as primarily responsible for policy and sector strategy setting, regulation, and oversight. This approach departs significantly from what is considered to be good practice in promoting private sector-led development in the telecommunications sector and sometimes results in state-owned entities directly competing with private actors, being the only provider for given services, or blocking and discouraging potential foreign direct investment in the sector. An example of this is satellite Internet service provision, currently exclusively provided by YahClick at very high costs.[155] Similarly, the government's monopoly on international connectivity and access to the backbone infrastructure inhibits the expansion of the sector and entry of new players. The combination of high centralisation and politicisation in the telecommunications sectors has undermined a levelled playing field among operators and has limited the sector's efficiency, quality of services, and attractiveness to potential investors.

155 Arabian Brain Trust, 2022

11 Policy principles and recommendations

Table 9: Policy principles, objectives, and action

Underlying policy principles

1. Shift from service provision to regulation
2. See the private sector as a driver of economic development rather than a source of revenues
3. Build greater transparency and accountability
4. Prioritise incumbent operators over newcomers
5. Limit further fragmentation and politicisation
6. Adopt a step-by-step approach
7. Favour context-based solutions, identified through an inclusive process, over international best practice
8. Ensure inclusive service delivery
9. Decentralise some decision-making
10. Ensure political will and prioritisation

Timeline	Objective	Action
Short term 6 months to 1 year	**Restore local and international connectivity**	Reinstate and upgrade licenses
		Scale local community networks
		Channel funds towards network rehabilitation
		Strengthen state-owned institutions
		Link with the forthcoming SEA-ME-WE-6 cable
		Review the security embargo
		Scale satellite-based Internet services
	De-escalate and de-politicise selected issues	Establish a technical working group to negotiate key issues among parties and operators
	Mobilise external support	Reconnect with international development community
		Negotiate funding for training, technical assistance, and investment
	Build greater transparency by leveraging quick wins	Launch an ICT data initiative
	Strengthen institutional transparency and oversight	Empower existing institutions with regulatory oversight
		Establish a legal framework for AdenNet
		Remove overlaps in responsibilities and functions among institutions
		Entrust a neutral body with authority over the top-level domain
Medium term 1 to 3 years	**Tackle legislative and policy bottlenecks**	Revise the tax policy
		Review the telecommunications law
		Negotiate domestic roaming agreements with operators and develop the relevant regulations
		Develop transparent and adequate licensing regulatory frameworks
		Tackle political and economic risk indicators
		Scale the adoption of mobile money
	Unlock key bottlenecks through diplomacy	Unfreeze TeleYemen's funds
		Regain access of most international gateways and undertake investment to activate them
		Negotiate with countries to re-route international calls through Aden
Long term 3+ years	**Develop a modern and independent regulatory framework that is conducive to private investment and healthy market competition**	Establish an independent regulator
		Formalise the structure of operating licenses and spectrum licenses
		Implement regulated termination rates
		Monitor the level of competition
		Implement good practice regulation
	Develop a long-term, national vision for the telecommunications sector	Develop a digital strategy

Sections 9 and **10** above have outlined the opportunities to unlock private sector engagement in the telecommunications sector and the potential obstacles and risks that may prevent this from happening. In this section, we propose a set of underpinning principles and related policy objectives and actions that are aimed at overcoming the challenges and realising the opportunities identified previously (**Table 9**).

11.1 Guiding principles for reform

Yemen's reform agenda for the telecommunications sector should be grounded on a few guiding principles. These should represent a basis against which policies are evaluated and implemented. Adopting some of these principles will require a significant shift in the way authorities have traditionally engaged with the telecommunications sector – nonetheless, a new approach has potential to promote a more conducive policy environment to enable sustainable, market-based, long-term sector development. Key principles include:

1. **Shift from service provision to regulation –** The telecommunications sector has historically been characterised by high levels of state centralisation and control. The negative implications and risks of centralising the entire sector in Sana'a became evident with DFA's takeover of the capital and its seizing of key assets and infrastructure. It also resulted in limited access to sectoral technical skills outside Sana'a. These dynamics are being replicated in Aden. Moreover, IRG efforts to liberalise the sector are often offset by interference measures that constrain the private sector. Institutions such as MoTIT and PTC continue to play a dual role as both operators and sector regulators. In the absence of strong checks and balances and accountability mechanisms granted by independent regulatory institutions, state operators tend to enjoy unfair advantages such as scope to distort and stifle competition and efficiency. In contrast to other parts of the economy, the resilience of private telecommunications companies indicates that such high levels of state participation in service delivery might not be justified. For genuine liberalisation to take place, a shift in IRG's attitude towards the sector is needed. This would involve the state gradually assuming a more marginal role in service provision and a more active one in regulation, monitoring, and enforcement.[156] This approach would help promote a healthier and fairer business environment, spur productivity and innovation, and ultimately improve the quality and affordability of telecommunications services for the population. Ultimately, greater private participation would also protect the sector in the case of continued or future conflict, as the experiences of Afghanistan, Iraq, and Somalia demonstrate.[157]

156 Arabian Brain Trust, 2022
157 World Bank, 2020c

2. **See the private sector as a driver of economic development rather than a source of revenues –** High levels of state participation in Yemen's telecommunications are in great part motivated by IRG's over-reliance on the sector's revenue, which has led to a highly extractive fiscal burden for operators. Realistically, a genuine shift towards less interference will hinge on a different, less oppressive relationship between IRG and private operators. For this to happen, telecommunications should primarily be viewed by the state as an essential service to the population and a critical enabler of economic activity and sustainable development, rather than merely as a source of revenue. This is because the indirect economic gains that modern, accessible, reliable, and affordable telecommunications services could generate in the future (including a broader tax base) far outweigh the benefits (i.e., public revenues) that can be appropriated today. This does not mean that telecommunications cannot play a role in sustaining fiscal capacity, but rather that revenue considerations should not be a first-order factor shaping IRG's decisions—something that is especially important in Yemen's context, where operators face significant risks, challenges, and costs, and where tax rates are already highly burdensome. A change in IRG's attitude towards the sector would ultimately improve its relationship with operators and deliver policies that achieve greater private engagement and improved service delivery.

