Internet crossing borders: Boosting the Internet in Landlocked Developing Countries

Executive Summary

Internet Society

There are 44 landlocked countries in the world

of which 32 are classified as middle- or low-income by the United Nations.[1] These 32 comprise the Landlocked Developing Countries (LLDCs). They can be grouped into seven distinct regions, each with unique challenges. Nine LLDCs were selected for closer analysis as part of this report.

Table 1: LLDCs by region

South-eastern Europe	**West and Central Asia**	**South America**	**South and East Asia**	**Southern Africa**	**Eastern Africa**	**Western Africa**
FYR Macedonia Moldova	Afghanistan Armenia Azerbaijan Kazakhstan Kyrgyzstan‡ Mongolia Tajikistan‡ Turkmenistan Uzbekistan	Bolivia Paraguay‡	Bhutan‡ Lao PDR‡ Nepal	Botswana‡ Lesotho Malawi Swaziland Zambia Zimbabwe	Burundi Ethiopia‡ Rwanda‡ South Sudan Uganda	Burkina Faso‡ Central African Rep. Chad Mali Niger

‡ Case Study LLDCs.

The key factor that sets LLDCs apart from other countries is access to the sea and the consequent trade obstacles that presents in respect to transport and transaction costs. In 2014, the average cost to export one container from an LLDC was US$ 3,444 and US$ 4,344 to import.[2] Comparatively, transit countries faced much lower average costs of US$ 1,301 to export and US$ 1,559 to import.

Rather than describe generic issues related to enhancing Internet access applicable to many developing nations, this report focuses on how the Internet can help the specific condition of being landlocked. There are three key areas where the Internet can assist physically landlocked nations become digitally land linked.

1. First, networked customs systems have a significant impact on reducing the delays and cost of trading across borders.

2. Second, just as LLDCs need access to the sea for goods trade, they also need it for access to fiber optic submarine cables.

3. Third, LLDCs are on a more equivalent footing with non-landlocked countries in services trade. Here the Internet can provide a platform for the offshoring of information technology services.

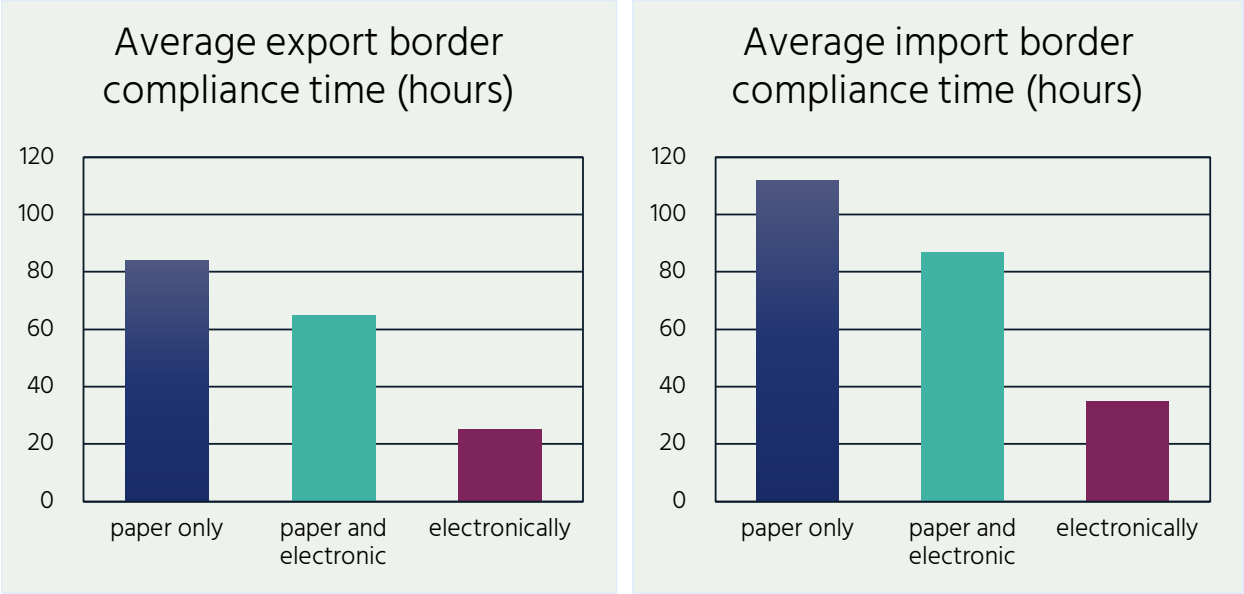
Use of the Internet to overcome the specific condition of being landlocked involves several different focus areas. The report uses the Internet Society's policy framework to analyze how the Internet can be boosted in the LLDCs:[3]

