Sectoral Analysis: Nepal

Information and Communications Technology

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Acronyms

5G	5th Generation Wireless Networks
AB SKF	Svenska Kullagerfabriken AB
B2B	Business to Business
B2C	Business to Consumer
BP	BP Plc
BPC	Buyer Purchasing Criteria
BPO	Business Process outsourcing
Cisco	Cisco Systems, Inc
DMR	Digital Mobile Radio
GVC	Global Value Chain
GoN	Government of Nepal
ICT	Information and Communications Technology
ICTES	ICT Enabled Services
ILO	International Labour Organization
IoT	Internet of Things
INSEAD	Institut Européen d'Administration des Affaires
Intel	Intel Corporation
IoT	Internet of Things
KSF	Key Success Factors
Microsoft	Microsoft Corporation
MoF	Ministry of Finance
MoC	Ministry of Commerce
NPR	Nepalese Rupee
NRB	Nepal Rastra Bank
NTIS	Nepal Trade Integration Strategy
R&D	Research and Development
SaaS	Software as a Service
SWIFT	Society for Worldwide Interbank Financial Telecommunications
USA	United States of America

Contents

Executive Summary

Nepal's information and communications technology (ICT) services are nascent, informal and centered in Kathmandu. Only a few firms operate formally, while there are many small firms operating informally. Most firms offer outsourced software development services to international clients, such as back office business process outsourcing (BPO) functions, data analytics, document digitization services, web and mobile applications development, etc. Some ICT firms also provide product-based solutions in financial technology solutions, digital marketing and specialized software.

The improved performance of Nepal's telecommunications sector signals a more conducive environment for the ICT sector. Following a sharp uptake in infrastructure investments in 2008-09, telecommunications exports have grown faster since 2012. The cost of connectivity has decreased and the connection speeds have increased in recent years in Nepal.

However, several critical barriers to growth remain which, if left unchecked, will restrict the development of Nepal's ICT activity. Nepal's ICT industry has exploited a low-wage advantage and grown in size in recent years. However, Nepal's low-wage advantage in ICT will likely diminish over time. Given the small size of the industry and the limited supply of skilled workers, it does not enjoy the economies of scale needed to compete in segments in which barriers to entry are low.

The supply of skilled manpower is not well-oriented to the needs of ICT firms. Only a fraction of the 7,500 engineering and ICT graduates are available to the ICT industry due to labor migration. Moreover, the outdated course curricula at the university level, the migration of graduates, and a limited pool of middle-managers with higher-level IT skills and managerial capabilities all serve to increase the costs of doing business for ICT firms. Meanwhile, procedures for obtaining a work visa for foreigners are difficult and complex.

Similar to other sectors, Nepal's ICT sector also faces severe cross-cutting business climate challenges, the most critical relating to institutions and infrastructure. While Nepal has made major strides in infrastructure development in recent years and continues to invest in infrastructure, the potential impact of this on wider connectivity is hampered by weak implementation of policies and unstructured planning. The infrastructure-sharing policies are not enforced and there is limited availability of licensed bandwidth. Besides infrastructure, issues relating to informality, data security and public-sector capacity are also limiting factors. Weak inter-ministerial coordination and collaboration make it difficult to address cross-cutting issues in higher education and skills development, foreign exchange, infrastructure, data security and support for research and incubation activity.

Limited access to finance and excessive barriers to foreign investment and foreign-exchange transactions also hamper the ICT sector. The incubation and funding eco-system is very limited and this hampers the creation of a pipeline of innovative start-ups and new entrants into this sector. Nepal hosts only a handful of funds offering venture capital, mentorship, and seed funding, and only one of these currently offers funding and/or mentorship to ICT firms. Nepal has strict foreign exchange controls that constrain access to foreign direct investment (FDI) and foreign markets. The lack of an international payment gateway solution remains a significant barrier to competitiveness in many strategic segments.

Reform efforts should focus on improving access to skills, infrastructure and finance, together with regulatory simplification. The education sector reforms are required to increase the pool of skilled

manpower for the ICT sector. Systematic industry and academia collaboration on curriculum design and skills development will generate a better quality pool of graduates for the ICT industry. The increased availability of licensed bandwidth at lower cost to internet service providers (ISPs), the relaxation of taxes and better enforcement of infrastructure-sharing policies will help to ease the infrastructure constraints. At the same time, data protection laws ensuring higher security of data and financial transactions are essential to a globally competitive ICT sector. Ensuring availability of seed-funding for start-ups and easy access to foreign funds will increase the pipeline of innovative start-ups and entrepreneurial opportunities in the sector.

There may also be opportunities to orient policies to encourage entry and growth in strategic niche segments by some players, which could play an anchoring role to grow smaller IT companies and provide a template to local companies to develop outsourcing business. Policies to improve public procurement of IT services aimed at encouraging local firms and easing regulations will also be essential to steer the ICT industry toward developing capabilities for high-end specialized services for local needs.

ICT Landscape

Figure 1. Nepal's market share in telecom services (exports US$ per 10,000 exported US$ globally)
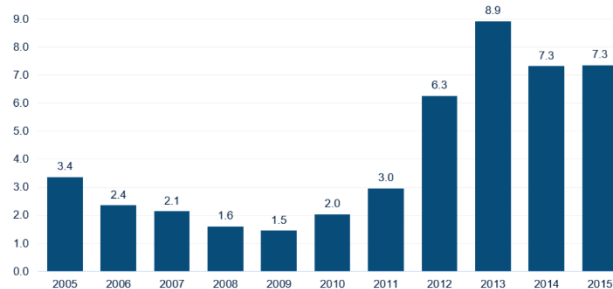
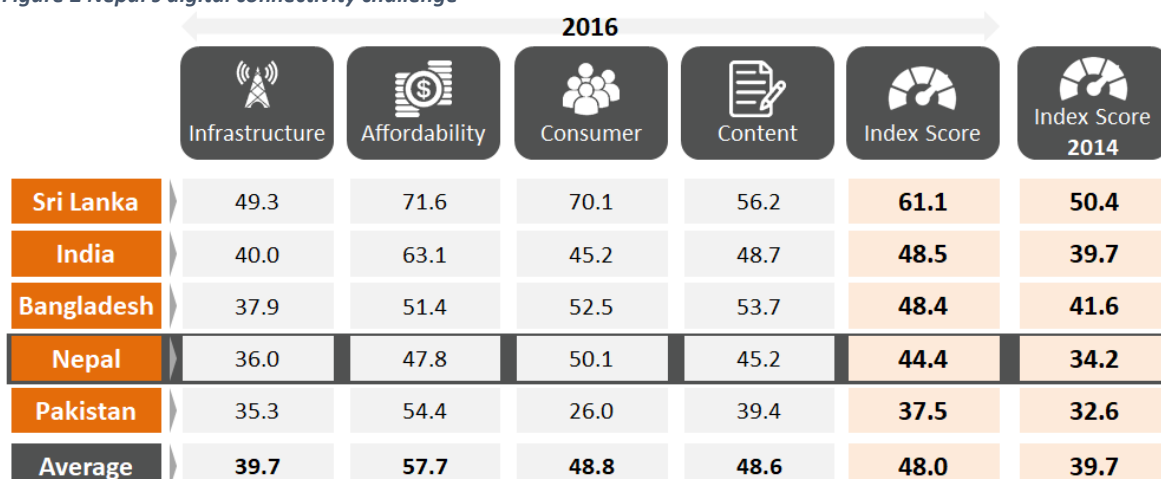Telecommunications exports suffered a decline in the period leading up to 2009 as the country recovered from a 10-year civil war. The telecommunications sector started to recover following investment in infrastructure in 2008-09. From 2011 to 2015, a sharp increase in telecommunications services exports started, peaking at US$$8.9 per US$10,000 of global exports in 2013. This may reflect the launch of GSM 3G data services in 2011, and Wimax 4G, IP-CDMA, and IP-based Wireline Network (NGN) services in 2012.