3. **Build greater transparency and accountability –** Lack of transparency and weak accountability in the way telecommunications policy is designed and implemented such as opaqueness of the criteria informing decisions to assign or renew licenses, reduce trust in IRG and hurt competition. As part of the broader shift in the government's approach towards the sector, IRG should aim to build a more level playing field for operators, with stronger checks and balances that mitigate conflict of interests and corruption in government decision-making.

4. **Prioritise incumbent operators over newcomers –** IRG often faces a tension between attracting new operators and supporting incumbents. While both aims are valid, the former is arguably costlier and more time-consuming to implement. For example, it may require hefty tax incentives or regulatory reform to lower business risks. On the other hand, prioritising support towards incumbent operators could be implemented more practically and rapidly, given their existing presence on the ground and familiarity with the market and its challenges. For example, Sabafon already controls over 400 sites from where it delivers services in IRG-controlled areas. From interviews, we learned that new entrants might need five to six years to reach the same level of investment. Indeed, with the advent of COVID-19, supply chain disruptions, and the ongoing embargo on imports, it takes a long time to acquire a site from existing owners and build the infrastructure required. For example, under current conditions, it takes one year to build approximately 35 sites. Prioritising support to incumbents could

potentially also be a fairer approach, given that these firms have demonstrated resilience and willingness to continue serving the Yemeni market throughout the conflict. Further, with regards to FDI attraction policy, it might be worth prioritising companies with experience in fragile and conflict-affected environments such as Afghanistan, Iraq, Myanmar, or northern Pakistan, as these companies may have the risk appetite, expertise, and strategies needed to operate successfully in challenging circumstances.

5. **Limit further fragmentation and politicisation –** The telecommunications sector is becoming increasingly fragmented by the day, a trend that has already triggered acute economic and social challenges and issues. Moreover, the strength and resilience of any national communications network depends on enhanced interconnection and open access across geographical and regulatory areas. While we recognise how politically and practically complex upholding this principle is in Yemen's current context, IRG should still aim to de-politicise and de-escalate key sectoral issues by addressing them as technical, in an effort to limit (and ideally reverse) further fragmentation and strengthen the sector's neutrality.

6. **Adopt a step-by-step approach –** Reforming the telecommunications sector in a way that promotes private sector participation presents large and contextually unique challenges from political, operational, and regulatory standpoints. Aiming to roll out fully-fledged reform packages at once is unrealistic and unlikely to produce satisfactory outcomes. A preferrable approach could entail kickstarting the reform process by identifying and rapidly implementing a few, tangible, and publicly visible actions that yield quick gains (e.g., connecting isolated communities), thereby building confidence and momentum within and towards IRG, and establishing a relatively solid basis for the next round of policy efforts. This may require policy experimentation to identify what works and what does not. Notably, incremental policymaking and trial and error could, in fact, be a more feasible and practical approach, given current circumnstances.

7. **Favour context-based solutions, identified through an inclusive process, over international best practice –** The telecommunications sector in Yemen presents challenges and dynamics that are uniquely tied to the country's socio-economic and political context. While international best practice and lessons from comparable contexts can offer useful guidance, both should be checked against local realities. After all, it is Yemen's context that will determine whether external advice can be successfully adopted. Critically, achieving this will require an inclusive decision-making process involving all relevant stakeholders such as the private sector, civil society, and minority groups.

8. **Ensure inclusive service delivery –** Unequal access to telecommunications services is a serious concern in Yemen. As policies are designed and rolled out, service delivery should be

inclusive of all Yemenis, and particular attention should be paid to marginalised groups such as women, rural communities, and youths. The multi-stakeholder decision-making process discussed above can act a way to guarantee this.

9. **Decentralise some decision-making –** Decentralising some decision-making in telecommunications sector reform towards local authorities and communities to achieve improved outcomes in service delivery can be justified on the basis of limited capacity at the central government level and the value of deeper contextual understanding and better aligned incentives at the local level. Selecting what decisions to decentralise and what to retain centrally warrants careful consideration by IRG, which in any case should maintain a monitoring role. Moreover, given Yemen's complex political and security context, not all regions or communities are amenable to decentralised processes. These efforts could be tested in relatively stable regions that are removed from the fighting and have well-established centres of local power. This approach may also allow to test alternative policy options across localities, with successful ones potentially being replicated and scaled across the country. Afghanistan offers an insightful example of this: local assemblies, or jirgas[158], were empowered to bring together Taliban and private operators and to negotiate ways to keep services running at the community level during previous conflict.

10. **Ensure political will and prioritisation –** Successful and sustainable reforms will hinge on IRG's solid political will and sustained commitment, buy-in, and willingness to confront the strong vested interests in the sector. This, in turn, will require telecommunications sector reform to be featured as a top development and political priority in IRG's agenda.

Grounded in the principles outlined above, the next sections propose a set of objectives and actions to strengthen private sector participation in the telecommunications sector in Yemen. First, we present recommendations that can yield quick benefits at a relatively low cost and that could be kickstarted within the next six months to one year. Next, we focus on more ambitious and complex options that could be rolled out within the next one to three years. Finally, we present longer-term recommendations that are informed by international good practice. It is worth stressing that the options below, particularly the longer-term ones, are highly dependent on (and vulnerable to) the political and military developments in the country. Therefore, a high degree of flexibility and scenario planning to adjust to any unforeseen developments will be key throughout the reform process.

158 An assembly of leaders that takes decisions by consensus according to the Pashtun social code and has the authority to settle a dispute in a way acceptable to both sides.