1. Expanding Infrastructure
2. Fostering Skills and Entrepreneurship, and
3. Supportive Governance.

Facilitating trade

There is a shared view in the international development community that trade facilitation is paramount in addressing the unique condition of LLDCs. Computerized customs facilitation systems streamline the exchange of goods across borders, and have been the focus of much development effort and funding in the last 10 years. Networked computer systems are ideally suited for processing the vast amount of documentation involved in trade and linking customs with importers and exporters. The World Bank finds that countries that support electronic submission of trade documents have shorter border compliance times compared to paper only or hybrid systems. [4]

Figure 1: Average trade compliance time (hours)



Despite near universal application of automated customs systems by LLDCs, there are a number of limitations. Real world problems have sometimes intervened, such as inefficient backend processes, poor project implementation, or disagreements between government agencies. Electronic communications to border posts has been imperfect. Another challenge is that customs software needs to continually upgraded and actively managed not only to take advantage of changes in hardware and software but also to reflect the widening trade community.

LLDCs need to implement automated single windows that provide access over the Internet to the entire universe of institutions and companies involved in trade with facilities for e-payments. Given that all LLDCs rely on transit countries, it is imperative that customs systems be linked through regional single windows using open protocols and international standards to minimize problems caused by proprietary systems. LLDCs need to leverage digital tools such as Internet of Things, tracking systems and big data that make trade more efficient. [5] For digitalization to have the biggest impact, LLDCs need to remedy analog shortcomings. This includes leveraging regional economic communities to move as close as possible to open borders and incorporating the entire trading community in the digitalization process to enhance trust and acceptance. Only then can LLDCs remove a major development defect caused by their being landlocked.

Boosting cross border connectivity

National backbones are crucial for LLDCs in order to interconnect with the networks of sea facing nations for access to undersea fiber optic systems. Downstream local access is dependent on upstream backbone networks as well as traffic exchange arrangements in terms of quality and prices. If there is insufficient international bandwidth due to constraints with the backbone network, quality and pricing of Internet access will be high. LLDCs that can successfully deploy cost-effective national backbones that are interconnected with regional transmission networks and submarine cables and where there are open domestic traffic exchange mechanisms will reap gains through fast Internet and low prices for consumers.

Similar to the transport of goods trade, landlocked countries are dependent on transit countries for access to submarine cables. Ideally, national backbones in LLDCs should extend to all bordering countries to increase choice, minimize costs, and enhance redundancy. In practice, this is often not the case:

- **Transit infrastructure:** In some instances, there is no route to the sea via some neighbors because that country has not extended its backbone to the border. Take the D.R. Congo, which borders Rwanda to the west and has access to two submarine cables on the west coast of Africa. While Rwanda's national backbone extends to the border with D.R. Congo, the opposite is not the case.

- **Political relations with neighbors:** Armenia does not have diplomatic relations with either its neighbor to the east, Azerbaijan or to the west, Turkey. As a result, it has north and south links via Georgia and Iran but no east to west route even though its national backbone goes to the borders of Azerbaijan and Turkey. Bhutan has had a closed border – and no network connectivity – to China for decades.

- **Peace and stability within transit neighbors:** Burkina Faso could not avail of submarine cables in southern neighbor Cote d'Ivoire for a number of years because of civil war in the latter nation.

- **Administrative processes in transit:** There are generally no regional regulations that would establish fair interconnection and termination arrangements between countries resulting in bilateral negotiations between transit operators and LLDC operators that can result in significantly high costs. While some economic communities have established free trade of goods and services, they have not done so for cross-border data flows. There are also concerns about transiting through neighboring countries that might filter or otherwise control Internet traffic.

Microwave can be used for cross-border transmission and satellite completely negates the need for cross-border transit. However, these technologies cannot match the price and capacity of fiber optic. While the long run costs of fiber optic networks are cheaper, their construction cost is high. Civil works and rights of way are significant financial challenges. LLDCs have pursued several models for deploying national backbones. There are often overlaps between the models.