The telecommunications sector growth rate could signal an increasingly conducive environment for growth of Nepal's ICT firms (Economic Policy Incubator, 2018). While the trends in telecommunications services are encouraging, data on information and computer services are not available due to the lack of an international payment gateway, making the recording of "formal" exports of ICT services virtually impossible.

ICT Infrastructure

Digital infrastructure remains nascent in Nepal. Telecommunications services have improved in recent years, but there are still major gaps in coverage and quality, and costs remain high. There are also large regional and rural-urban disparities. In 2017, the total penetration rate of fixed lines was only 3.2 percent, centered in Kathmandu and other urban areas. The broadband (ISP) market has grown but still has extremely low penetration (only 2.0 percent in 2017). Internet penetration is also low, with only 15 percent of households having internet access, while 97 percent of all users connect through mobile broadband. However, the mobile internet market is still at an early stage of development, with outdated technology and penetration rates below most other Asian countries. Nepal scores below the regional average across all parameters for mobile internet adoption, as measured by the Mobile Connectivity Index: infrastructure, affordability, consumer readiness and content.

Figure 2 Nepal's digital connectivity challenge

	Infrastructure	Affordability	Consumer	Content	Index Score	Index Score 2014
2016						
Sri Lanka	49.3	71.6	70.1	56.2	**61.1**	**50.4**
India	40.0	63.1	45.2	48.7	**48.5**	**39.7**
Bangladesh	37.9	51.4	52.5	53.7	**48.4**	**41.6**
Nepal	36.0	47.8	50.1	45.2	**44.4**	**34.2**
Pakistan	35.3	54.4	26.0	39.4	**37.5**	**32.6**
Average	**39.7**	**57.7**	**48.8**	**48.6**	**48.0**	**39.7**

Connectivity: **The cost of connectivity has decreased and connection speeds have increased in recent years in Nepal.** Nepal Telecom and NCELL are two principal mobile service providers with a 94 percent market share. Mercantile, Wordlink, Suibisu and Vianet are some of the other providers of internet services. Licensed bandwidth is only available to mobile operators and given the high associated costs it is limited to only three providers in practice. Other mobile operators and ISPs share unlicensed bandwidth, resulting in none of the ISPs in the Kathmandu Valley offering WiFi services and only providing fiber-to-the-home (FTTH) services. The

Table 1 Data and internet subscribers, Nepal 2017 (Nepal Telecommunications Authority, 2017)

Services	No. of Subscribers
Dialup (PSTN+ISDN)	152
Wireless	52,950
Cable Modem/ Optical Fibre	226,445
ADSL	185,146
GPRS, EDGE, WCDMA	15,634,893
CDMA 1X, EVDO	199,776
WiMAX	16,907
VSAT based Internet	13
Total	**16,316,281**

available bandwidth cannot sustain the current demand for connection speeds. The resultant lack of competition in WiFi service provision and continued congestion will lead to severe degradation of services, which will become increasingly vulnerable to noise and interference.

Infrastructure: Nepal's infrastructure-sharing policies enabling the shared use of passive infrastructure (e.g., towers, cables and cooling systems) are not enforced. The leading telecoms providers NCELL and Nepal Telecom have laid intra-city cables, while ISPs provide their own cable network for serving new areas. This increases the cost to consumers, and limits access and options in remote areas. The over-ground cable infrastructure further undermines the integrity of information networks. Utility poles are overloaded and low-lying cables are prone to damage. In 2016, The Nepal Telecommunications Authority (NTA) invited applications to build a district fiber-optic network and provide optical network lease connectivity services in Provinces No. 4 and 5. The network will include underground and over-ground infrastructure to make good use of fiber-optic networks.

Taxation: The corporate income tax is typically 20 percent for mobile operators. The ISPs pay 25 percent corporate tax and are also required to pay an additional 6 percent "royalty" tax on revenue. In 2016, the GoN decided to assign one-third of this royalty tax to the capitalization of a Rural Telecommunications Development Fund (RTDF) to expand the broadband internet services in rural areas. However, there is a lack of clarity on the remainder of the total NPR 25 billion (US$245 million) accumulated by 2016.

ICT Services

Nepal's ICT services are nascent, informal and centered in only one city. There are only about 10 large[1] firms operating formally, all based in Kathmandu, and many small firms mainly operating informally. Estimates pertaining to the total number of ICT firms range from 100 to 1,000 firms in consultations with the industry. The high degree of informality has resulted in limited official information related to the number of firms, their areas of expertise, their strengths and weaknesses, or the amount of revenue generated. Consultations with 30 companies[2] suggest that most firms offer outsourced software development services to international clients.

These firms offer animation services, data analytics, document digitization services, data entry, data extraction, web application development, mobile application development, website development and customisation, data storage and back office BPO functions. Other ICT firms provide product-based solutions, including financial technology development, payment gateway solutions, lead-generating and email marketing software, e-commerce data exchange software and data security software. The largest firm interviewed had about 400 employees and the smallest had just two employees. The oldest firm interviewed had been in business for 15 years. Prevalent skills include web designers, animators, programmers in PHP, .Net Framework, Android OS, iOS, WordPress, Drupal, Ruby on Rails and Python.