11.2 Policy options: Short term (6 months to 1 year)

In the short-term, we suggest that IRG focuses on three key objectives and considers the following policy actions for each (**Table 10**):

Table 10: Short-term objectives and actions

Objective	Action
Restore local and international connectivity	Reinstate and upgrade licenses
	Scale local community networks
	Channel funds towards network rehabilitation
	Strengthen state-owned institutions
	Link with the forthcoming SEA-ME-WE-6 cable
	Review the security embargo
	Scale satellite-based Internet services
De-escalate and de-politicise selected issues	Establish a technical working group to negotiate key issues among parties and operators
Mobilise external support	Reconnect with international development community
	Negotiate funding for training, technical assistance, and investment
Build greater transparency by leveraging quick wins	Launch an ICT data initiative

Patrons use computers in an internet cafe, Republic of Yemen. Photo: Dana Smillie / World Bank

Objective 1: Restore local and international connectivity

1. **Reinstate and upgrade licenses for private operators –** Licenses of Aden-based carriers should be reinstated with long-term extensions and upgraded to 4G or made technology-neutral. This includes Sabafon-Aden, whose outstanding legal disputes should be dealt with in parallel. This will allow companies to keep growing, investing, and properly competing with other operators in Yemen. To expand the penetration and geographical coverage of telecommunications services, future licenses could also be made conditional on set coverage targets and minimum levels of open access to the Internet through free Internet hotspots.

2. **Scale local community networks –** IRG should support the private sector to deploy localised wireless connectivity (or community networks), through Plug and Play technology.[159] Roll out could start in relatively peaceful regions that are currently cut off from mobile and fixed networks to demonstrate viability. If successful, this decentralised approach could rapidly bring connectivity to communities, potentially attracting follow-on funding support from donors. Licenses to operate local community networks, just like the provision of other internet services, will require parliamentary approval – and this is not feasible at moment give that the parliament does not convene. A potential solution to overcome this, in the short term, could entail:[160]

    - Granting sub-licenses to local community networks companies through state-owned ISPs that are already authorised to operate by IRG. Given that AdenNet lacks a legal framework and YemenNet is controlled by DFA, TeleYemen-IRG should be the only institution allowed to issue contracts and supervise the activities of community networks.

    - Ensuring and enhancing the transparency of how these licenses will be granted, focusing on the expansion of internet services, in the contracts.

    - Developing rules and procedures to manage these networks and regulating relationships among all the stakeholders involved, based on other countries' experience, including the granting of licenses via mobile operators.

3. **Channel funds towards network rehabilitation –** Yemen's telecommunications infrastructure is outdated and much of it is damaged and not fit for purpose. If and when public, private,

159 A technology that allows peripheral devices to be connected to a computer and be used almost immediately. All the user has to do is plug the device into a free computer port, with no need for manual configuration and no need to install a driver.

160 Interiview with MoTIT official.

and development partner financing become available, spending decisions should prioritise the following:

- Reinstating **mobile broadband coverage** where this has been damaged or lost during the conflict, including both the access network and links to the core network, likely achieved in the short-term through microwave links.

- Rehabilitating and expanding the **fibre-optic cable network**, to be deployed with new infrastructure that can carry it such as roads and power grids. This will allow the rollout of access networks with good quality backhaul and core network connections.[161]

- Regain control and maximise the use of existing **international cable capacities**, taking advantage of their geographical proximity to Yemen, to improve the speed and quality of Internet services and to reduce the risk of outages. The focus should be on submarine links as these are less likely to be targeted by military attacks and thus more resilient. Efforts should include:

  i. Making full use of the capacity of the Aden-Djibouti cable

  ii. Activating the AAE-1 link

  The first (i) requires negotiations between IRG and the Djibouti Government to jointly agree on the cable expansion. Investment will be needed in both countries to replace the existing terminals of the cables with modern terminal equipment and increase the bandwidth of the existing fibre networks.[162] This upgrade would allow the cable capacity to double.

  To activate the AAE-1 link (ii), IRG (and its partners) would need to pressure companies in the cable's consortium (and their respective governments) to recognise TeleYemen-IRG and provide it with the information needed for activation. This highlights the significant scope for international diplomacy to play a role is resolving some sectoral issues. Critically, unlike Aden-Djibouti, AAE-1 would be better suited to support Internet connectivity across the entire country due to it being based on higher bandwidth and modern technology.

4. **Strengthen state-owned institutions –** Key telecommunications institutions that were recently re-established from scratch in Aden, such as PTC and TeleYemen, are in dire need of financial and technical support. Available funding from IRG and development