One model is **operator** driven. Given the high cost of deploying fiber optic cable, if there is not agreement among operators, then there will likely be duplication of backbones as well as routes that only some or one operator covers. This generally results in a high level of microwave connections due to the cost of fiber. Operators with deep resources and high market share are likely to invest the most in fiber optic backbones. An added incentive would be if the operator is part of a group that has subsidiary operations in neighboring countries. An example is West Africa where Maroc Telecom has a string of geographically connected subsidiaries. It is present in Mauritania where connection to the ACE submarine cable has created the impetus to build out the national backbone to the east so that it can interconnect with

LLDCs in Mali, Burkina Faso, and Niger. Unless there are regulatory safeguards, operators dominant in the fiber backbone market might not lease to other operators or might do so at a price that is not cost-based.

Another is a **cooperative** model where operators agree to share the cost of deploying fiber backbones. The Burundi Backbone System (BBS) is a partnership between different operators in the country to share a national backbone on an open access basis. BBS is a joint venture between the Government of Burundi and five ISPs. The project involved the creation of a 1,250 km fiber optic backbone connecting all 17 provinces and cross-border connections for access to the landing points of international submarine cables in Mombasa and Dar Es Salaam.

A third model is **government led** either by itself or through a public private partnership (PPP). In Rwanda, the government built a national fiber optic backbone financed in part from the sale of the incumbent operator. It later created a PPP to manage the asset. Bhutan is another example; the government has deployed fiber on electricity transmission networks, and ISPs do not pay to use it (but have to light the fiber themselves). One advantage of the government or PPP model for cross-border connectivity is that arrangements tend to take place at an inter-government rather than inter-operator level and can result in lower transit prices.

Wholesale provided through specialized companies is another model. For example, Liquid Telecom, a Pan-Africa telecommunication group, has one of the continent's largest fiber backbones stretching from South Africa to Uganda. They also have capacity on five submarine cables. Their network connects LLDCs Botswana, Lesotho, Rwanda, Uganda, Zambia, and Zimbabwe. The attraction of the wholesale model is that theoretically since the backbone providers are not involved in the retail market, they would provide the same cost-oriented price to any customer. Wholesalers may also have robust regional connectivity facilitating cost-effective and reliable routes to submarine cables.

A **regional** approach involves an agreement among a group of countries to connect their networks and financing is generally available from other operators or development partners to finance the project. For example, in Lao PDR, two regional projects enabled it to achieve connectivity to all its neighbors, a rarity for an LLDC. Cross-border connectivity between Lao PDR and China, Vietnam, and Thailand was deployed as part of the China-Southeast Asia Cable (CSC) project, which launched in 2001. Connectivity was enhanced in 2009 through the Greater Mekong Subregion (GMS) Information Highway Project. The network was partly financed by the Export-Import Bank of China. The GMS Information Highway Project includes cross-border links between Lao PDR and Cambodia, China, Myanmar, Thailand, and Vietnam – all countries where government is involved in the telecommunications sector and therefore may have facilitated regional connections.

It is often argued that LLDCs pay more for international connectivity because they incur transit costs for access to undersea fiber optic cables. However, this is not always the case due to a number of reasons. First, operator groups might leverage their presence in neighboring countries (e.g., Sonatel linking Mali from Senegal and hence building its Senegalese backbone to the Mali border). In these instances, the operator group usually internalizes transit prices and other operators that desire to use this link may find the prices are not cost-oriented. Second, the distance to undersea cables in some LLDCs is not far. This is relevant when transit is charged by distance. Third, transit costs may be influenced by a variety of factors such as bi-lateral government agreements and scale.

The case of Rwanda illustrates that it is possible for landlocked nations to have cheaper international wholesale connectivity prices than sea facing countries. Several enabling factors led to low costs in Rwanda. First, the World Bank provided a grant for the Rwandan government to purchase bulk capacity in order to achieve scale and lower international bandwidth costs. Second, in 2012, a 10-year agreement

was struck with the Tanzania Telecommunications Company Limited to procure international bandwidth at an attractive price. Third, the government owned the national fiber backbone allowing it to provide cost-based open access so that operators could cheaply get their traffic to border crossings.