Verscend and Deerwalk are prominent firms due to their size and stature in the country. Other large firms include F1Soft International, CloudFactory, Braindigit IT and Javra. These firms that are outward-looking are mostly structured as subsidiaries of parent companies located overseas. As such, much of their income is accrued overseas, and subsidiaries in Nepal only receive revenue to cover operational costs. There is little lateral coordination between large firms, and vertical integration between large and small firms is very limited. Nepal has not been able to attract international firms of a large size that would be willing to transfer technology, and employ and invest in human resources. Operations of large multinational companies such as Microsoft are present, but limited to selling of products such as learning packages and short courses (Economic Policy Incubator, 2018).

ICT Policy and Governance

Table 2 Ministries and agencies related to ICT sector in Nepal

Organization	Tasks
Ministry of Information and Communication (MoIC)	ICT policy formulation for the country
Ministry of Science, Technology and Environment (MoSTE) - Department of Information Technology (DoIT)	Development of ICT infrastructure, e-governance and cyber security
Nepal Telecommunication Authority (NTA)	Regulatory body for telecommunications services (issuing telecommunications services licenses, determining license fees, setting standards for equipment)
Nepal Rastra Bank (NRB)	Central bank, foreign exchange regulations, banking regulations

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[1] "Large" being defined as firms that employ more than 100 people.
[2] World Bank Group mission, December 2017.

The boundaries between different ministries dealing with the ICT agenda are blurred, creating a lack of strategic vision, coordination and clarity among the stakeholders. For example, the National Information and Communications Technology Policy issued in 2015 was designed by the MoIC, while the Department of Information Technology (DoIT) is currently in the process of developing an IT Act (Economic Policy Incubator, 2018). Moreover, overlapping and unclear mandates limit the coordination between ICT issues and other related issues, such as higher education, skills development, etc.

The MoIC has included ICT and BPO services as one of three services sectors that will receive support under the Nepal Trade Integration Strategy (NTIS). The NTIS outlines seven short-term and five medium-term actions for increasing the export potential of ICT services. Previous attempts to catalyze the sector have seen mixed results. The Industrial Policy (2010) sought to incentivize the private sector by providing tax exemptions for firms operating inside a new IT Park in Panauti (about 30 km from Kathmandu). Tax exemptions to firms were initially 40 percent and have been revised upward in recent years. However, only two firms are currently located in the park.

In August 2016, the GoN announced projects worth NPR 1.48 billion (US$14.8 million) for the implementation of four ICT-related infrastructure projects:

- District Optical Fibre Network Programme (comprising the installation of optical fiber cables along 2,376 km of the Mid-Hill Highway covering 32 districts), with 70 percent of the work completed as of 2017;
- Broadband infrastructure development in 14 earthquake-affected districts;
- Establishment of a model e-village development committee in each of the 75 districts; and
- Extension of internet services to 500 rural community schools and colleges.

Key Constraints

Skills development is not well-oriented to the needs of ICT firms

Figure 3 Activity post graduation, BBA and BIM students, Thames International College, 2017
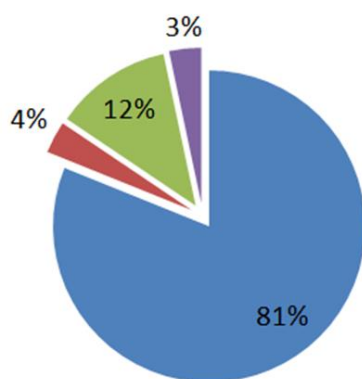
Although Nepal has a mid-size population (28.9 million in 2016), only 7,500 students graduate from engineering and ICT-related courses each year (including BE, B. Tech, BIT, BCA, BBIS, BIM and BScCSIT courses) (Pokharel, 2017). Pure ICT graduates number only 3,000 students annually (Economic Policy Incubator, 2018). Of these, only 20 percent remain in Nepal. Furthermore, only a small percentage of those who remain continue to work in ICT-related fields (Figure 3).

Private firms currently bear the cost of increasing the "industry-readiness" of graduates. These extra training costs are compounded by a high level of attrition due to labor migration and have resulted in lower rates of return, increased costs of doing business, and an associated reduction in competitiveness.

As indicated, Nepal's limited human resource pool is directly linked to Nepal's culture of labor migration. A 2016 ILO report stated that the GoN issued about 4 million permits to work abroad (excluding India) during the 1993/94 and 2014/15 fiscal years, representing almost 14 percent of the population at that time. Despite the quality of training in Nepal, ICT graduates who migrate (and remain in ICT product and service provision) have been able to find work in large BPO and service-oriented organizations in India, the Philippines, Malaysia and the United States. Such firms rely on having a high volume of workers and are able to absorb the associated training costs. Conversely, Nepal's nascent ICT sector is characterized by SMEs and start-ups.

Middle-managers are scarce and the visa process makes hiring foreign talent difficult

There is a dearth of middle-level management resources available to Nepal's ICT firms. Beyond organic development of this key resource (as firms mature and grow), or recruiting managers from other more established local industries, other countries have relied on recruiting talent from other countries. Obtaining a valid work visa in Nepal is currently difficult and complex. Work visas are issued by the Department of Immigration only upon concurrent recommendations from a line agency (i.e., the relevant government ministry), the Department of Labour (in the form of a labor permit, although there are exceptions) and the Ministry of Home Affairs (in the form of a work agreement), as well as additional documentation. The rather onerous work-visa application process means that foreign ICT workers often travel to Nepal and work on tourist visas, which not only limits their sphere of influence but also the income revenue payable to the GoN that could be used to further expand ICT activity.

Foreign exchange controls disproportionately hinder small firms targeting B2C markets

Rigid foreign exchange controls have greatly hampered the development of ICT in Nepal. Mid-to-large size companies offering B2B solutions are able to pay for foreign services using the SWIFT (Society for

Worldwide Interbank Financial Telecommunications) system to receive payments in specially designated US dollar accounts.