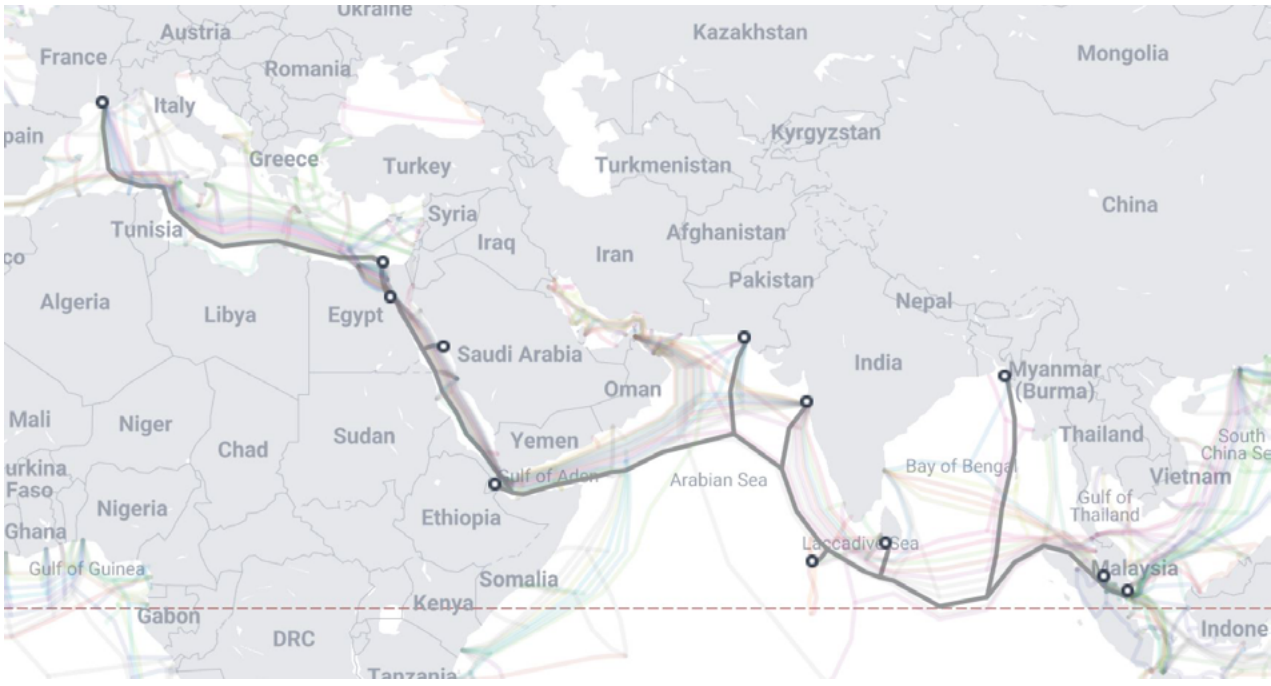
161 About 75% of the cost of laying fibre is in digging the trenches for the ducts and other necessary groundwork. The global trend is for fibre ducts to be built alongside electricity grids and highways, among other utility infrastructure. It will therefore be most cost efficient to allow deployment of fibre via linear infrastructure, in particular for electricity grids and roads/highways (World Bank, 2020a).

162 Interview with a MoTIT official. This equipment is called DWDM, an optical fibre multiplexing technology that boosts bandwidth.

partners should also be channelled towards hiring new and qualified technical staff, building capacity, and revising regulations and legislation.

5. **Link with the forthcoming SEA-ME-WE-6 cable –** The recently launched USD 600 billion G7 Partnership for Global Infrastructure and Investment (PGII) will support, among others, the completion of the Southeast Asia–Middle East–Western Europe 6 (SEA-ME-WE-6) cable, a fibre-optic submarine telecommunications cable that will connect Singapore to France, passing alongside Yemen's coastline (**Figure 16**). The cable is set to be operational by early 2025.[163] Given its proximity to Yemen, this project presents a concrete opportunity to connect the country's domestic network to the international cable system, deliver high-speed Internet to the population, improve the sector's resilience, and allow IRG to regain control over a functioning international gateway. IRG should consider engaging with the cable's consortium and G7 leaders to explore opportunities to link the cable with new landing stations on the ground as the infrastructure is laid down.

Figure 16: SEA-ME-WE-6 cable map[164]



6. **Review the security embargo –** The current security embargo on telecommunications equipment (which cannot be sourced domestically) is both proving to be ineffective in stopping cross-border smuggling and highly burdensome for private operators and humanitarian agencies. IRG should review the embargo and

163 The White House, 2022
164 Telegeography, 2022

ensure that equipment can pass import controls relatively swiftly, provided that those imports are meant for the rehabilitation, expansion, upgrading, and maintenance of telecommunications infrastructure across the national territory.

7. **Scale satellite-based Internet services –** Satellite-based Internet is likely to be excessively costly for nation-wide provision. However, Internet via Very Small Aperture Terminals (VSAT)[165], especially the recent innovations that rely on the low earth orbit (LEO) satellites, could help rapidly deploy connectivity to communities that have been cut off from the national network or that are located in remote parts of Yemen. A similar model has been successfully adopted by isolated communities in other developing countries such as Peru and Mongolia. VSAT networks have a big advantage when it comes to deployment: because the ground station is communicating with satellites, very little infrastructure is required to service remote locations. This, in turn, ensures more resilient services as these systems are independent from large-scale infrastructure (which are more vulnerable to direct and indirect military attacks). International investors such as Starlink, have expressed interest in entering the Yemeni market and offer faster and more reliable and affordable services than those currently provided by YahClick, via TeleYemen-DFA (currently priced at 100 USD per 10 GB). IRG should consider engaging with potential investors and working with them to address existing concerns around security risks and the payment of fees and seek to promptly roll out these services in rural and remote locations or in conflict zones.

Objective 2: De-escalate and de-politicise selected issues

1. **Establish a technical working group to negotiate key issues between IRG, DFA, and operators –** Even though telecommunications are not a direct cause of the war, they are becoming increasingly entangled in conflict dynamics. Failing to address telecommunications-related disputes between the parties could deter peace efforts, in addition to holding the sector's development. Efforts to de-escalate tensions and de-politicise the sector are urgent, as the sector's security and military importance is becoming more prevalent. The UN-led peace talks may offer a window of opportunity for IRG and DFA to address ICT issues linked to the conflict. This could be done through a technical working group made up of technical staff from IRG and DFA and other relevant stakeholders. Issues of focus may include:

165 A small-sized earth station used in the transmit/receive of data, voice and video signals over a satellite communication network, excluding broadcast television.

- **Mechanisms to share and use telecommunications revenues,** especially future streams, by, for example, establishing a dedicated fund to deliver essential services across the national territory, using revenues for the payment of civil servants' salaries, or protecting funds in an escrow account to be used once peace prospects materialise.[166]

- **Strategies to limit further market fragmentation.** These could focus on restoring interconnection between operators across the national territory and on allowing operators that were forced to suspend operations in certain regions to resume their activities.