Although international Internet connectivity via satellite is often eclipsed by undersea fiber optic, satellite remains relevant because it provides LLDCs sovereign connectivity. For example, Lao PDR, in 2015, launched its first satellite. Satellite provides backup in case of cable disruption; a cut to the Georgian fiber optic backbone took down the Internet in Armenia for several hours, and Bhutan's connectivity lacks redundancy because of a single point of failure outside its territory (the Indian town of Siliguri). Satellite is also important for parts of the country that are not within reach of fiber backbones. South Sudan was about to install fiber optic to the Kenyan Border as part of road construction project until civil war broke out in South Sudan. In the meantime, one of the leading ISPs uses the O3b low earth orbiting satellite network for international Internet connectivity for its WiMAX customers. O3b has low latency and higher bandwidth compared to earlier generations of satellites. Another LLDC using O3b is Chad where the satellite provides international bandwidth for a wireless ISP.

Internet Exchange Points

Internet Exchange Points (IXPs) are of particular relevance to LLDCs since they keep locally destined data traffic within the country, helping reduce costly Internet Protocol (IP) transit traffic. IXPs also improve quality by lowering latency, often serve as hubs of technical expertise, and are attractive to foreign and local content providers who want their content to be easily accessible within the country. Also, IXPs keep local Internet sites running if a country experiences disruptions to its international bandwidth.

Despite their value, only half of LLDCs had an active IXP in May 2017. One quarter had no IXP and another 25% had IXPs that were inactive or not truly open exchanges (e.g., run by an operator rather than an independent association). Even in LLDCs with IXPs, it should be noted that many of the facilities are not exchanging a significant amount of traffic, suggesting some type of barrier such as non-participation by key ISPs.

Among the nine case study countries, five have active, neutral IXPs. Among those without an IXP, two have little need: Ethiopia has just one ISP and in Bhutan, two ISPs account for the vast majority of subscriptions. In these cases, there is not a pressing need for an IXP given the market structure. In Tajikistan, operators prefer to exchange data bilaterally. In Lao PDR, the government has tried to establish an IXP, but this has not been successful to date.

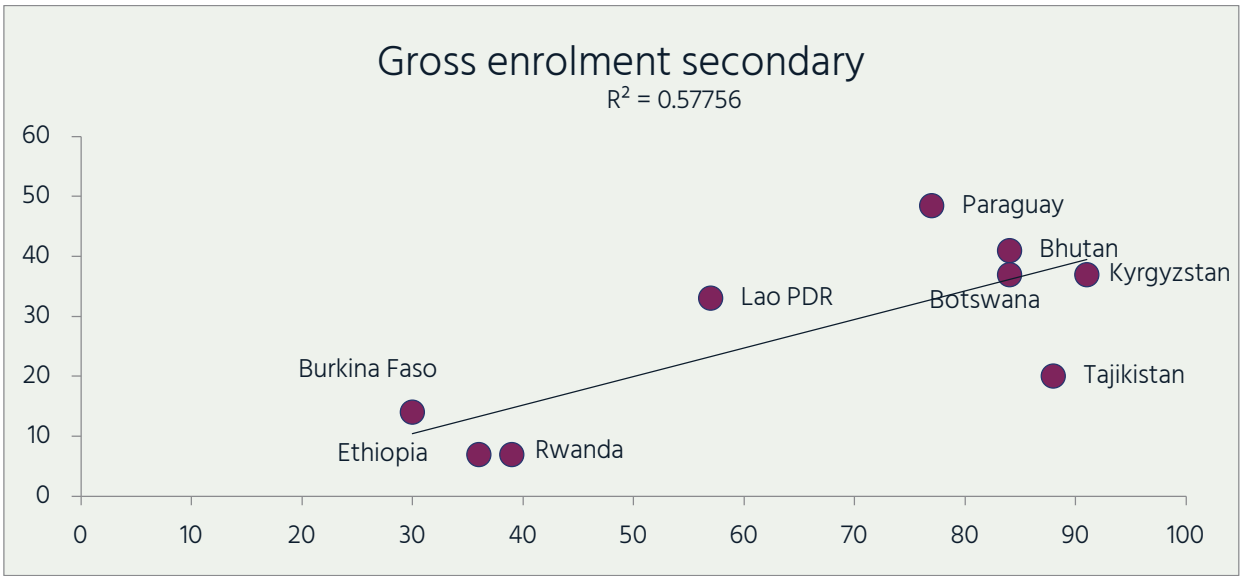
Skills and digital business

Digital skills are essential to leverage the opportunities created by expanded Internet infrastructure. Internet-enabled services could be attractive for LLDCs since unlike goods trade, there is no need to physically cross borders.