ICT firms in Nepal are unable to fully exploit global B2C growth (particularly smartphone applications) due to the fact that inbound foreign currency regulations have precluded the creation of an international e-payment gateway solution. In addition, Nepal's financial sector does not yet comply with the international Know Your Customer (KYC), Counter-Terrorism Financing (CTF) or Anti-Money Laundering (AML) standards and therefore does not meet the minimum requirements of leading international payment processing solutions, e.g., PayPal and Amazon Payments. 2checkout, a lesser known international payment gateway, became operational in Nepal in 2018. However, a lack of trust among consumers (particularly international consumers) limits its utility. Furthermore, the application process is long and arduous; companies are required to send substantial supporting documentation (e.g., rental agreements and electricity bills), which means that the set-up time can take up to one month (Jajodia, 2018).

The lack of an international payment gateway is a significant contributor to the high degree of informality among Nepal's ICT service providers. Nepal's ICT firms are unable to (legally) purchase international domain names (such as .com), much less storage services, data analytics, consulting services, applications, plug-ins and or widgets. Firms that deal with overseas clients trade through overseas accounts (and often rely on friends and family for the use of their online payment gateways, such as PayPal and Amazon Payments), recoup earnings through the remittance system. Operating in this way not only precludes formalization but also undervalues firms that could otherwise benefit from investment.

Absence of bandwidth and infrastructure-sharing policies

The cost of connectivity to consumers has decreased dramatically over the past few years, along with sharp increases in the speed of connections. Internet services are principally provided by Nepal's two main mobile operators, Nepal Telecom and NCELL, which together capture 94 percent of the market share. Other telecom operators and a number of ISPs, most notably Mercantile, Wordlink, Suibisu and Vianet, also provide internet services. Currently, licensed bandwidth is only available to mobile operators, but high associated costs mean that it is only used by three operators.

Nepal has infrastructure-sharing policies regulating the shared use of passive infrastructure (e.g., towers, cables and cooling systems). Currently these policies are not enforced meaning that even where leading telecoms providers NCELL and Nepal Telecom have already provided cable intercity and "last-mile" connections, each ISP hoping to service the region must lay their own cable network, increasing the cost to consumers, and limiting access and options in remote areas. The absence of infrastructure-sharing further undermines the integrity of Nepal's information networks, as Nepal's cable infrastructure is currently over-ground.

Information asymmetry in public tenders

Information asymmetry in public tenders for ICT solutions has undermined the GoN's digitization strategy. Several private sector stakeholders expressed concerns that key government departments are not keeping pace with the high rate of evolution of global ICT. It is essential that policymakers are well informed and that they keep abreast of the emerging trends and disruptive technologies that are characteristic of ICT. Information asymmetry can lead public institutions to award contracts that are not

technically sound. There has been some evidence of this in Nepal; as the GoN has continued its efforts to digitize its records and services, it has at times focused heavily on financial criteria rather than technical viability. In so doing, the GoN has in a number of cases awarded contracts focused on solutions that may have been appropriate in the near term, but have limited longer-term applications.

Lack of clarity on departmental responsibilities

Many private sector stakeholders interviewed in preparation for this report expressed a lack of clarity relating to which ministries and/or regulatory bodies are responsible for specific aspects of business and operations. Similarly, regulations related to ICT services and remote services (e.g., BPO) are not well understood.

Absence of representative industry group or PPD platform

There is currently no clear industry group or communication channel for Nepal's nascent ICT firms. The Computer Association of Nepal (CAN) is an active member of the Federation of Nepal Chambers of Commerce and Industries (FNCCI). However, formed in 1992, CAN is principally comprised of high street and wholesale retailers of personal computers, mobile phones, printers, modems and other personal communication equipment. Manufacturers and importers of equipment are also members, as are the few ICT service providers that are emerging, but the association is heavily dominated by the first aforementioned category. The development of ICT in Nepal will require the implementation of an effective public-private dialogue strategy that fosters open communication in both directions.

Key Recommendations

This section provides recommendations on key horizontal and cross-cutting challenges that are essential to develop the ICT sector in Nepal. Furthermore, it provides a strategic segment analysis applicable to a small number of niche ICT firms that can develop specialized software and services in focused sectors such as tourism and mountaineering.

Horizontal Actions

Education Reform

Issue	Public ICT and computer science courses have not evolved in line with the global digital revolution
Action	**Short/Medium Term:** • Revise course curricula (involving industry stakeholders in decision-making and reviewing course content on an annual basis) • Enact teaching reforms to reduce incidence on tertiary educators paid by the hour at multiple facilities in favor of stronger ties between educators and institutions such that they can better develop students and dedicate time to research • Systematize university-industry collaboration through internship and apprenticeship programs. Introduce internships within 3-year graduate courses with course credits **Long term:** • Revise student evaluation techniques to reduce emphasis on end-of-year exams and increase focus on coursework • Reduce the number of political appointees in university management positions (e.g., university directors or deans) in favor of meritocratic systems
Private Sector Role	The private sector should be more closely involved in STEM course design and in facilitating internship and apprenticeship programs for students in ICT-related fields. The private sector can also be involved in developing short-term specialized IT courses and certification to create a pool of industry ready manpower.
Lead Agency(s)	
Ministry of Education	

Foreign Exchange, Payment gateway and Tax regulations

Issue	Rigid foreign exchange controls have greatly hampered the development of ICT in Nepal
Action	**Short/Medium Term:** • **Expedite implementation of e-payment gateway** • Ease regulations related to entry, external funds and tax incentive for IT industry – reassess threshold of 300 employees for tax break • Reassess forex control policy and cap on contracts in US dollar-denominated accounts for IT exporters **Long term:** • Devise and implement strategy to address foreign exchange reserves

	• Develop an identity solution (leveraging existing identifiers) that satisfies international KYC/CDD and AML regulations • Allow mobile operators (as well as banks) to facilitate electronic payments
Private Sector Role	The private sector should work with the GoN to devise solutions and policies, especially those related to electronic payments
Lead Agency(s)	
NRB, MoC, MoIC, MoSTE	

Infrastructure

Issue	**Infrastructure issues still inhibit the development of ICT solutions in Nepal**
Action	**Short/Medium Term:** • Implement and enforce infrastructure sharing policies regulating the shared use of passive infrastructure (e.g., towers, cables and cooling systems) • Increase the availability (and reduce the cost) of licensed bandwidth such that it is available to all mobile operators and also to ISPs **Long term:** • Devise a strategy for reinvestment of the remaining "royalty" tax (one-third of which is currently used for the RTDF program)
Private Sector Role	N/A
Lead Agency(s)	
MoC, MoIC, MoSTE	

