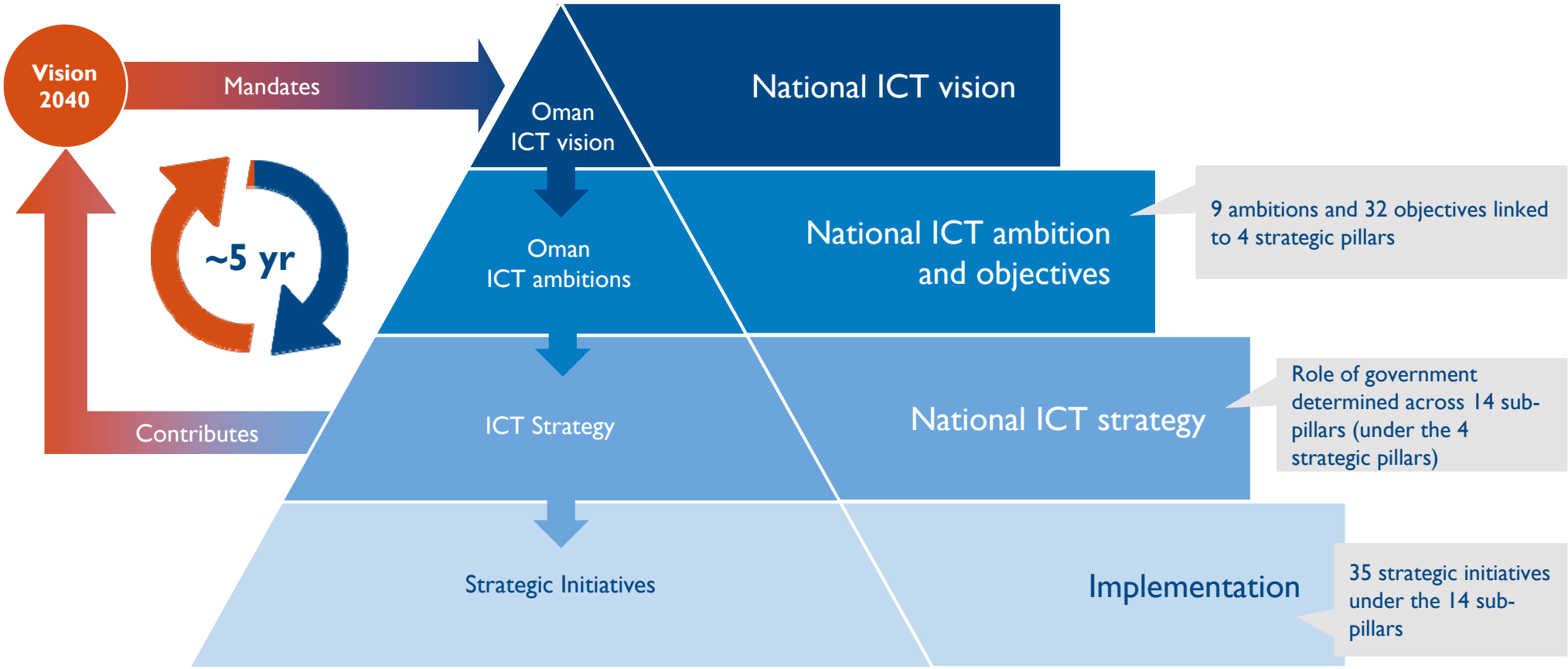
Oman National Strategy Framework for ICT Sector

Full Strategy Report

07 July 2019

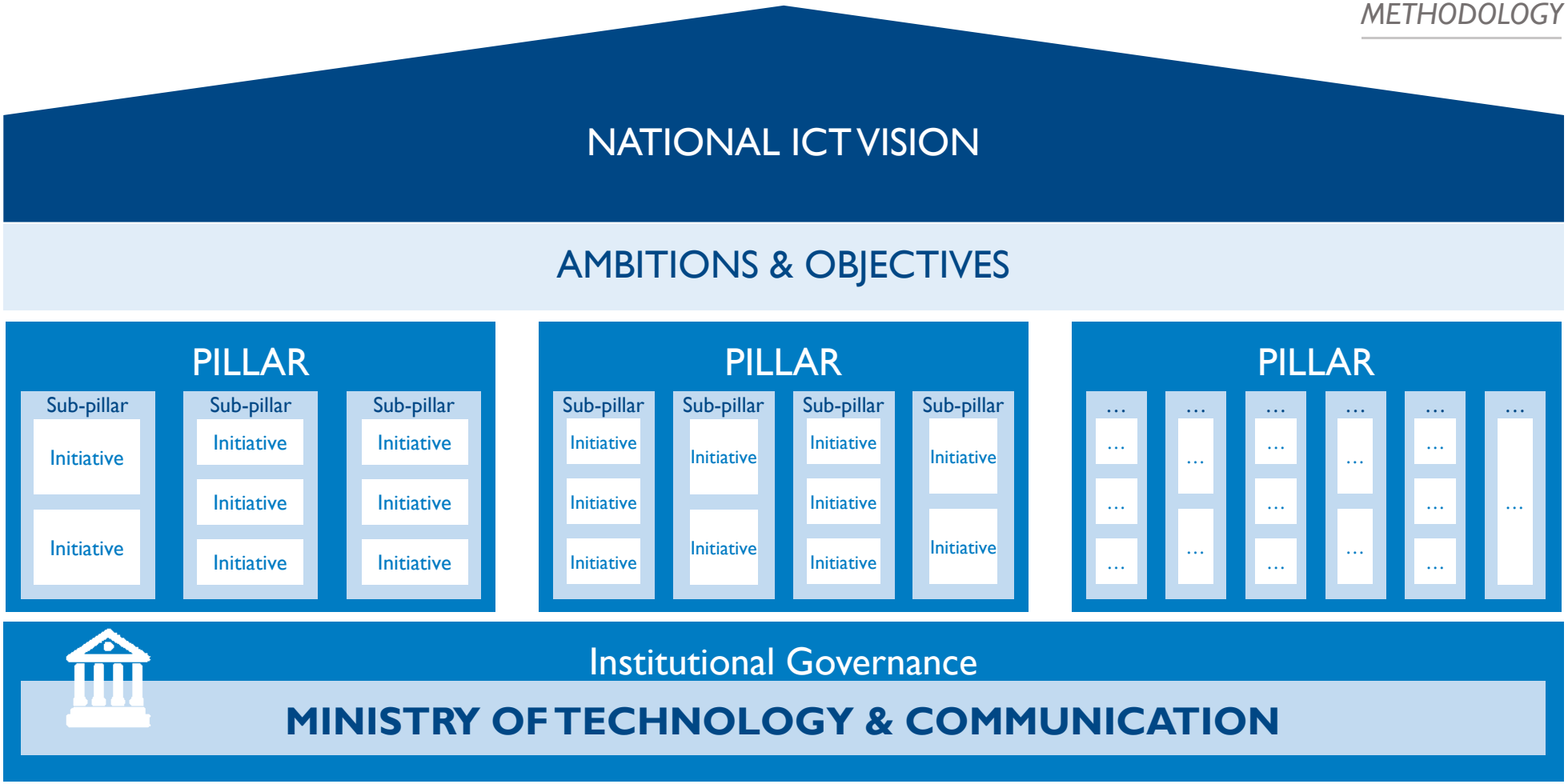
Oman's national ICT vision will drive the ambition, objectives, strategy and ministerial implications and implementation