- **Addressing the risks related to duplicated telephone numbering.** This issue has already been resolved for Y-Telecom as IRG granted the company a new numbering range (starting with 75) different from that of former Y-Telecom in Sana'a, HudHud (starting with 70). However, the problem remains unresolved for Sabafon-Aden, whose current numbering range (starting with 71) is the same as that of Sabafon-Sana'a.

The technical working group could be integrated into the UN-led negotiations. However, according to a few interviewees, excessively formalising these discussions within the official Track 1 negotiations may backfire, derailing peace efforts. For example, the parties might end up exploiting technical issues as bargaining chips to advance political demands, as in the past. Rather, a solutions-oriented, technical, less formal group that aims to address telecommunications issues as technical rather than political matters could be more effective in quickly identifying compromises and solutions. Undeniably, the parties will still need to empower their technical teams with enough agency to lead on these discussions, put forward propositions, and secure agreements without fear of personal negative repercussions.

Alongside an inter-party working group, the authorities and the international community should also seek to facilitate dialogue among telecommunication operators in light of their shared challenges and similar objectives. Issues to be addressed could include licensing policy, numbering, interconnection, spectrum policy, domestic roaming, infrastructure sharing, pricing, billing, radio interferences, and so forth. These efforts would allow operators to advocate, communicate with, and potentially advise authorities through a common voice; address key challenges in a more neutral and technical way than if these were left to only IRG and DFA; and even find solutions to certain technical issues in a self-regulated manner. By contrast, the persistent lack of coordination among operators may lead to a "tragedy of the commons" – a situation in

166 Unless the conflict over access to resources is addressed directly and resolved during peace negotiations, historical evidence indicates a heightened chance for violence to erupt soon after a conflict has officially come to an end.

which individuals or firms with access to a public resource act in their own interest and, in doing so, ultimately deplete the resource – with operators adopting opportunistic and economically inefficient behaviours (e.g., underusing shared resources, radio interference issues). Afghanistan offers a useful example of this. There, during the previous conflict, given the risks and costs faced in developing and maintaining the infrastructure throughout the country, a neutral private infrastructure provider was appointed by operators to manage telecommunications assets on their behalf. Responsibliities included putting up towers and providing power supplies. On the other hand, operators were responsible for managing their radio networks (often shared). This resulted in them mainly competing on branding, given the now common costs. A similar approach could be trialled in Yemen.

Objective 3: Mobilise external support

1. **Reconnect and leverage support from the development community –** Multiple development organisations could offer significant support to IRG through technical assistance, training, and development finance, which can unlock investment and help rehabilitate the sector.[167] Critically, development partners' support would allow IRG to access advanced technical expertise and dedicated financing, both of which are very scarce. IRG, through MoTIT, could begin by mapping, rebuilding, and nurturing relationships with key players in this space (such as the ITU, OECD, ICANN, GSMA, and the World Bank Group and its Multilateral Investment Guarantee Agency, or MIGA [see **Box 4** below]).[168] Given the neutral status of most donors, requesting support towards non-political issues is likely to be more effective. This may include technical training for public and private sector staff, satellite-based Internet, local community networks, powered WiFi hotspots, and investment in e-governance systems (e.g., health, education). Development partners' interventions should be assessed carefully to ensure they do not end up competing with and displacing private sector operators.

Objective 4: Build greater transparency by leveraging quick wins

1. **Launch an ICT data initiative –** Strengthening the transparency of the telecommunications sector in Yemen is a time-consuming, politically complex, and long-term effort, especially at the level of regulatory and institutional reform. However, there are opportunities to be leveraged in the short term that could yield rapid and valuable benefits by improving access and availability

167 Notably, investment in telecommunications is tends to occupy a large share in development finance institutions balance sheets that's their lower risk compared to other sectors. For example, between 2014 and 2018, World Bank Group's IFC investments in telecommunications sector averaged 13% of its total investment volume in conflict-affected states, the largest contribution following financial services and energy (IFC, 2019).

168 Arabian Brain Trust, 2022

of information on the sector. One relatively low-cost, high value option is launching an ICT data initiative, spearheaded by MoTIT. This would entail regularly publishing historical and current telecommunications sector information such as the number and characteristics of users, infrastructure data, and other development indicators. As a key benefit, this initiative would help promote transparency and trust in IRG. Furthermore, the data could also support private sector investment, as operators would be better equipped to conduct feasibility studies, assess risk, and make business decisions. This is also an area that could attract assistance from development partners.

BOX 4: MIGA'S POLITICAL RISK INSURANCE IN AFGHANISTAN AND MYANMAR'S TELECOMS SECTOR

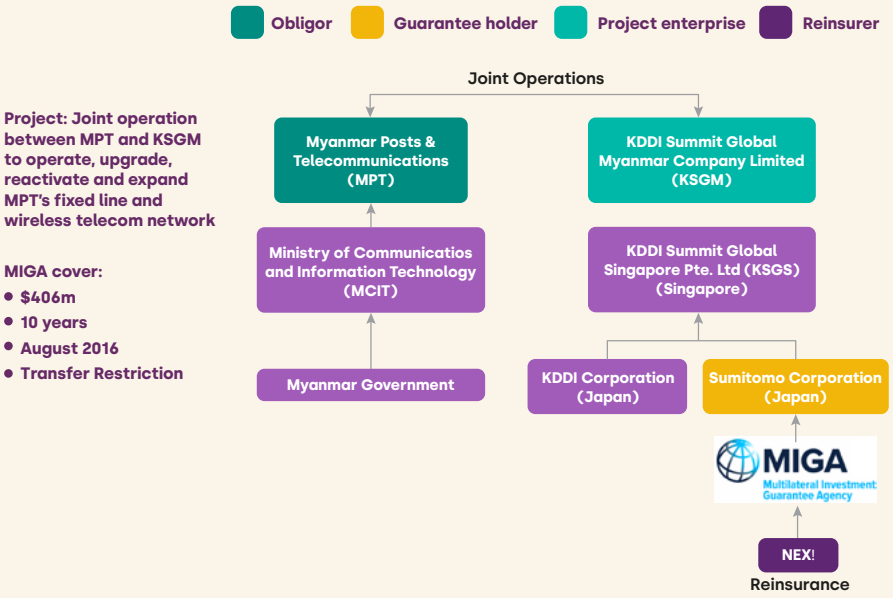
The World Bank Group's MIGA has a mandate to promote FDI into developing countries and into fragile and conflict-affected contexts in particular. Its support typically consists of political risk insurance in the form of guarantees to public and private sector entities against non-commercial risks (e.g., war, expropriation, currency inconvertibility, breach of contract).[169]