Data Security

Issue	**The absence of data protection laws has reduced the attractiveness of local ICT product and service providers**
Action	**Short/Medium Term:** • Designate a dedicated regulator and build a framework to address data and security issues **Long term:** • Create and equip an IT emergency response center • Develop a security compliance framework for banks and other firms and institutions that require a high degree of high-security
Private Sector Role	
Lead Agency(s)	
MoC, MoIC, MoSTE	

Research and Incubation

Issue	There are few funding or mentorship programs available for Nepal's ICT firms
Action	**Short/Medium Term:** • Establish mentorship fora that facilitate connections between international experts and local ICT firms **Long term:** • Establish government-funded grants that can be awarded to ICT firms that meet set criteria • Facilitate foreign investment that will allow seed funding and venture capital flows to local ICT firms
Private Sector Role	• Provide mentorship/internship opportunities for ICT graduates in collaboration with universities and educational institutions
Lead Agency(s)	
MoC, MoIC, MoSTE, NRB	

In addition to the horizontal actions recommended above, creation of industry platforms for ICT sector, leveraging tourism industry, effective public-private sector dialogue and streamlining of public procurement policies are some the strategic actions which will benefit the ICT sector in Nepal.

Strategic Actions

Create platforms for ICT-solution providers to better address existing challenges in Nepal (in strong and emerging sectors)

While Nepal's nascent ICT products and service providers may struggle to compete with global firms offering solutions to mass-market problems, some of the niche industry players may take a lead in creating digital solutions to issues and challenges that are particularly salient in Nepal (taking advantage of geographic proximity, language and cultural understanding). These solutions may then have regional and international application. Nepal's mountaineering and trekking industry is one such example, but other potential areas for investigation may include remote education services, remote health-care provision, clean energy applications and productivity tools that reflect the Nepalese calendar and numbering system. Encouraging solution-oriented development will require closer ties between Nepal's nascent ICT community and private sector stakeholders in respective sectors through industry platforms.

Leverage tourism to attract "digital nomads"

If and when Nepal is able to address bottlenecks related to foreign workers, policymakers can leverage its rich tourism sector and cultural attractions to attract "digital nomads" to the country to further bolster the capacity of ICT firms and solution providers through extra resources (to support elasticity of demand), mentoring and as middle management in more mature firms. Estonia's e-Residency program and Thailand's SMART visa program are examples of policies oriented toward capturing this segment. Other examples of cities that have also been relatively successful in this regard include Chiang Mai, Bali, Singapore and Oslo.

Increase PPD and digital sensitizing in government departments

The development of ICT in Nepal requires the formulation and implementation of an effective public-private dialogue strategy that fosters open communication in both directions. The Computer Association of Nepal (CAN) is principally comprised of retailers of computing and communication equipment and may not fully represent the voice of those firms geared toward the provision of digital solutions and services. As a result, there is currently no clear industry group or communication channel for Nepal's nascent ICT firms.

In addition, it is essential that policymakers in key government departments are well informed and cognizant of emerging trends and technologies characteristic of global ICT. Though disruptive technologies such as 3-D printing, augmented reality, the Internet of Things (IoT), vehicle automation, distributed ledgers and artificial intelligence (AI) may currently seem far from Nepal's productive frontier, their emergence will have a direct impact on the productive structure in sectors highly relevant to Nepal. Only through a concerted effort on the part of private and public actors will Nepal be able to adequately respond. Extending public-private dialogue to include joint projects and programs within the GoN to sensitize and raise awareness of emerging technologies could be one way to address this need.

Structure public tenders to allow Nepalese firms to participate or receive knowledge transfers (without compromising the quality of the contract)

Competency in ICT is often developed through demand for services by local public institutions that can "absorb" development costs and play a key role in catalyzing local capacity development. However, very few Nepalese ICT firms are eligible to bid for government digitization and service contracts due to the fact that their size, turnover and experience do not typically meet minimum requirements.

Including knowledge transfer (training) clauses in government contracts and/or local content clauses can be a means to acquiring technically sound services, while at the same time bolstering the capacity of local actors and facilitating their growth. Infrastructure projects in Nepal have used such clauses in the past, rating international proposals not only on financial and technical criteria but also on:

- Detailed training plans, including methodology and objective of training to be delivered (including training components and suggested participants); and
- Specification of technical training to include systems maintenance, configuration and customization, development and systems administration programs.

Using such an approach might be a way to structure public tenders to allow Nepal firms to bid without compromising the quality of the service provided.

Opportunities for niche ICT firms

The IT services sector, although nascent and small, can help unleash Nepal's entrepreneurial spirit, and enable productivity growth in other sectors. In the short run, it can increase exports of low- to mid-range business process outsourcing and data analytics. In the longer run, the IT services sector could develop niche expertise and raise the productivity of other sectors, such as tourism and agribusiness (through tailored software such as apps for mountain hiking), retail (e-commerce) and transport (logistical

software). This is explained with an example of tourism sector in Annex 2 and in the application of Porter's Competitive Strategies model below:
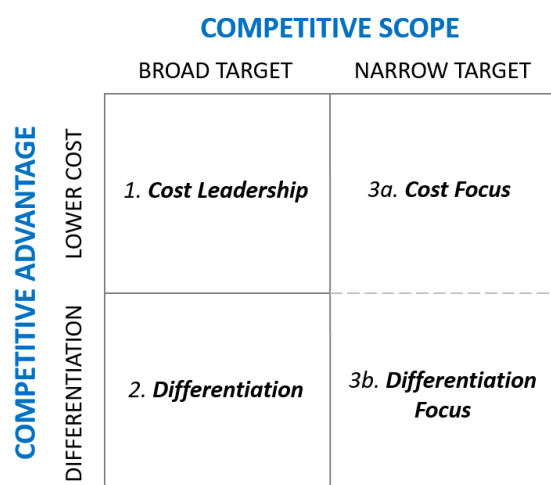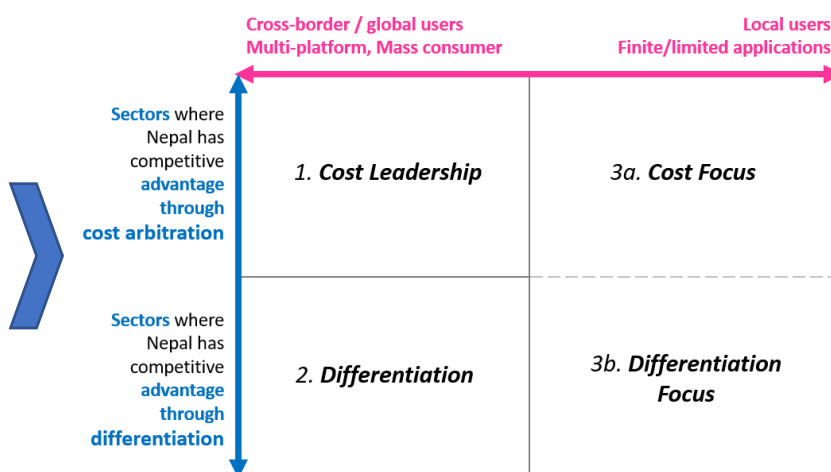
Figure 4 - Porter's Generic Competitive Strategies   *Figure 5 - Strategic options for Nepalese ICT firms targeting ICT-enabled sectors*

Source: Porter's Generic Competitive Strategies from Porter (1985).