National ICT strategy – Approach



The strategy developed follows a step by step approach from the vision to initiatives

METHODOLOGY

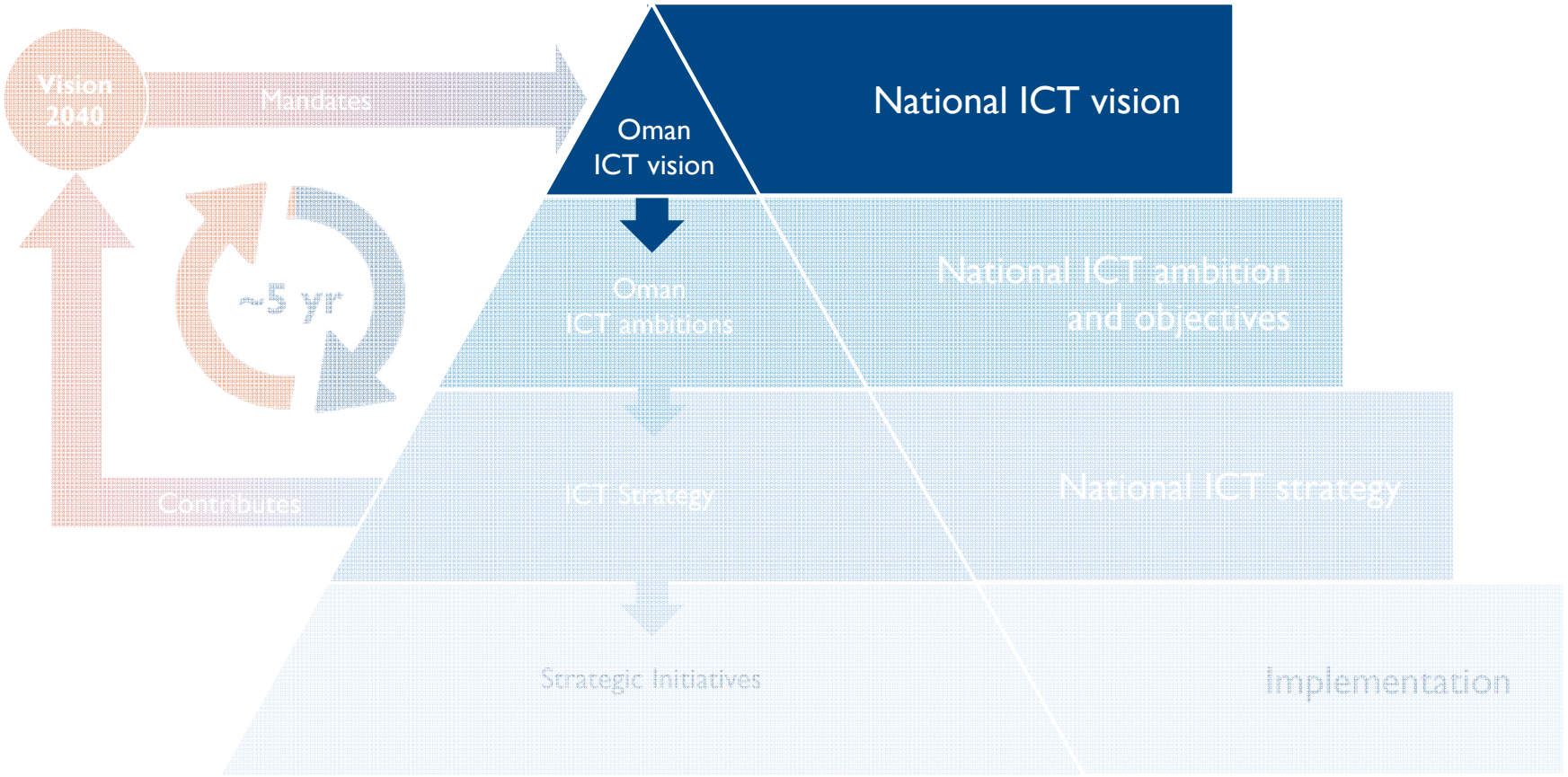


Source: Arthur D. Little

Pillars | Sub pillars | Initiatives

Agenda

National ICT strategy – Approach



The ICT vision of Oman should be holistic to address the needs of the nation, ICT sector and overall society

Relevant topics for ICT sector vision

What do we want to stand for?
What is our long-term goal?

A Economic contribution

What is the contribution of ICT sector target status in Oman?

Shift from **"consuming" to "producing"** ICT services & goods

B Societal empowerment

What is the role and contribution of ICT for Oman's residents?

ICT as a means to **improve quality of life** of Oman's residents

C Sectoral enablement

What is the role and contribution of ICT for other economic sectors?

ICT as a **pre-requisite for innovation & competitiveness** in key economic sectors

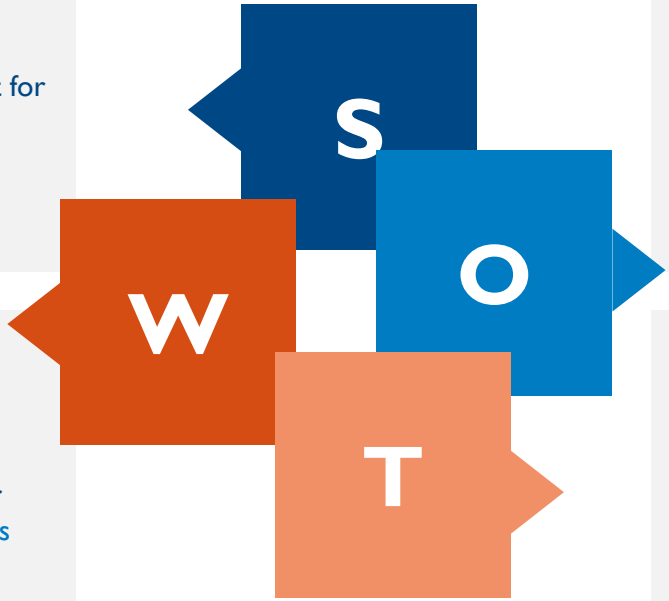
Oman ICT sector's has many strengths, but also weaknesses on its path to growing the ICT sector