MIGA guarantees can help foster FDI and improve projects' attractiveness to lenders by lowering the overall risk profile. Further, MIGA-backed projects can improve confidence among the international and domestic business communities, helping attract follow-on investment and encouraging the return of capital to the country.

The case of Afghanistan – In war-torn Afghanistan, MIGA played an important role in backing private investors in the telecommunications sector. Its first intervention in 2007 consisted of providing MTN-Afghanistan (formerly Areeba Afghanistan LCC) with a USD 76.5 million guarantee, backing the company's USD 85 million investment to cover the installation, operation, and maintenance of a GSM network. This included USD 2 million under MIGA's Afghanistan Investment Guarantee Facility designed to encourage foreign investment into the country. The operation was followed by a USD 80.4 million guarantee to cover the expansion of MTN's operations in the country. Ultimately, MIGA's financing allowed its client to replace the entire network, expand access to telecommunications services (including through cell phones, satellite Internet, and public pay phones) to cover over 80 percent of the national territory, grow its customer base, and increase profitability – all this despite high security risks and a highly uncertain policy environment.[170]

169 MIGA, 2022
170 MIGA, 2021

The case of Myanmar – Under the Thein Sein presidency, Myanmar's telecommunications sector underwent significant liberalisation reforms that led to large-scale improvements in penetration rates across the country and sizable FDI inflows. These included a Joint Operation Agreement (JOA) between government-owned Myanmar Post and Telecom (MPT) and Japanese companies Sumitomo Corporation and KDDI Corporation. The joint venture aimed to implement, upgrade, and expand the national telecommunications services (including mobile, fixed, Internet, etc.). MIGA supported the investment by providing a USD 406.2 million guarantee covering equity and shareholder loan investments from Sumitomo to KDDI's Summit Global Myanmar Co. Ltd for a period of 10 years against the risk of transfer restriction.[171]



171 MIGA, 2016; MIGA 2019; Frontier Myanmar, 2017

11.3 Policy options: Medium term (1 to 3 years)

In the medium-term, we suggest that IRG focuses on three key objectives and related policy actions (**Table 11**).

Table 11: Medium-term objectives and actions

Objective	Action
Strengthen transparency and oversight	Empower existing institutions with regulatory oversight responsibilities
	Establish a legal framework for AdenNet
	Remove overlaps in responsibilities and functions among institutions
	Entrust a neutral body with authority over the top-level domain
	Launch an ICT data initiative
Tackle legislative and policy bottlenecks	Revise the tax policy
	Review the telecommunications law
	Negotiate domestic roaming agreements with operators and develop the relevant regulations
	Develop transparent and adequate licensing regulatory frameworks
	Tackle political and economic risk indicators
	Scale the adoption of mobile money
Unlock key bottlenecks through diplomacy	Unfreeze TeleYemen's funds
	Regain access of most international gateways and undertake investment to link with them
	Negotiate with countries to re-route international calls through Aden

Objective 5: Strengthen institutional transparency and oversight

1. **Empower existing institutions with regulatory oversight responsibilities –** Establishing an independent regulator will require time, resources, and political will, all of which are currently limited. However, until these conditions materialise, provisional solutions could be considered. This could include empowering existing government supervisory or regulatory institutions such as the Central Organization for Control and Accounting (COCA), the High Authority for Tender Control (HATC), the Anti-corruption Commission, and the Central Bank to play a role in providing at least some oversight over public and private telecommunications sector players with regards to licensing, taxation, competition, appeals and financial disputes, among others. This is also likely to be the more feasible approach between the two suggested here.

   Given that under the current circumstances the main issues are likely to be of financial nature, the Central Bank might be especially well placed to play a regulatory role, with higher guarantees of autonomy, compared to other government institutions. This approach has been trialled in Afghanistan where, before the establishment of an independent regulator, the Central Bank was tasked to deal with appeals from the private sector and issues regarding operators' inward and outward capital flows, remittances, investments, and payments of dividends. Notably,

licenses of Afghanistan's operators included an explicit clause providing for such a role by the Central Bank. A similar approach could be considered in Yemen, provided that the appropriate amendments to the Central Bank's legislation are made to allow for supervision over non-financial institutions or that an ad-hoc presidential decree is issued. While the establishment of a regulator may be a longer-term goal, plans for its implementation should be developed early on to provide certainty to investors. More broadly, it is critical that current government plans indicate the regulatory and policy reform that will be set up at a later stage to allow operators to understand how competition and regulation will be implemented in the future, thereby strengthening certainty of investment.

2. **Establish a legal framework for AdenNet –** IRG should consider developing a legal framework for AdenNet that includes articles of association and rules of procedure, as requested by IRG's Ministry of Commerce and Industry (MoCI). Further, a board of directors should be appointed with a clear governance structure, audited financial statements, and spectrum and operating licenses. Having a legal framework with strong governance procedures is an essential step to develop and expand the company's services to all IRG territories while ensuring fair and transparent operations and competition.