Figure 4 features a representation of Porter's Generic Competitive Strategies (Porter, 1985) **adapted in Figure 5 to show implications on strategic options for select ICT firms in Nepal**. Porter (1985) purports that firms wishing to compete in a given strategic segment within a sector typically pursue one of three strategies.

- A **cost leadership strategy** (firms compete through low cost production);
- A **differentiation strategy** (firms position themselves to command a premium for products and services, for example through superior quality, branding strategies or innovative processes); and
- A **focus strategy** (firms target a segment within the sector that they are uniquely positioned to serve, either through low cost or differentiation strategies).

Many of Nepal's ICT firms are currently trying to participate in strategic segments across a range of sectors that demand cost leadership strategies, including health insurance data mining, events and conference applications and software, retail software, banking software, insurance software and security software. Some ICT firms may increase their competitiveness and survivability employing focused strategies (Figure 5, quadrants 3a and 3b). These might encompass:

a) Forward integration or "servicification" of value-chain activities in broader sectors that are not only tailored specifically to the Nepalese market but also require a high degree of local understanding and knowledge (language,[3] geography, culture, networks) to function well. For example, the provision of remote education services for remote areas in Nepal (as opposed to education software only) and productivity tools that reflect the transportation and services (as opposed to booking software only).

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[3] Language alone is not a sustainable barrier to entry. Machine translation services, such as Google Translate, are growing in sophistication and credible real-time translators are on the horizon. These services will greatly lower the effectiveness of 'language' as a barrier to entry.

b) ICT products and services that leverage vertical themes, particularly applicable to Nepal's own country context (although they might still target international clients). For example, clean energy applications and software, mountain hiking and tourism applications, geolocation and meteorology.

The case study presented in Annex 2 highlights the role of ICT in the tourism sector. Tourism was chosen as an example due to Nepal's irrefutable competitive advantages in this sector, particularly in mountaineering and hiking. The case study presents the potential that certain strategic segments within the sector could offer ICT firms if government and private sector stakeholders were to strategically devise policies and investments to drive growth within these segments.

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Annex 1: Analytical Approach:
Sector-Enablers and Global Value Chain Analysis

Strategic segmentation, a key aspect of global value chain analysis, uses Porterian concepts to identify strategic segments within a given sector.[4] Each strategic segment is defined not only by the product or service being offered but also by the intended market and final use of those products or services. Each strategic segment is also served by its own distinct value chain, comprising activities of varying value-addition for which firms, regions and countries strive to compete (Figure 6).

Figure 6 - Each strategic segment within a sector is served by its own distinct value chain
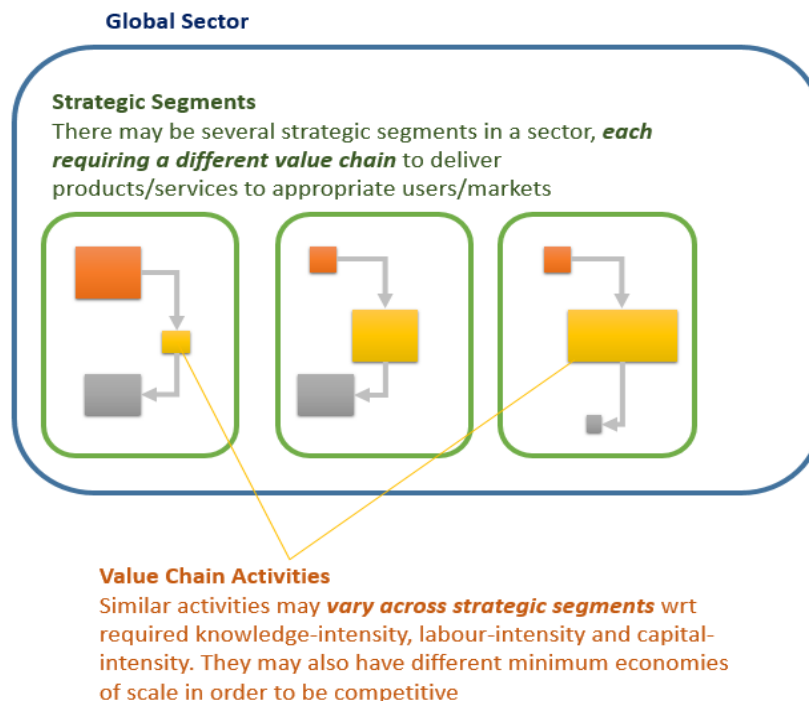
Source: (World Bank, 2018).

With rapid advancements in communications technology and the introduction of disruptive technologies such as 3-D printing, augmented reality, the Internet of Things, vehicle automation, distributed ledgers and artificial intelligence into previously siloed, traditional sectors, ICT has evolved into a sector "enabler", an intermediary, or an endemic feature of value-chain activities**.** For some sectors such as productivity solutions, the reliance on ICT-centric activities is clear; programming and software development dominate the value chain (although it should be well noted that marketing, branding and retail capture a progressively larger share of this value chain as programming activities become increasingly commoditized). For other sectors, the value contribution of ICT products and services may be less apparent; a widely shared 2017 infographic demonstrated that there were more lines of code in a modern high-end car (100 million) than in Facebook (61 million) (McCandless, 2017).

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[4] Developed by Professor Michael E. Porter, and implemented by the European Foundation for Cluster Excellence (in association with the European Commission and IESE Business School).

As such, business process outsourcing (BPO) activities, knowledge process outsourcing (KPO) activities, and 'ICT-enabled professional services' are no longer considered in isolation of their sectoral application. As an example, engineering and architectural services form part of the construction sector and certain (though not all) strategic segments within the construction sector will allow those services to be provided remotely. As another example, remote radiology services are growing in importance within the health and medical services sector, but building capacity in this activity requires an understanding of the medical services value chain(s) rather than the "ICT value chain".