Strengths

- Political stability compared to neighbors
- Government commitment to diversify from oil revenues
- Extensive submarine cable connectivity and geographical advantage
- Mobile connectivity in most parts of Oman
- Global positioning and institutional commitment for Cybersecurity
- Large number of ICT-educated graduates

Opportunities

- Growing demand for ICT services globally and regionally + untapped demand locally
- Access to large markets such as Africa and Middle East
- Growing interest of foreign investors in regional ICT sector
- New technologies (considered to be part of 4th IR) in which Oman could become a leader



Weaknesses

- Small size of local market
- Limited execution of strategy
- Lack of coherent sector governance
- Lack of national focus and funding for ICT sector
- Restrictive licensing requirements and regulations
- Complexities in operationalizing businesses
- Low fiber penetration
- Open data & e-government not world-class
- Low maturity of ICT market as a whole
- Low skill levels despite high number of ICT graduates
- Funding, regulatory & R&D concerns in innovation ecosystem

Threats

- Race towards new technologies among countries – Oman could be left behind
- Misalignment across various stakeholders required to grow the sector

Updated parameters for the ICT sector which were identified and calculated in the inception report

2.1% GDP contribution in 2016	**17%** IT as percentage of ICT spending	**2** Government entities	**5** ICT-related strategies	**355** Open data sets	**782** E-government services (more e-services available over 2018)
8k+ ICT companies (of which 5.5k are 1st class & above)	**13k** employees in ICT	**14/7** Int. submarine cables & landing stations	**3** Tier 3 private data centers	**60/8%** Fixed internet & fiber penetration	**23%** Of population not engaged digitally
12% ICT graduates to overall graduates	**5-10** Compulsory coding courses in schools from Grade 5+	**59%** Universities offering IT-related courses	**19/1** % of job seekers in ICT sector to % of jobs in ICT ratio	**93.86%** Mobile internet penetration	**1-2 x** Pricing comparable to region, but 2x OECD prices

Source: Fact-finding report --- **18 November 2019**

A number of key parameters for the ICT sector were identified and calculated in the inception report

3.0% GDP contribution in 2023	**17%** IT as percentage of ICT spending	**2** Government Entity	**1** ICT strategy	**Top 40** Open data Indicies	**≥80%** **of all services request fulfilled online**
10 listed Omani IT firms	**≥70%** Omani nationals employees in private IT companies	**1** data center hub of the region	**≥60%** SME use cloud solutions	**85%** FTTH access of households with speed 100+ Mbps	**≥95%** population participating digitally
12% ICT graduates to overall graduates	**2 Hr/Week** IT for (grade 1-4), compulsory coding (grade5-10) &elective(grade11-12)	**1** university in the Top 250 global QS university ranking	**<10%** of job seekers in ICT sector to % of jobs in ICT ratio	**100%** wireless access for households and businesses at speed of 10+ Mbps	**1-2 x** Pricing comparable to region, but 2x OECD prices

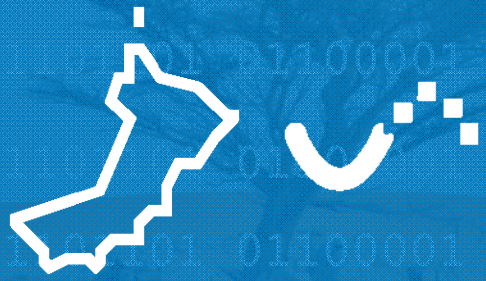
ICT **Vision**

Towards a leading **DIGITAL NATION** & a globally **COMPETITIVE ICT SECTOR**

Source: Arthur D. Little

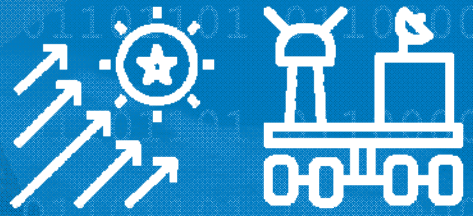
Vision Glossary

DIGITAL NATION



Tech-savvy population, businesses and institutions capable of applying information and communication technology as a natural part of their everyday life through and affordable and performant infrastructure including products, services and solutions

COMPETITIVE ICT SECTOR



Information and communication technology related products, services and solutions that have similar or better attributes with respect to functionality, performance and quality compared to others of a similar nature on a global scale

Source: Arthur D. Little

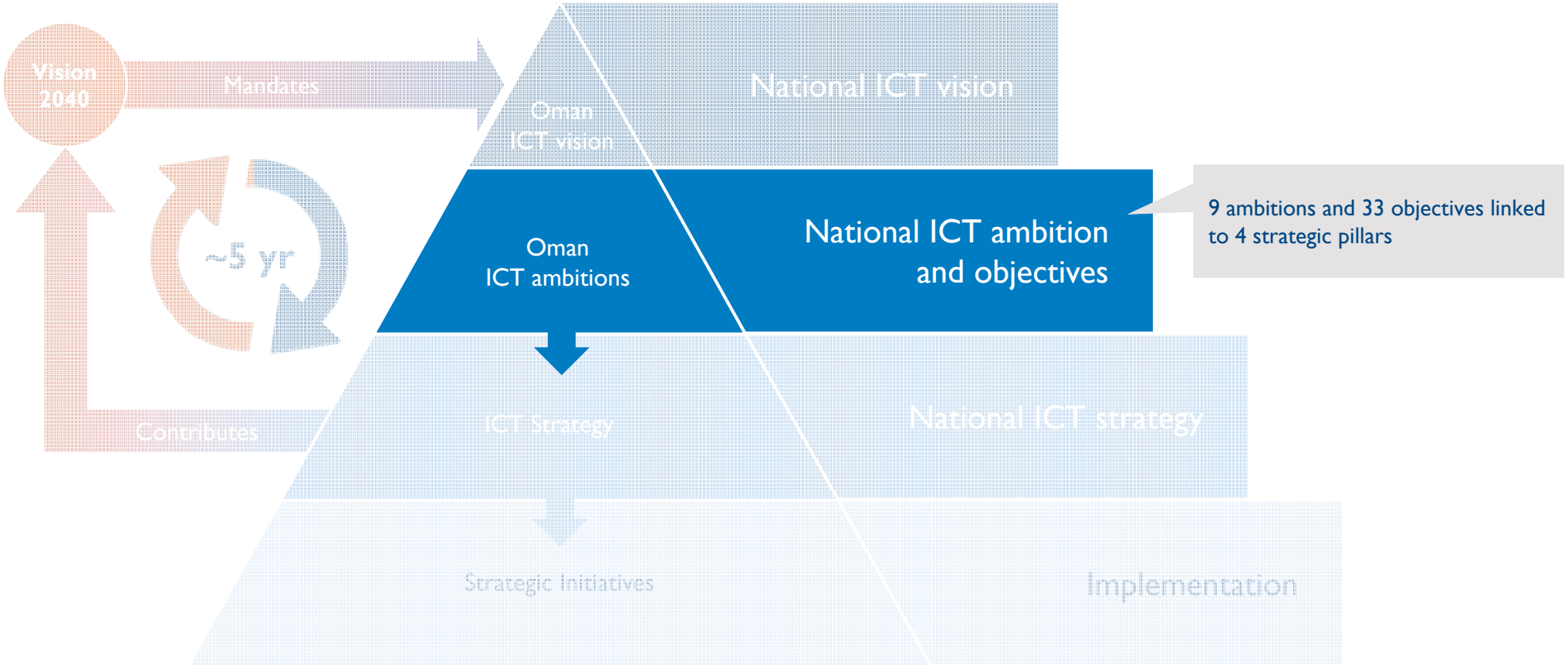
Our strategy and its underlying objectives and initiatives are in line with the 'Vision 2040' draft