3. **Remove overlaps in responsibilities and functions among institutions –** Despite the fact that AdenNet is exclusively an Internet service provider, it currently also holds responsibilities similar to those of the international gateway, TeleYemen-Aden. Notably, based on its mandate, TeleYemen should be exclusively responsible for international calls, which instead are currently a prerogative of AdenNet. This overlap in responsibilities and tasks among public telecommunications institutions should be avoided as it generates unnecessary complexities and governance risks.

4. **Entrust a neutral body with authority over the top-level domain –** Yemen's country code top level domain, .ye, is currently controlled by DFA. However, best practice recommends entrusting the management of this type of service to an independent, neutral, and technical entity such as the Internet Society Yemen Chapter. Given how politically contentious this might be, addressing issues of authority over the management of Yemen's top-level domain and ensuring that national websites adopt a single country code could be included into technical group negotiations discussed earlier, as part of broader actions to prevent the sector's further fragmentation.

Objective 6: Tackle legislative and policy bottlenecks

1. **Revise the tax policy –** IRG should revise the current tax policy to make it less extractive on private sector operators through a reform process that is conducted in consultation with operators. Options for reform may include relaxing taxes for a few years on operators that are willing to engage in dense network rollouts and/or that are able to meet pre-agreed key performance indicators.

2. **Review the telecommunications law –** Efforts to revise and update the current telecommunications law in a way that meets the needs of the telecommunications market, enhances the role and partnership of the private sector, encourages competition, and is more aligned with technological development and international good practice should resume.

3. **Develop transparent and adequate licensing regulatory frameworks –** As IRG seeks to support existing operators and attract new ones, transparent processes in the allocation, renewal, and upgrading of licenses are needed to ensure that these are rolled out in a fair and symmetrical way across operators and that issues such as certainty in licensing contracts and risk of corruption are addressed. Private operators will require certainty that their operating and spectrum licenses will be guaranteed for a relatively long period if they are to commit to significant investment in rolling out networks, conducting initial network planning exercises, and bidding for licenses. This requires a clear departure from current practices that are characterised by weak institutional checks and balances and by unpredictable and obscure decision-making in the way licensing contracts are issued.

4. **Negotiate domestic roaming agreements with operators and develop the relevant regulations –** Domestic roaming takes place when mobile devices switch to partner networks in areas where the device's primary carrier does not have coverage. Given the geographical access gaps present in Yemen due to operators' lack of capacity to service the entire country, IRG could encourage national roaming agreements among operators to promote competition, particularly as networks are being rolled out. These would allow consumers to roam on respective networks in areas where one may lack coverage at a negotiated price, rather than forcing consumers to switch sim cards. This approach has been successfully implemented in the conflict regions of northern Pakistan. The price for national roaming is often regulated on a cost-base level. However, if multiple operators have areas in which they are the only provider, the competitive market may be sufficient since each operator will be reliant on other operators to provide parts of their coverage – and if they were to charge excessive prices for others to roam on their network, then they would expect their competitors to raise the prices that they pay in return. The eventual aim of such regulation is to ensure that operators have the ability and customer base to offer equivalent coverage without roaming. Yet, in cases where there are limited sites available, or where there is a limited backhaul availability, roaming may need to continue.

5. **Tackle political and economic risk indicators –** Attracting new investment to Yemen's telecommunications sector, whether from incumbents or newcomers, greatly depends on improving key drivers of political and economic risk could help significantly, as infrastructure investors are more sensitive to improvements in country risk ratings in conflict-affected countries than in others. As Yemen is ranked among the riskiest countries to do business in (187 out of 190 according to the World Bank), targeted policies that address key risk indicators may help guide reform places and go a long way in accelerating infrastructure investment in telecommunications.[172] Particularly poor indicators such "dealing with construction permits", "getting electricity", and "trading across borders" are likely to affect telecommunications investors decision, indicating potential starting points for government intervention.

6. **Scale the adoption of mobile money –** Expanding mobile money services to increase financial inclusion and private sector development requires an array of reforms in multiple sectors, including telecommunications. IRG should focus on upgrading the legislation for electronic payments, improving the necessary telecommunication infrastructure to guarantee reliable connectivity, and allow mobile operators to use technologies such as unstructured supplementary service devices (USSD) and integrated voice recording (IVR) services through encrypted SMSs.[173]

Technical assistance from international organisations such as the OECD and ITU, could be leveraged to support government efforts in the areas discussed above.

172 World Bank Group, 2020
173 Sana'a Center Economic Unit, 2022

Objective 7: Unlock key bottlenecks through diplomacy

There are several areas in which IRG should leverage its internationally recognised status to address urgent sectoral issues by engaging in talks and negotiations with relevant foreign governments. To this end, lobbying and seeking support from partner governments, the UN, and other development agencies could improve chances of success. Key areas of focus include:

1. **Unfreeze TeleYemen's funds –** Over USD 300 million, including interconnection fees paid to TeleYemen, have been frozen in a Saudi bank since 2015. More could be done by IRG (and bilateral and multi-lateral partners) to pressure senior policymakers in Saudi Arabia and have the bank release TeleYemen's funds. A way to achieve this could be tying the financing to urgent, cross-country development, rehabilitation, and maintenance projects in the telecommunications sector, or to other politically neutral development projects. Alternatively, the funding could be placed in an escrow account to be unfrozen at a later stage as prospects for peace and a political process materialise.

2. **Regain access of most international gateways and undertake investment to link with them –** Besides Aden-Djibouti and AAE-1 discussed above, there are other submarine cables that are currently inactive due to political disputes or that outside IRG's control. Critically, these cables could deliver high-speed connectivity to Yemen and improve the sector's resilience if the right investment is undertaken. These include Africa-1, SEA-ME-WE-5, and FALCON. For each of these, IRG should consider the following options in the medium-term, which are likely to demand time and significant costs, but also potentially high returns:

    - **Africa 1 –** IRG should consider undertaking investments to connect the national network to the cable, by developing a landing station in Mocha, and purchasing internet capacity.