Some economies and clusters still "specialize" in sector-agnostic ICT activities; India provides software development (and BPO) activities that serve a range of industries. In the same vein, Chinese firms manufacture a wide range of products from electronic components to furniture parts and holiday souvenirs. However, in both cases, firms chase a cost leadership strategy (Figure), as the value chains being served rely on large economies of scale (EOS). In the case of China's manufacturing capability, EOS typically relate to power generation, land, plant size and affordable raw materials and labor. In the case of India's ICT services, EOS typically relates to an almost commoditized availability of programming skills in Python, SQL, Java, JavaScript, C#, Ruby, PHP and other widely used programming languages. While the aggregate value of these activities is high, switching costs and barriers to entry are low, meaning that Indian ICT firms are not always able to retain a high proportion of the value in the strategic segments that they serve. Countries with comparable skills availability, scale and infrastructure sophistication and reliability may be able to compete with India in the strategic segments it dominates.

Annex 2: Case Study on Specialized ICT Services in the Tourism Sector

Case Study: ICT Services in Mountaineering and Hiking
Opportunity for specialist solutions but required investments imply higher risks

Nepal has a strong pedigree in the tourism sector and an inimitable competitive advantage in mountaineering and hiking. Nepal's ICT firms may be well positioned to leverage tacit knowledge of this niche industry to better devise tailored and targeted solutions. Nepal's ICT firms may target the Nepalese market (taking advantage of their cultural and geographical proximity to the B2B and B2C users), or draw on their particular understanding of the sector to target international clients.

Niche industries' growth of this kind is inherently riskier than mass market products and solutions requiring upfront product development and capital expenditure. In addition, as the rate of job creation may be slower than BPO-led growth, policymakers must be incentivized to implement long-term growth policies. In so doing, Nepal's ICT firms could be empowered to move beyond lower value-added outsourced activities and increase the sophistication of the activities performed in the global value chain.

Tourism and Mountaineering in Nepal

The World Travel and Tourism Council (WTTC) has calculated that the total contribution of travel and tourism to Nepal's GDP was US$1.6 billion (7.5 percent) in 2016. The WTTC has also forecast that this figure will be 6.2 percent higher for 2017, and that the industry's contribution to GDP will rise by 4.3 percent a year to US$2.7billion (8.3 percent of GDP) by 2027. Nepal's thriving tourism sector presents rich opportunities for Nepal's ICT firms to devise tailored tourism-tech solutions. These could include real-time booking platforms, property management services, smartphone services for flight bookings, accommodation, excursions and entertainment services, and data analytics that can improve and streamline customer experience. However, many of these services are mass-user, multi-platform services that would require Nepalese firms to compete directly with global firms providing similar services. In contrast, Nepal's ICT firms could leverage tacit knowledge of niche markets within the tourism industry, particularly mountaineering and hiking, to better address the needs of the subsector. Nepal's ICT firms may target the Nepalese market (taking advantage of their cultural and geographical proximity to the B2B and B2C users), or draw on their particular understanding of the sector to target international clients.

Where is the potential for Nepal in the mountaineering and hiking strategic segment?

Figure 7 shows a preliminary representation of the value chain (based on secondary research only) in the mountaineering and trekking strategic segment. For the purposes of this report and its emphasis on ICT activity, the representation of the value chain places deliberate emphasis on ICT-related products and services. (Some value-chain activities, for example textiles and clothing, and air/land connections and transportation, have been simplified for ease of representation.) Hampered by weak communications infrastructure, stakeholders in Nepal's **mountaineering and trekking strategic segment** severely underutilize ICT solutions, products and services. A very small number of private firms have associated apps but these are largely cosmetic rather than true B2C or B2B solutions. ICT solutions in the public domain are equally scarce. Even in the area of visitor management, where visitors to the mountainous regions are still recorded via paper permits. This underutilization presents an opportunity for Nepal's ICT