Oman: Joining the World's Developed Countries		Towards a leading digital nation & a globally competitive ICT sector
(…) striving to become a developed country	🔗	*An ICT-related indicator for a 'developed country' is the GDP ratio of IT-to-telecom, i.e. the more developed, the higher the share of IT*
(…) driven by the private sector towards synergy with the global economy and active contribution to global trade	🔗	*Objectives and initiatives in the ICT sector strategy aim at improving private sector contribution in the economy*
(…) coherent institutional framework of economic policies and legislations (…) and diversification of public revenues	🔗	*The strategy recommends to review and align the institutional governance in the ICT sector and have a performant legislation*
(…) attractive environment for competencies in the labor market (…) in a competitive business climate	🔗	*Digital capabilities aims at improving the competencies of Omanis in the local labor market*
(…) build smart and sustainable cities with advanced technological infrastructure (…) and social justice	🔗	*Emerging infrastructure objectives and initiatives contribute to this statement; Social justice through digital inclusion*
(…) knowledge-based society [cultivating] the skills of the future, [contributing] to reinforcing scientific research (…)	🔗	*'Skills of the future' are mostly related to technology; Scientific research related to ICT is covered in 'technology innovation'*

Source: Preliminary Vision 2040 Document (February 19, 2019), Arthur D. Little

Agenda

National ICT strategy – Approach



Four pillars will help Oman achieve its ICT Vision

Towards a leading **DIGITAL NATION** &
a globally **COMPETITIVE ICT SECTOR**

DIGITAL INFRASTRUCTURE

DIGITAL ECOSYSTEM

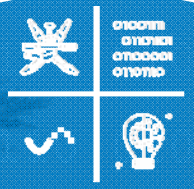
DIGITAL CAPABILITIES

INSTITUTIONAL GOVERNANCE

MINISTRY OF TECHNOLOGY & COMMUNICATION

Source: Arthur D. Little

For each of the four pillars, we have developed ambitions to be achieved



Towards a leading **DIGITAL NATION** & a globally **COMPETITIVE ICT SECTOR**

DIGITAL INFRASTRUCTURE

- To establish a high-performing, future-ready and affordable ICT infrastructure providing access to all residents and businesses in Oman
- To establish a liberalized and agile regulatory and legislation framework in line with global best practices

DIGITAL ECOSYSTEM

- To increase the contribution of IT to the Omani economy
- To nurture a thriving IT industry with private Omani companies and locally operating MNCs
- To provide holistic digital government services including open data

DIGITAL CAPABILITIES

- To ensure digital participation of everyone (residents + businesses) in a safe and secure online environment
- To support the enhancement of the education system in order to foster suitable ICT talent
- To improve ICT skills of local workforce in line with market requirements

INSTITUTIONAL GOVERNANCE

MINISTRY OF TECHNOLOGY & COMMUNICATION

Source: Arthur D. Little

We have developed the ICT vision for Oman covering the long-term goals for the sector

Oman's ICT vision components

Oman will…

…establish a globally competitive ICT sector

…empower its society digitally through the effective use of ICT

…nurture innovation and competitiveness through ICT in key economic sectors

The ambitions relate back to what Oman wants to stand for and its long-term goals

	ICT industry	*Society*	*Other sectors*
DIGITAL INFRA-STRUCTURE	High-performing, future-ready and affordable ICT infrastructure providing access to all people and businesses in Oman		
	Liberalized and agile regulatory and legislation framework in line with global best practices		
DIGITAL ECOSYSTEM	Locally operating MNCs		
	Innovative Omani companies able to compete on a global scale		
	Holistic digital government services		
DIGITAL CAPABILITIES	Digital participation of everyone (people + businesses) in a safe and secure online environment		
	Enhancement of the education system in order to foster suitable ICT talent		
	ICT skills of local workforce in line with market requirements		
INSTITUTIONAL GOVERNANCE	Streamlined governance		
	Clear end-to-end responsibilities		

Ambitions have been translated into quantifiable/actionable objectives – Infrastructure pillar

INFRASTRUCTURE

Ambition	Objective
Establish high-performing, future-ready and affordable ICT infrastructure providing access to all people and businesses in Oman	1. Achieve access of at least 85% of all households with an effective speed of at least 100+ Mbps using latest technologies available in the market 2. Achieve access for all large enterprises and public institutions, incl. schools and hospitals, in urban areas with at least 1 Gbps using latest technologies available in the market 3. Achieve 100% wireless access for remaining households and businesses at an effective speed of 10+ Mbps 4. Target the commercial launch of 5G in one city within 5 years from project initiation with ut up to 10 Gbps 5. One Omani city to figure in top 50 smart cities, two Omani cities to figure in top 100* 6. Become the data center hub of the region, offering hosting and cloud services to companies across the Middle East
Establish a liberalized and agile regulatory and legislation framework in line with global best practices	7. Market concentration for fixed broadband services should be improved and more competition need to bero bught in. should achieve an HHI score ≤4000 for fixed broadband 8. Ensure investor-friendly regulatory regime for emerging technologies 9. Guarantee a level playing field for existing players and new entrants

Source: Arthur D. Little Note: Unless stated, the objectives are to be achieved in 5 years

*) As per the EasyPark 2018 Smart City Index

Ambitions have been translated into quantifiable/actionable objectives – Digital Ecosystem pillar