Skills

Of all the relations between Internet use and education, one of the best fits is gross secondary enrolment (Figure 2). This is because in the LLDCs, the Internet is primarily a youth phenomenon. There is a far higher share of young Internet users in relation to their population share. The finding that secondary school enrolment is most closely linked to Internet use reflects the youth impact, as well as the fact that there is an even higher link between a secondary education and Internet use as well as that in most of the countries where computers and Internet access is available in secondary schools. There is a big gap between the three African case study countries and the others in both secondary school enrolment and Internet use. Botswana is the African exception with relatively high school enrolment, and hence, a higher level of Internet use. Therefore, Internet infrastructure deployment alone will not be enough to grow Internet use unless it is accompanied by investment in education.

Figure 2: Internet use and years of schooling, LLDCs



Source: Adapted from UNDP, national statistical surveys and Authors' estimates.

The Government of Rwanda recognizes digital literacy is a major obstacle to its aspirations of the country becoming a Smart Nation. In early 2017, it launched the Digital Ambassador Program (DAP) where 5,000 youth will be trained and then posted to all 30 districts in the country to provide digital skills training to five million Rwandans over a four-year period. The DAP is a partnership between the Ministry of ICT, the Canadian NGO Digital Opportunity Trust (DOT), and the World Economic Forum's Internet for All initiative. DAP would require each trainer to teach 250 people a year, which seems realistic based on current experience. If successful, it would dramatically boost Rwanda's digital literacy to 85% of the population.

Digital business

It can be argued that LLDCs have better prospects for services exports since trade in services does not need to physically cross borders. Therefore, LLDCs compete on a more level playing field with other developing nations for services exports. In terms of Internet-enabled service exports, opportunities include computer services such as software exports and data processing as well as business services such as accounting, call centers, medical transcriptions, etc. delivered over computer networks.

Few LLDCs are leveraging opportunities from Internet-enabled service exports to any noticeable degree. LLDCs are not perceived as computer outsourcing destinations and none figure in the list of 55 nations compiled in the Global Services Location Index.[6] Not facing the sea need not be a barrier as there are three landlocked countries on the list (Czech Republic, Hungary, and Slovak Republic).

Just three of the 22 LLDCs for which data is available have computer services exports greater than five percent of total services exports and they are all Central European (Armenia, Macedonia, and Moldova). They benefit from proximity to developed European nations and high levels of education. Nonetheless, LLDCs do have ambitions to develop ICT industries and tap export markets. The creation of specialized zones as hubs is one method being used.

Table 2: Tech parks, case study LLDCs

Country	IT zone	Description
Kyrgyzstan	High Tech Park	The park benefits from low income tax (5%) and no corporate tax apart from a 1% levy for the directorate of the Park, for companies that export at least 80% of their output. As of 2016, the park hosted 27 companies turning over US$3.5 million and employing 251 people. The largest export markets are Kazakhstan, the United States, Ireland, Russia, and Japan. The KG Labs Public Foundation maintains a list and a map of startups and related resources, and is active in running contests, hackathons, and incubation and mentoring sessions, while Ideagrad.com runs an incubation program.
Bhutan	Thimphu TechPark	Launched in May 2012, the TechPark offers office space and services for tech companies. It incubates start-ups via the Bhutan Innovation and Technology Centre (BITC). BITC provides six months free working space for startups, offers courses and competitions for entrepreneurs, and encourages overseas experts to spend time in residence sharing their experience. It currently has 15 startups, and the facility is now full, with further expansion in the pipeline. The TechPark has also attracted foreign firms, which mainly provide digital services outside Bhutan, using local talent forming an emerging ICT export industry.
Rwanda	Kigali Innovation City (KIC)	KIC aims to unite multinational information technology firms with domestic startups alongside higher education institutions. The hopes are that the synergies from anchoring educational institutions alongside tech companies will generate innovative applications and services and help grow the domestic ICT industry as well as generate exports. Carnegie Mellon University of the United States is one of the core anchor institutions. An innovation lab and skills academy is planned. The projected impacts of KIC include 4,500 highly skilled ICT jobs by 2022 and export earnings up to an estimated US$ 180 million by 2022. The Knowledge Lab (kLab) features an open space with room for around 60 people providing free Wi-Fi. It organizes various events such as workshops and hackathons and offers mentoring to help turn ideas into business models. Next door is the Rwanda FabLab, which opened in 2016 as the first hardware space in Central Africa. There is a range of equipment for users to experiment with such as 3D printers, milling machine, and a computer controlled laser cutter.
Ethiopia	EthioICT-Village	Inaugurated in 2015, EthioICT-Village features a data center and an incubator for digital startups as well as high-speed fiber optic connectivity and reliable electricity. Over 20 companies are currently housed there. It is hoped that international companies can be attracted given the park is inside an export processing zone and therefore has attractive investment incentives. It is also planned to leverage EthioICT-Village as an outsourcing hub. Ethiopia does have some experience in that area with exports as well as familiarity with English among university graduates.