    - **Falcon –** IRG should seek recognition for TeleYemen in Aden from the cable's consortium, which currently only deals with TeleYemen-DFA should then invest in replacing the equipment in Al-Mahrah (under IRG control) where a landing point for the cable is located, if shared management of the cable between IRG and DFA is not politically feasible

    - **SEA-ME-WE 5 –** Similar to the above, IRG should seek recognition for TeleYemen in Aden from the cable's consortium, which currently only deals with TeleYemen-DFA. Following this, options to move the landing point from Al-Hodeidah (under DFA control) to Mocha (under IRG control), if shared management of the cable between IRG and DFA is not politically feasible.

3. **Negotiate with countries to re-route international calls through Aden –** Most foreign operators, including those from Saudi Arabia, UAE, Jordan, and Turkey, currently route calls via TeleYemen-Sana'a rather than TeleYemen-Aden. This is depriving IRG of important revenues. There's scope for IRG, backed by foreign governments, to pressure foreign operators (through their respective national governments) to re-route calls for Aden-based operators through the Aden-Djibouti cable. Resolving this would also carry security benefits as it may curb DFA espionage and interception activities over some international calls. As long as IRG does not regain control over FALCON, however, re-routing calls from YOU, Yemen Mobile, and HudHud (which make up the largest share of international calls to and from Yemen) remains unfeasible.

11.4 Recommended policy options – Long term (3 years onwards)

In the long-term, we recommend that IRG focuses on the following objectives and related policy actions (**Table 12**):

Table 12: Long-term objectives and actions

Objective	Action
Develop a modern and independent regulatory framework that is conducive to private investment and healthy market competition	Establish an independent regulator
	Formalise the structure of operating licenses and spectrum licenses
	Implement regulated termination rates
	Monitor the level of competition
	Implement good practice regulation
Develop a long-term, national vision for the telecommunications sector	Develop a digital strategy

Objective 8: Develop a modern and independent regulatory framework that is conducive to private investment and healthy market competition

1. **Establish an independent regulator –** IRG's long-term role in the sector should be one of neutrality, regulation, monitoring, and enforcement. This would ultimately be attained by establishing an independent telecommunications authority. A regulator would enable the separation of regulatory powers and responsibilities from IRG, which currently covers both regulatory and service delivery functions. This development would ensure more stable and less politicised decision-making. The regulator's board should be made up of representatives from multiple stakeholder groups, including members of government, civil society, the private sector, and academia, and equipped with technical expertise in economics, law, and engineering. Critically, a genuinely independent regulator will be an effective signalling tool to attract capital, as it will give investors stronger guarantees for the standards with which the sector is managed.

2. **Formalise the structure of operating and spectrum licenses –** A role for the regulator in managing spectrum between different users should be clearly established and defined. Current spectrum use is almost universally outside a formal licensing framework, creating uncertainty over future use and no guarantee of interference requirements. Investment in networks will only take place if spectrum rights are defined. This does not only include spectrum used for access, but also for backhaul, sensors, broadcasting, navigation, and emergencies.

3. **Implement regulated termination rates –** Termination rates are the price charged by an operator for forwarding calls from other network customers to their own customers. By definition, these rates are a natural monopoly as each operator has complete control of their own network. Given the risks associated with natural monopolies, including unregulated termination rates that favour large operators over small ones and hurt competition, the ITU advocates for these rates to be regulated. Different methodologies exist to determine the price of price of termination, including long-run incremental cost (LRIC) and benchmarking. Over time, IRG should consider assessing what approach might be more feasible and effective in Yemen's context and update the regulatory framework accordingly.

4. **Monitor the level of competition –** Should one operator take over any short-term state-run network, there may be a competitive advantage which leads to predatory pricing (through monopoly) or margin squeeze (through higher wholesale prices). This may occur as the first-mover operator outcompetes others because its costs are too low (attained through economies of scale or by capturing most of the consumers). To address this, in the short-to-medium term, some level of price regulation is likely to be required, through a price cap or price floor, depending on the market context. The aim of this regulation is to ensure that there can be multiple viable operators with reasonable market shares, leading to the regulation no longer being needed in the future.

5. **Implement good practice regulation –** As the industry settles, it is important to maintain competition and incentivise investment in networks. Barriers to consumers switching networks should be removed through the implementation of mobile number portability, removal of penalties for leaving, and improved information and comparison tools.

Objective 9: Develop a long-term, national vision for the telecommunications sector

1. **Develop a digital strategy –** Future government policy in the telecommunications sector needs to be anchored in a clear, underlying vision and strategy for the country's long-term digital development. Important areas of focus may include rolling out e-governance services (such as in taxation, education, health) to increase transparency, tackle corruption, and encourage the return

of investment, the development of financial technologies, and so forth. Several developing countries have been working on digital strategies in recent years, including Benin, Malawi, Mongolia, and Ethiopia. IRG could seek to learn from these countries' experiences.[174] It is also critical that Yemen's digital strategy is developed in consultations with local communities, civil society, political parties, and private sector representatives from multiple sectors. IRG should aim to understand stakeholders' digital transformation and ICT development needs and provide incentives for operators to deliver on these.

Computer classes at the Telecom institute. Photo: Agnes MONTANARI/Gamma-Rapho via Getty Images

174 Kelly and Souter, 2014; Pathways Commission, 2022

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State Fragility initiative

The State Fragility initiative (SFi) serves as the Secretariat for the Council on State Fragility and is an International Growth Centre (IGC) initiative that aims to work with national, regional, and international actors to catalyse new thinking, develop more effective approaches to addressing state fragility, and support collaborative efforts to take emerging consensus into practice. SFi brings together robust evidence and practical insight to produce and promote actionable, policy-focused guidance in the following areas: state legitimacy, state effectiveness, private sector development, and conflict and security. SFi has financial support from the UK Foreign, Commonwealth, and Development Office (FCDO) and The Rockefeller Foundation.

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