DIGITAL ECOSYSTEM

Ambition	Objective
To nurture a thriving IT sector with local private IT companies in symbiotic relationship with MNCs	10. Increase the ICT contribution to the GDP over the implementation period (five years from the adoption of the strategy) and beyond to 3.2% 11. At least 5 listed Omani IT firms by 2025 12. Oman to have at least one IT startup valued at OMR 40 M 13. Have at least 100 high growth ICT companies with a historical revenue CAGR of ~10% 14. Attract at least 1 of FANGA, i.e. Facebook, Amazon, Netflix, Google, Apple, or Tier I /Tier II , IT corporations to setup local and regional value-added operations in Oman 15. Improve SME involvement in tenders (20% of government tenders) 16. 2 test centres for Emerging Technologies should be established and each test centre should produce at least 5 projects each
To provide holistic digital government services including open data	17. Rank top 40 on both Open Data indices by covering all 15 dataset clusters 18. Every first-point of contact with the government should be through an online channel 19. ≥80% of all services request offered by the government and government-related entities should be fulfilled online

Source: Arthur D. Little

Note: Unless stated, the objectives are to be achieved in 5 years

Ambitions have been translated into quantifiable objectives – Digital Capabilities pillar

DIGITAL CAPABILITIES

Ambition	Objective
To ensure digital participation of everyone (people + businesses) in a safe and secure online environment	20. Oman to have ≥95% of internet penetration to ensure that opportunity for digital participation is there for majority of population 21. ≥60% of SME use LOCAL cloud solutions 22. ≥ 80% of small[2] companies have a website 23. ≥ 90% of micro businesses are on online business listing(, e.g. Google Maps, Bing, etc.
To support the enhancement of the education system in order to foster suitable ICT talent	24. Oman to-rank on top 5 on ITU's cybersecurity index 25. Primary school (grade 1-4) to have at least 2 hours per week for IT courses 26. Secondary school (grade 5-10) to have compulsory coding courses, and as elective for higher secondary (grade 11-12) 27. One university in the Top 250 for post-graduate computer science in the global QS university ranking 28. Oman to issue 100+ scientific publications on computer science as well as at least 5 ICT or ICT enabled patents annually per million inhabitants
To improve ICT skills of local workforce in line with market requirements	29. Offer financial support to at least 100 students in advanced technology topics (e.g. AI, blockchain, etc.) defined by ministry in line with industry input 30. Unemployment rates for the technology skilled Omani national to be less than 10%

Source: Arthur D. Little

Note: Unless stated, the objectives are to be achieved in 5 years

Ambitions have been translated into quantifiable objectives – Institutional Governance pillar

Ambition	Objective
To streamline the sector governance with clear end-to-end roles and responsibilities for all governmental institutions	31- Establish a institutional framework for cross-sector initiatives

INSTITUTIONAL GOVERNANCE

Source: Arthur D. Little

Note: Unless stated, the objectives are to be achieved in 5 years

Ambitions have been translated into quantifiable objectives. Objectives will allow establishing future-ready infrastructure & access

	Ambition	Objective	Rationale
INFRASTRUCTURE	**Establish high-performing, future-ready and affordable ICT infrastructure providing access to all people and businesses in Oman**	1. Achieve FTTH access of at least 85% of all households with an effective speed of at least 100+ Mbps	1. NBS targets 100% *population* coverage in Muscat & 33% outside Muscat up to 100 Mbps by 2018; 80% residents live in urban areas Other countries FTTH penetration (Q3 2017): *UAE: 94%, Korea: 90%, Singapore: 90%, China: 62% (2017). Oman has 36-72% HH passed (depending on level of Omantel-OBC overlap), and 8.5% HH penetration in Q2 2018*
		2. Achieve 100% FTTB access for all large enterprises and public institutions, incl. schools and hospitals, in urban areas with at least 1 Gbps	2. Defined as per NBS for improving corporate networking to lead to productivity gains
		3. Achieve 100% wireless access for remaining households and businesses at an effective speed of 10+ Mbps	3. NBS targets a speed of 10 Mbps; USO with minimum 10 Mbps connection adopted in UK and Ireland; broadband for all businesses set as target in NBS
		4. Finalize 5G test networks and field trials by end of 2019 and target the commercial launch in one city by end of 2020 with up to 10 Gbps	4. Ooredoo Qatar launched first commercially available network in 05/18; Korea launched 5G test network at 2018, commercial launch in 2020; EU targets commercial 5G in at least 1 city in each member state by 2020
		5. One Omani city to figure in top 50 smart cities, two Omani cities to figure in top 100*	5. Other GCC countries figure in the list[1]: UAE (Dubai: 37 and Abu Dhabi: 54), Bahrain (Doha: 44), KSA (Riyadh: 99)

Source: Arthur D. Little Note: Unless stated, the objectives are to be achieved in 5 years

1) As per the EasyPark 2018 Smart City Index

Improvement of the infrastructure, services and investments will be enabled by a liberalized and agile regulatory framework

INFRASTRUCTURE

Ambition	Objective	Rationale
Establish high-performing, future-ready and affordable ICT infrastructure providing access to all people and businesses in Oman	6. Become the data center hub of the region, offering hosting and cloud services to companies across the Middle East	6. Relevant to leverage its geographical advantage, political stability and submarine connectivity (similar to Ireland and Singapore)
Establish a liberalized and agile regulatory and legislation framework in line with global best practices	7. Achieve an HHI score ≤4000 for fixed broadband	7. HHI Index in competitive markets, like Germany, Australia, and the UK, are below 3600 while concentrated countries, like China, have a high HHI (about 5000) Oman currently scores 5000+ on HHI
	8. Ensure investor-friendly regulatory regime for emerging technologies	8. Existing regulatory processes are complex requiring Ministry level approval and specific licenses are issued by a royal decree
	9. Guarantee a level playing field for existing players and new entrants	9. Outdated telecom law/regulations and/or not implemented regulations in Oman

Source: Arthur D. Little Note: Unless stated, the objectives are to be achieved in 5 years
[1]Lower HHI scores indicate a healthier competitive environment

Oman should enhance its digital ecosystem through MNCs and startups

DIGITAL ECOSYSTEM

Ambition	Objective	Rationale
To nurture a thriving IT sector with local private IT companies in symbiotic relationship with MNCs	10. Increase the ICT contribution to the GDP over the implementation period (five years from the adoption of the strategy) and beyond to 3.2%	10. Oman: ICT sector contributes~2% to GDP with IT's forming 17% of ICT OECD: Avg. 5.4% contribution to GDP, with IT share close to 80% of ICT in some economies
	11. At least 10 listed Omani IT firms by 2025	11. KSA aims to list 10 IT firms by 2020; US, Singapore, India exchanges have many IT cos.
	12. Oman to have at least one IT startup valued at OMR 40 M and total of 5+ startups to be listed on any stock exchange	12. GCC has 7 startups that surpassed OMR 38 M (i.e. USD 100 M) valuation Souq.com: OMR 385M in 11 years Maktoob: OMR 38M in 9 years Talabat.com: OMR 38M in 11 years Fawry: OMR 38M in 8 years (+12 other companies)
	13. Have at least 100 high growth ICT companies with a historical revenue CAGR of ~10%	13. 44,000 job seekers in Oman 23% of which are in the ICT sector HGCs have on average 90-100 employees Oman's economy is recovering and growing again (allowing sizeable CAGR)
	14. Attract at least 1 of FANGA, i.e. Facebook, Amazon, Netflix, Google, Apple, and 3-5 international IT corporations to setup local and regional value-added operations in Oman	14. FANGA may serve as anchor around which an ecosystem may develop Bahrain attracted Amazon to set up shop UAE hosts Facebook and Google