Governance in a dynamic world

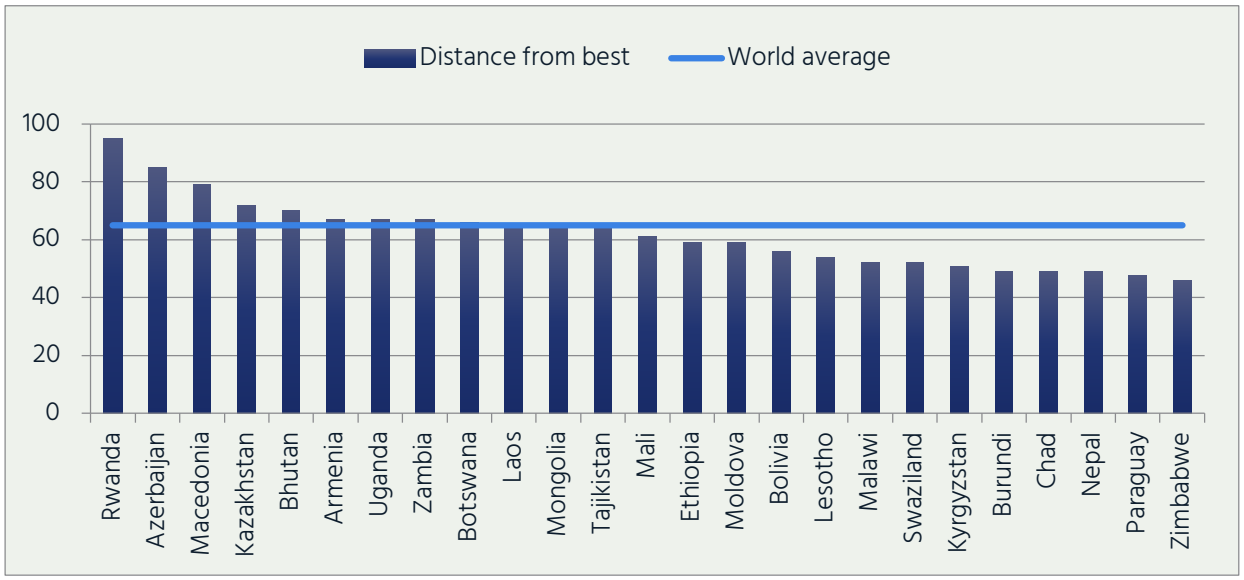
The way the Internet sector is nurtured and encouraged to grow is a function of the effectiveness of policy and regulatory mechanisms as well as high-level government commitment. While most LLDCs have adopted the common prescription of creating sector regulators and introducing competition and quite a few have ICT sector development plans, results are mixed. This is often related to hard to quantify but critical factors such as commitment, transparency, and institutional independence.

Governance and Sustainability

Most LLDCs have followed the advice of telecommunications sector reform prescribed by the international community. However, the devil is in the detail. All but two of the LLDCs have opened their mobile market to competition but the depth of competition varies, with a number of LLDCs exhibiting signs of high market concentration. Twenty-four LLDCs (75%) have a sector regulator although true independence is not always assured as it depends on the regulator's management composition, how they are appointed and whom they report to. Concerning the legality of online shopping, 21 LLDCs have an electronic commerce law, but few have a thriving online shopping market often for reasons related to trust, payments, or interpretation and implementation of the law.