products and service providers to provide targeted solutions, taking advantage of proximity, language and cultural understanding to provide offerings that best fit the Nepalese context.
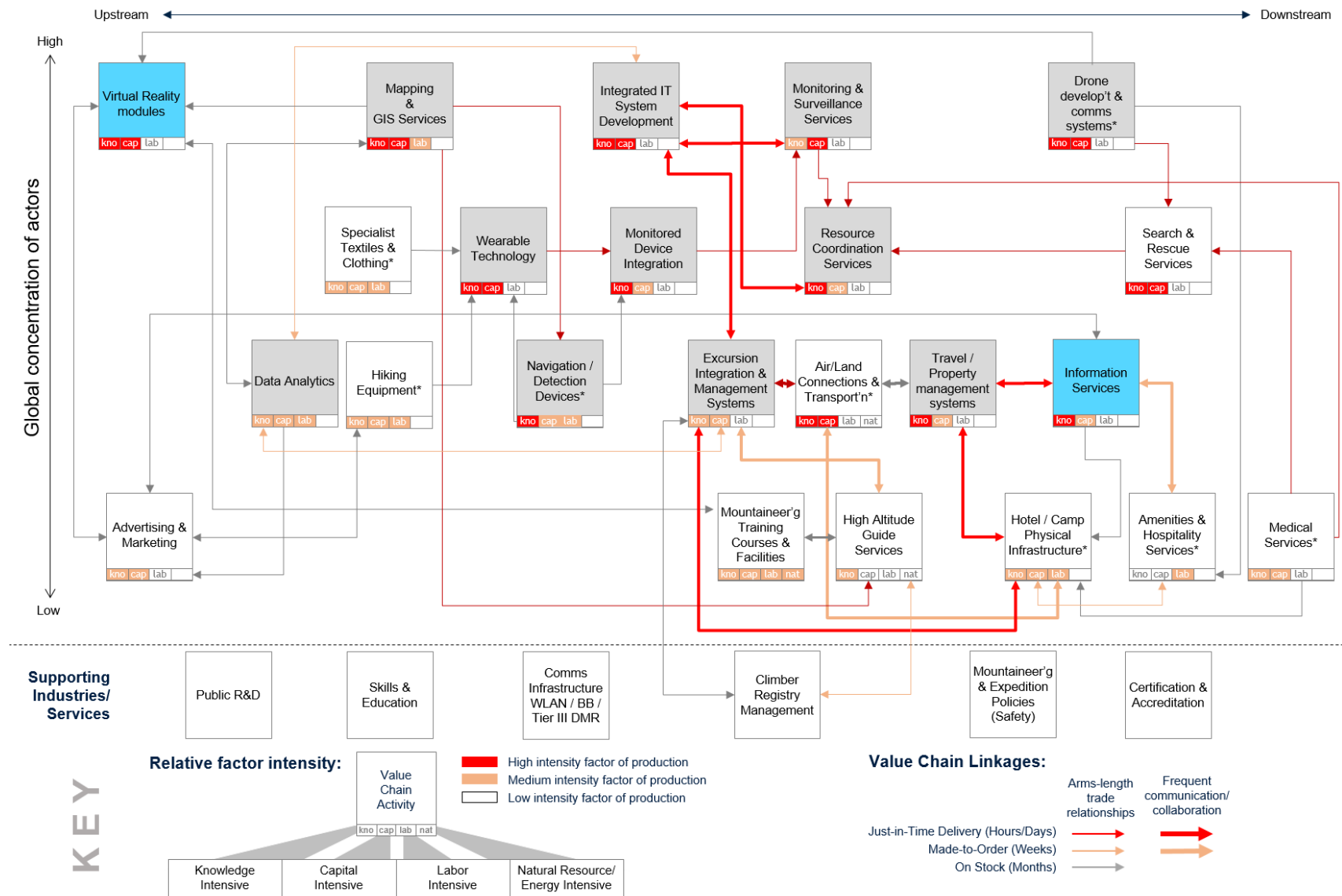
Geolocation and wearable technology have strong applications in the mountaineering and trekking strategic segment. Wrist bands, watches and devices that allow navigation and tracking not only support mountaineers and hikers in their endeavors directly, but also support related industries, particularly monitoring and surveillance, and search and rescue services (S&R). Since 1953, 4,833 climbers have reached the summit of Everest, with about 800 attempts a year (Himalayan Database, 2017). Of these, 288 people have died leading to an amendment to the Mountaineering Expedition Regulation in 2017 banning solo climbs. However, these numbers do not account for 40,000 people each year who trek from Lukla airport to Everest Base camp. Although there are no official statistics for deaths that occur on the Base Camp Trek (or related routes), estimates range from 3 to 15 deaths each year (Everest Base Camp Trek Guide, 2017). The Base Camp Trek is also susceptible to avalanches (an avalanche in 2015 at Everest Base Camp cost the lives of 19 climbers). Geolocation and wearable technology that are appropriate for use at high altitude and in extreme weather conditions could have a natural market in Nepal's mountaineering and trekking community. GPS application services providing users with trail information and routes, local folklore and warning information are already being developed by Nepalese firms. However, there is also an opportunity to develop monitoring and surveillance services. This is a highly complex networked service requiring reliable and consistent WLAN, and dedicated mission control services supported by guide services and S&R that can respond as needed.

As drone technology and virtual reality become more accessible and affordable, Nepal could also play a role in offering related ICT products and services. Drone technology not only has applications in surveillance and S&R (see above) but it is also being used for mapping and GIS services, as well as leisure applications (e.g., aerial video production). Nepal's ICT firms could have a role to play in developing related ICT products and services (e.g., live feeds and channels for trekking enthusiasts, delivery and cargo services, science and research), as well as developing dedicated on-board UAV systems with particular application to the Himalayan context. Similarly, as mobile and tethered virtual reality headsets and glasses become more accessible and affordable, there will be opportunities for applications in experiential marketing and training courses. Nepal's ICT firms are well-positioned to work closely with Nepal's Sherpa community and climbing guides to claim a large share of this billion-dollar industry.

What are the challenges to strategic expansion in Nepalese ICT solutions for mountaineering and hiking?

Well-understood ICT solutions designed for established markets (e.g., banking, retail, insurance, office tools) carry less risk than niche products and services. As such, financing might be easier to obtain, and clients and customers may even share development costs through advance payment models. A strategic expansion of Nepalese ICT solution for mountaineering and hiking would require access to risk capital (traditionally through business angels, incubators and venture capital investors). This type of capital is severely lacking in Nepal and foreign investment, since these types of new ventures are all but prohibited. Policymakers could bridge the funding gap through matching grants and funding support programs. However, it must be recognized that organic, "bottom-up" start-ups require long-term growth strategies. Policymakers who are incentivized to deliver short-term results—especially in the area of job creation— may be drawn toward policies that favor BPO development models.

Figure 7 Mountaineering and trekking strategic segment

Upstream ⟷ Downstream

High ↑ Global concentration of actors ↓ Low

Virtual Reality modules — kno | cap | lab

Mapping & GIS Services — kno | cap | lab

Integrated IT System Development — kno | cap | lab

Monitoring & Surveillance Services — kno | cap | lab

Drone develop't & comms systems* — kno | cap | lab

Specialist Textiles & Clothing* — kno | cap | lab

Wearable Technology — kno | cap | lab

Monitored Device Integration — kno | cap | lab

Resource Coordination Services — kno | cap | lab

Search & Rescue Services — kno | cap | lab

Data Analytics — kno | cap | lab

Hiking Equipment* — kno | cap | lab

Navigation / Detection Devices* — kno | cap | lab

Excursion Integration & Management Systems — kno | cap | lab

Air/Land Connections & Transport'n* — kno | cap | lab | nat

Travel / Property management systems — kno | cap | lab

Information Services — kno | cap | lab

Advertising & Marketing — kno | cap | lab

Mountaineer'g Training Courses & Facilities — kno | cap | lab | nat

High Altitude Guide Services — kno | cap | lab | nat

Hotel / Camp Physical Infrastructure* — kno | cap | lab

Amenities & Hospitality Services* — kno | cap | lab

Medical Services* — kno | cap | lab

Supporting Industries/ Services

Public R&D

Skills & Education

Comms Infrastructure WLAN / BB / Tier III DMR

Climber Registry Management

Mountaineer'g & Expedition Policies (Safety)

Certification & Accreditation

KEY

Relative factor intensity:

Value Chain Activity — kno | cap | lab | nat

Knowledge Intensive | Capital Intensive | Labor Intensive | Natural Resource/ Energy Intensive

- High intensity factor of production
- Medium intensity factor of production
- Low intensity factor of production

Value Chain Linkages:

Arms-length trade relationships | Frequent communication/ collaboration

Just-in-Time Delivery (Hours/Days)
Made-to-Order (Weeks)
On Stock (Months)

*Source: World Bank staff's own elaboration. Based on secondary research. / *Simplified for the purposes of this report.*

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