Source: Arthur D. Little

Note: Unless stated, the objectives are to be achieved in 5 years

Gov. services should become fully digitized, and provide access to a wide array of data sets, thus positioning Oman as a top e-Gov performer (1/2)

DIGITAL ECOSYSTEM

Ambition	Objective	Rationale
To nurture a thriving IT sector with local private IT companies in symbiotic relationship with MNCs	15. Improve SME involvement in tenders (20% of government tenders)	15. Oman goal: 10%; UAE goal: 10% of gov't tenders to SMEs UK goal: 25% Singapore goal: 55%
	16. Become preferred testing ground for emerging two technologies in the region	16. Singapore / UAE are providing infrastructure and facilities for companies to test new technologies such as AI and Blockchain
To provide holistic digital government services including open data	17. Rank top 40 on both Open Data indices by covering all 15 dataset clusters	17. Oman currently ranks 81 in Open data index and should aim to improve its standing and move up the list **Oman** currently has 56 open data sets across 3 out of 15 clusters defined in the open data index[1], while **USA** has 302K data sets, **Canada** 81k, **UK** 46k, and **UAE** 776 data sets
	18. Every first-point of contact with the government should be through an online channel	18. In **Denmark** and **Estonia**, communication with public sector can mainly be initiated through digital solutions (online portal) In **Singapore** (world leader in e-Gov), gov acts as a service provider and aims to be a sufficient online source of information for citizens' inquiries **Oman** still utilizes government hotlines only

Source: Arthur D. Little Note: Unless stated, the objectives are to be achieved in 5 years
1Government budget, national stats, procurement, laws, environment, etc.

Gov. services should become fully digitized, and provide access to a wide array of data sets, thus positioning Oman as a top e-Gov performer (2/2)

DIGITAL ECOSYSTEM

Ambition	Objective	Rationale
To provide holistic digital government services including open data	19. ≥80% of all services request offered by the government and government-related entities should be fulfilled online	19. In **Denmark**, the self-service initiative obliges citizens to access and fully perform 91 e-Gov services online In **Estonia**, 99% of gov services are performed online except for marriages, divorces, and real-estate transactions *(offline duplication only in exceptional cases)* **Singapore** aims by 2023 for 95% of all services to be completed digitally

Source: Arthur D. Little

Note: Unless stated, the objectives are to be achieved in 5 years

Oman should nurture digital capabilities to ensure participation of people and businesses in a safe and secure environment

DIGITAL CAPABILITIES

Ambition	Objective	Rationale
To ensure digital participation of everyone (people + businesses) in a safe and secure online environment	20. Oman to have ≥95% of population participating digitally	20. More than 95% internet penetration in other GCC countries as per ITU
	21. ≥60% of SME use cloud solutions	21. 57% enterprises on public cloud in Europe and US in 2017
	22. ≥80% of small[2] companies have a website	22. 65-95% of small companies had a website in advanced countries (Finland 95%, Denmark 93%, UK 83%, Estonia 78%, USA 72%)
	23. ≥90% of micro businesses are on online business listing(, e.g. Google Maps, Bing, etc.	23. Online business listings are a easy-to-use customer acquisition channel at almost zero cost
	24. Oman to rank #1 on ITU's cybersecurity index	24. Oman is currently ranked 4th and should aim to improve its efforts and maintain a ranking in the top 3

Source: Arthur D. Little

Note: Unless stated, the objectives are to be achieved in 5 years

[1]50+ employees [2]10+ employees

The ICT awareness and education should start from an early age and continue through the formal systems

DIGITAL CAPABILITIES

Ambition	Objective	Rationale
To support the enhancement of the education system in order to foster suitable ICT talent	25. Primary school (grade 1-4) to have at least 2 hours per week for IT courses	25. India, Australia, and UK introduced mandatory IT courses in primary school
	26. Secondary school (grade 5-10) to have compulsory coding courses, and as elective for higher secondary (grade 11-12)	26. Schools across 15 EU countries (Estonia, Denmark, Ireland, UK, France, Spain, etc.) already include compulsory coding in their secondary courses
	27. At least one university in the Top 250 for post-graduate computer science in the global QS university ranking	27. In 2018, no Omani university/college is among the Top 500
	28. Oman to issue 100+ scientific publications on computer science…	28. Oman publishes 43 papers/mn pop in computer science, ranks 66/178, and should aim to move into top 50 with suitable support. (UAE: 45, KSA: 50, Lebanon: 51, Jordan: 52)
	…as well as at least 5 ICT patents annually per million inhabitants	Oman made great efforts in the past for ICT patents, growing at 29% CAGR '12-'16. It needs to further accelerate to match peers. 5 ICT patents/per mn pop would be 2x UAE and 3x KSA in 2016
	29. Offer financial support to at least 100 students in advanced technology topics defined by ministry in line with industry input	29. Other countries offer full scholarships for studies abroad (KSA: MoE's Safir al Taqdim, UAE: Scholarships through MoHE, Singapore: Grants through MoE and universities)

Source: Arthur D. Little

Note: Unless stated, the objectives are to be met in 5 years

Constituting a robust and well-trained workforce is critical to meet market requirements

DIGITAL CAPABILITIES

Ambition	Objective	Rationale
To improve ICT skills of local workforce in line with market requirements	30. ≥70% of employees in private IT companies to be Omani nationals	30. Demand>Supply of ICT graduates in Oman, while the situation is reversed in other countries. However, workforce skills and capabilities need to be improved to secure employment Omanis should be the preferred choice for open IT vacancies irrespective of mandated quotas

Source: Arthur D. Little

Note: Unless stated, the objectives are to be met in 5 years

As a basis to all ambitions, the institutional framework defining the sector's stakeholders and their responsibilities needs to be organized