A key indicator of whether sector reforms will be successful is how committed the government is. The World Economic Forum's Network Readiness Index includes a survey question on the perception of the extent to which governments have a clear implementation plan for using ICTs to improve the country's competitiveness (Figure 3). Rwanda ranks top among LLDCs and fourth in the world. This is not surprising given that President Paul Kagame has been a strong proponent of broadband and its critical role in development. This high level dedication to ICT is reflected in the country's accomplishments. It has among the highest mobile broadband population coverage in the LLDCs and has deployed an innovative public private partnership for 4G/LTE rollout that aims to cover most of the population by the end of 2017. Another LLDC that ranks high in government commitment is Azerbaijan, ranking second within the group and eighth in the world. One of the areas where the Caucasus nation has achieved impressive results is in the use of ICTs in schools. The People's Computer Initiative resulted in more than 10,000 teachers being provided with computers, 1,200 schools connected to the Internet and digital skills training for 75,000 people. Overall, there are eight LLDCs where the perception of government ICT commitment exceeds the world average.

Figure 3: Importance of ICTs to government vision of the future



Note: The question asked in the Executive Opinion Survey was "To what extent does the government have a clear implementation plan for utilizing ICTs to improve your country's overall competitiveness? [1 = no plan; 7 = clear plan]." The highest ranked country was the United Arab Emirates with a score of 6.1. The chart shows how close countries are to achieving that score (i.e., country score / UAE score * 100). Note that Afghanistan, Burkina Faso, Central African Rep., Niger, South Sudan, Turkmenistan and Uzbekistan were not included.

Source: Adapted from World Economic Forum Network Readiness Index 2016.

Cooperation

The complexity of the information society means that in contrast with other sectors, governments tend to have to rely on foreign firms and governments, local non-governmental experts, and industry to fulfill various roles in order for the whole to work efficiently, without consuming vast public resources or being left behind.

A number of LLDCs have industry groups to represent ISPs and telecommunications operators. In most cases, this group has a relatively strong voice in public and with the regulator and ministry. Examples are BITS in Botswana and BICTA in Bhutan, which are both active in setting the agenda for Internet policy discussions and inputting into policy and regulation. There is far more variation in the involvement of civil society in discussions around the Internet, reflective of the fact that there are differing views globally about accountability, and about rights to expression and association and how these translate from the real world to the Internet. On the one end of the spectrum are the countries in which the government formally or informally chooses to exclude civil society (and often other third parties such as the private sector or multinational companies) from discussions and decisions around the Internet. On the opposite end of the spectrum are those countries in which government actively engages and sometimes defers to feedback from external stakeholders. In Rwanda, this is explicit policy with the non-profit organization RICTA working with government, and the government engaging with the Internet Society to address issues like content localization. Bhutan follows this approach as part of its overall approach to government, which is accessible, transparent, and agile. Similarly, the government of Kyrgyz Republic has also increasingly called on industry and civil society for input, and has actively engaged in stakeholder-led forums including having the Prime Minister addressing the Kyrgyz Information Technology Forum in 2017.

Other countries lie between these extremes of government-dominated and stakeholder-led governance. For example, in Botswana, there is a will to adopt international best practice in consultation and in policy generally, but this may be let down by poor implementation. Botswana appears to be a particular case where increased stakeholder involvement may speed up decision-making and lead to the better outcomes that would be expected from a country with its wealth and education.

Conclusion

LLDCs vary more than other international groupings based of specific conditions such as Small Island Developing States (SIDS) or Least Developed Countries (LDCs). Some LLDCs are ahead of many non-landlocked countries in trade efficiency illustrating that having to pass through transit countries need not be a barrier. Similarly, in terms of access to undersea submarine cables, some LLDCs are well provisioned with capacity and pay prices less than many sea-facing countries. These LLDCs have largely overcome the barriers of being landlocked.

This report has shown that some LLDCs are successfully exploiting the Internet to minimize the condition of being landlocked. The Internet is used for trade facilitation to eliminate paperwork and streamline processes through networked access for participants through single windows. Proactive policies such as open access and wholesale competition in some LLDCs have resulted in the deployment of fiber optic backbones to key border points for onward transmission of international Internet traffic to undersea fiber optic facilities. Some LLDCs have also established an enabling framework for Internet-enabled services; though take-up is generally low, this is due more to underlying socio-economic conditions. The lessons learned are that the Internet can help countries overcome the barriers of being landlocked but will only have a significant impact if accompanied by a pro-active legal and regulatory environment accompanied by good governance. The best customs software in the world will be of little use if it cannot interoperate with that of border countries, a high capacity national fiber optic backbone will be underutilized if it is under monopoly control with high wholesale prices and a state of the art online shopping platform will have few users if e-payments are not allowed.