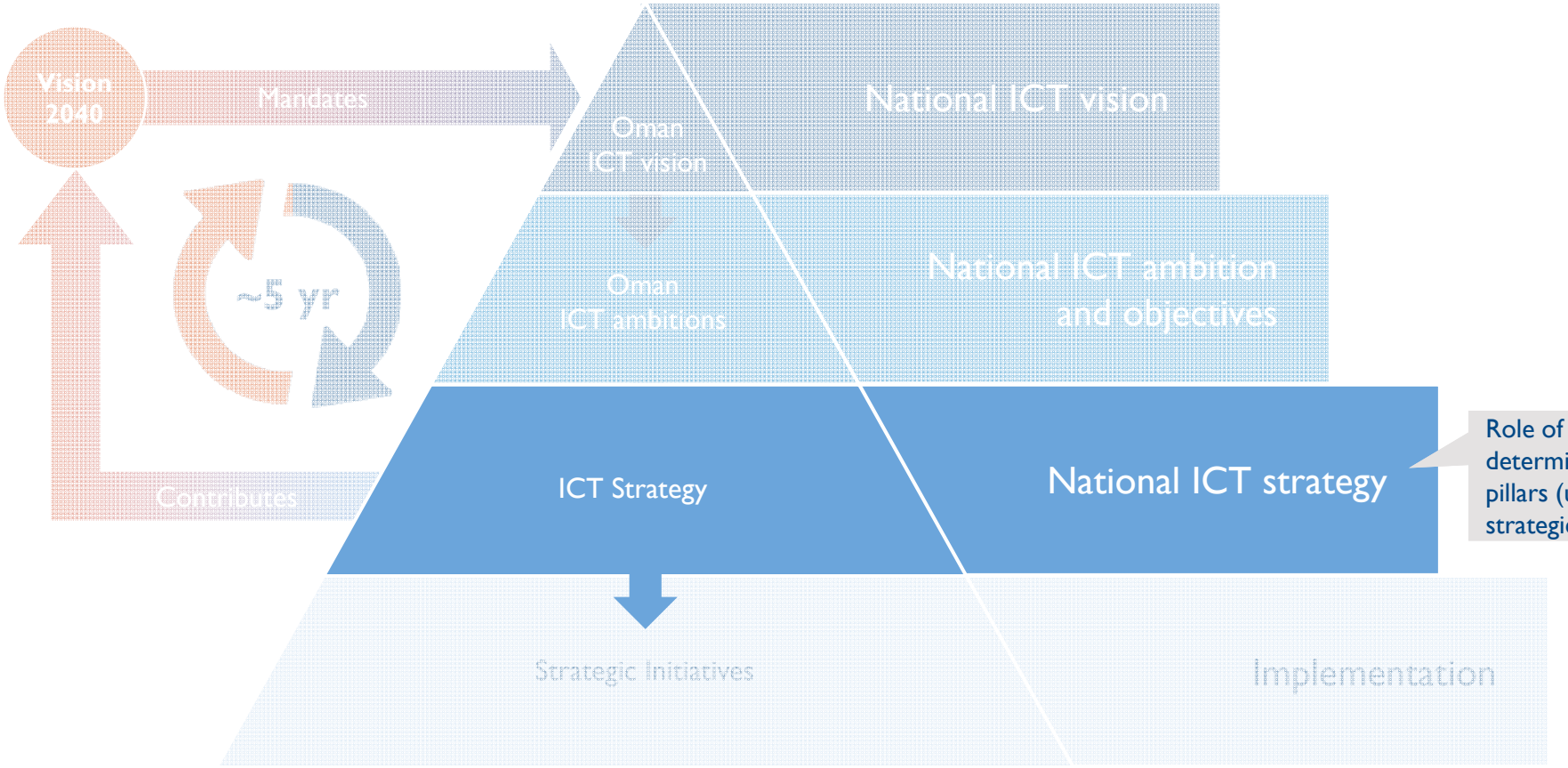
INSTITUTIONAL FRAMEWORK

Ambition	Objective	Rationale
To streamline the sector governance with clear end-to-end roles and responsibilities for all governmental institutions	31. Establish holistic and mutually exclusive ICT sector institutional hierarchy with a single entity for ICT sector on top (accountable) supported by relevant authorities and institutions (responsible	31. Singapore merged its media authority and infocomm authority into a single champion for the sector In South Korea, the MSIP and KCC[1] remained two separate entities, but merged forces to champion the country's ICT sector Oman recommends having a single champion entity in its NBS strategy
	32. Institutional framework for cross-sector initiatives	32. To ensure full success of the strategy, other government agencies and sectors need to be proactively involved

Source: Arthur D. Little
[1]Ministry of Science, ICT, and future planning (MSIP), and Korean communications commission (KCC)