Very few LLDCs have a balanced Internet ecosystem. While some like Rwanda, are strong in infrastructure and government commitment, they are lagging in digital skills. Others, like Azerbaijan, have good infrastructure and skills but the Internet economy is relatively undeveloped. The evolution of the Internet needs to be more balanced across infrastructure, skills, digital economy, and governance for the full impacts to be felt.

There are many sources of general advice regarding digital development in developing countries. Based on the findings from the case studies, however, additionally there are specific recommendations addressing the conditions of landlocked developing countries (Table 3). While the Internet can help with a number of challenges LLDCs face, it needs to have matching high-level commitment for it to be successful. The rewards make the commitment worthwhile. As one case study participant commented, “For landlocked countries, the Internet is the sea.”

Table 3: Recommendations for unlocking the Internet in LLDCs

Area	Recommendation
Facilitating trade	**Recommendation 1:** LLDCs should aim implement automated single windows that provide access over the Internet to the entire universe of institutions and companies involved in trade with facilities for e-payments. Given that all LLDCs rely on transit countries, it is imperative that customs systems be linked through regional single windows using open protocols and international standards to minimize problems caused by proprietary systems. LLDCs also need to leverage digital tools such as IoT, tracking systems and big data that make trade more efficient.
Expanding infrastructure	**Recommendation 2:** LLDCs should aim to increase domestic backbones and in particular to all border crossings to enhance options and redundancy for international connectivity. This can be achieved through various models such as a competitive backbone market, public private partnerships or wholesalers with the aim of achieving open and cost-based access. This can be further encouraged through swapping and sharing, and making public rights of way (roads, electricity pylons) available for fiber deployment. Governments could also create scale by aggregating demand and pre-purchasing connectivity to border posts, and may wish to consider the business case for deployment of additional infrastructure at borders (e.g., small data centers).
	Recommendation 3: Governments and operators in LLDCs should work with multilateral bodies (e.g., development agencies or regional communities) to promote competition in delivery of connectivity to inland borders of their neighbors, through regulation, funding of redundant routes, reducing administrative requirements for new infrastructure, or contributing public rights of way.
	Recommendation 4: Where costs to connect from the coast to inland borders are very high, either some form of subsidy or a regional trade agreement may be required. Subsidies could take the form of funding of construction costs, direct or indirect price subsidy to suppliers or users of the routes, or support for demand aggregation and long-term contracting to reduce unit prices. A regional trade agreement could the form of a cost-based transit price from the LLDC border to submarine cable landing stations.
Fostering skills and entrepreneurship	**Recommendation 5:** Given the close link between secondary school enrolment and Internet use, governments need to invest the necessary resources to boost secondary school participation. This is also particularly relevant bearing in mind Sustainable Development Goal 4 calling for universal secondary education by 2030.7 Investment should also include computers and Internet access, which can be facilitated through universal service funds and corporate social responsibility programs. Those out of school should not be left behind and digital literacy programs should be developed, leveraging facilities such as vocational schools, libraries, and community centers.
	Recommendation 6: Government, industry, and development partners should explore options for developing a services export industry, having regard for language compatibility and the level of skills available and varying from call centers to business process outsourcing to software development. Options could be evaluated based on the number of jobs likely to be created in the medium term and the contribution towards exports.
Supportive governance	**Recommendation 7:** LLDC governments should, in consultation with industry and civil society, identify sector governance activities, which may benefit from non-governmental input. These may include but are not limited to domain name management, innovation park planning and development, promoting local content development and local traffic exchange, authoring new laws on electronic communications, cyber security, and planning for e-government.
	Recommendation 8: LLDC governments need to ensure continuity of political and civil service leadership on ICT issues, and ideally for such leadership to be visible and accessible to industry and civil society.

Endnotes

1 See UNCTAD's "Map of Landlocked Developing Countries (LLDCs)" at: http://unctad.org/en/Pages/ALDC/Landlocked%20Developing%20Countries/LLDCs-Map.aspx

2 See "What are the LLDCs?" at: http://unohrlls.org/custom-content/uploads/2017/03/LLDCs-Fact-Sheet_2017_REVISEDS.pdf

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7 By 2030, ensure that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and Goal-4 effective learning outcomes." See Goal 4 targets at: http://www.un.org/sustainabledevelopment/education/

Internet Society

internetsociety.org
@internetsociety

1775 Wiehle Avenue, Suite 201
Reston, VA 20190-5108 USA

Galerie Jean-Malbuisson 15
CH-1204 Geneva, Switzerland

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