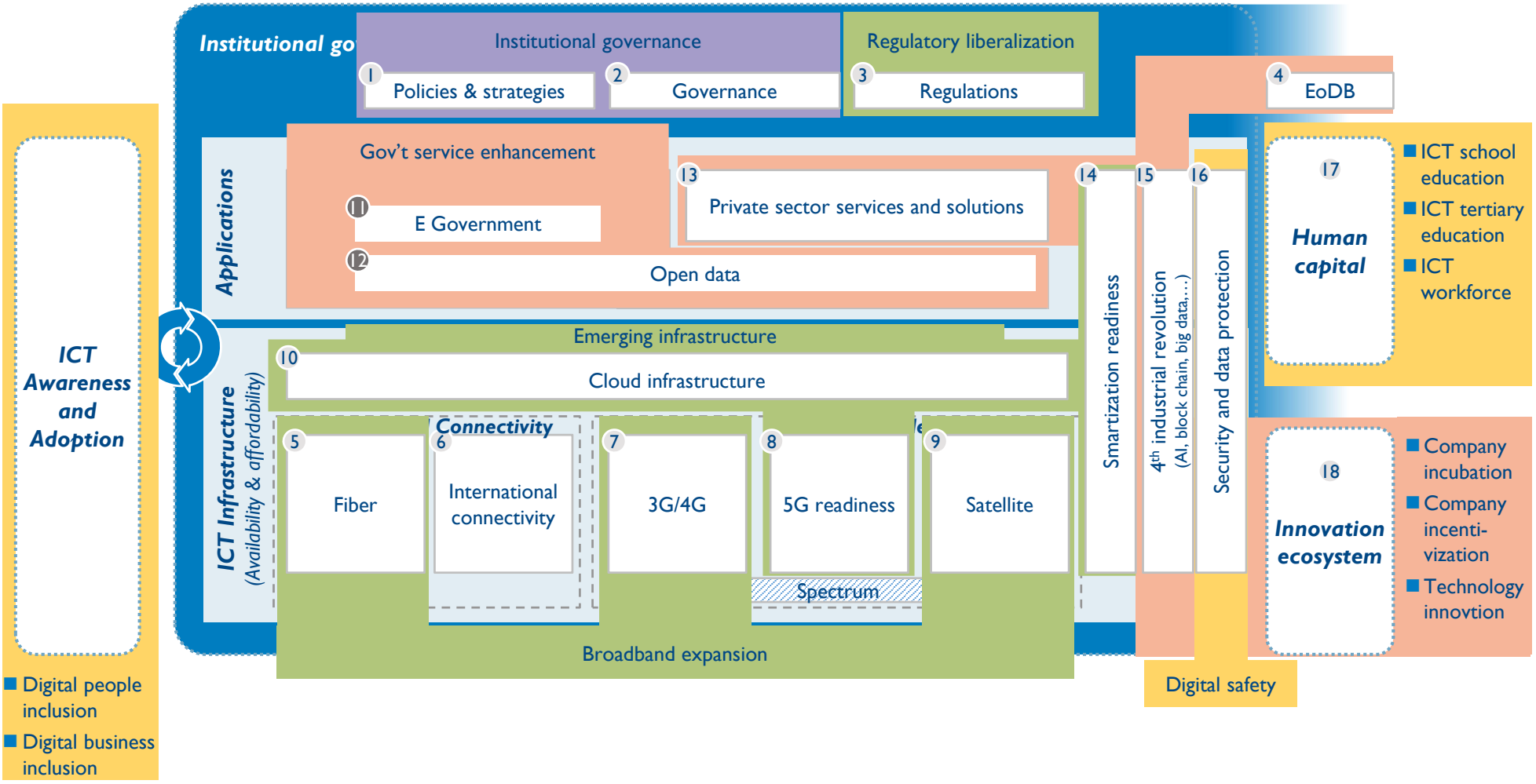
Agenda

National ICT strategy – Approach



Role of government determined across 14 sub-pillars (under the 4 strategic pillars)

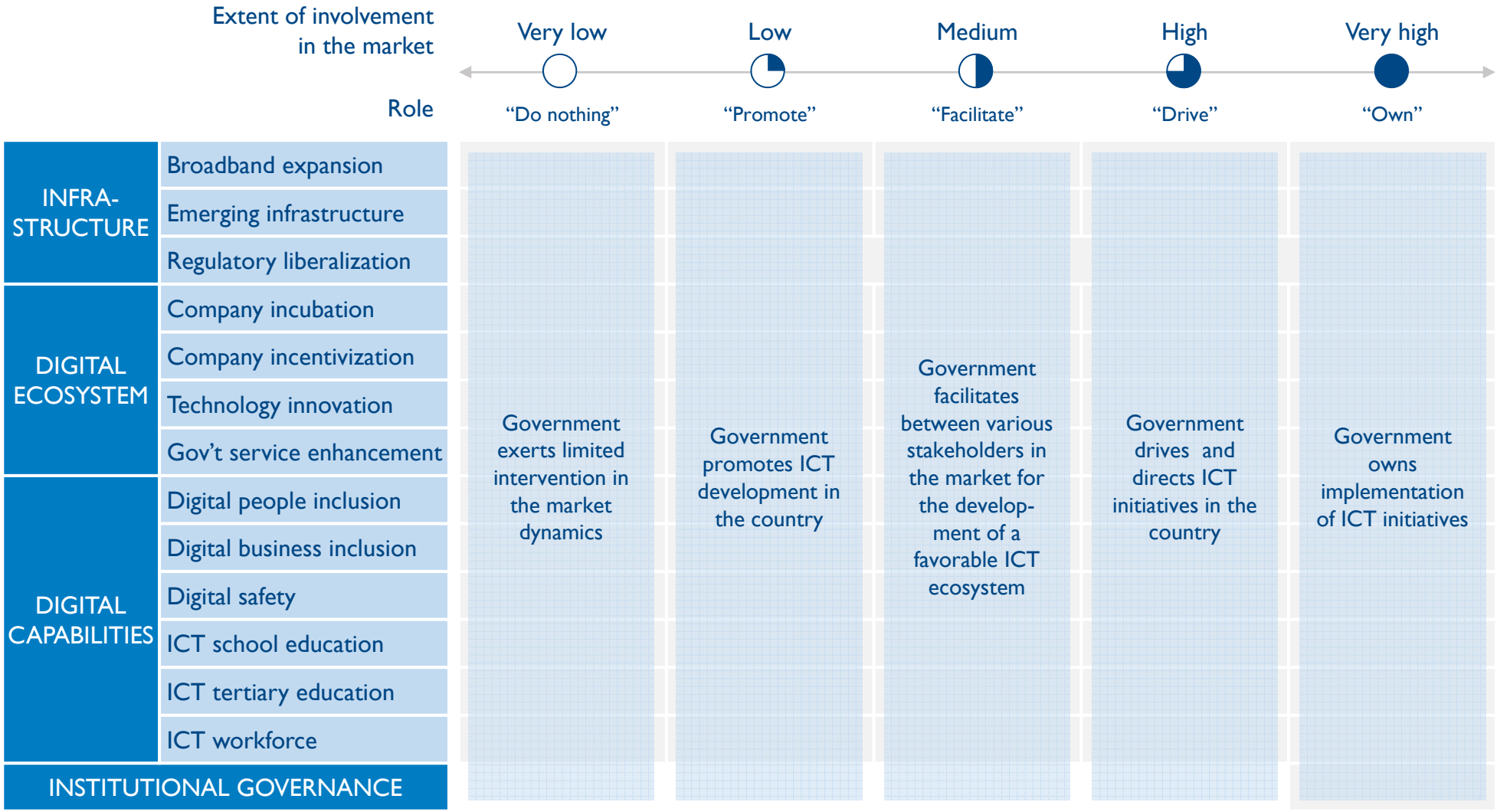
For the purpose of strategy development, the strategic pillars are split into sub-pillars and mapped to elements of the sector assessment (Phase2)



Source: Interviews, Arthur D. Little analysis

INFRASTRUCTURE | DIGITAL ECOSYSTEM | DIGITAL CAPABILITIES | INSTITUTIONAL GOV.

The ability to achieve the vision depends on the options chosen by the government[1] in its extent of involvement along the sub-pillars



1) Option Space determines the role of the government/quasi-government entities within the ICT sector, i.e. today this includes MOTC, TRA and ITA. The strategy cannot impose a mandate on other ministries, e.g. MOCI, MOE, etc

Various strategic options are available to the government

		Extent of involvement in the market: Very low	Low	Medium	High	Very high
		Role: "Do nothing"	"Promote"	"Facilitate"	"Drive"	"Own"
INFRA-STRUCTURE	Broadband expansion	*No public funding or coordination*	*Develop national ambitions and promote private investments*	*Gov't gap. funding, private/ operators led*	*Partly gov. funded, executed by private sector*	*Government owned NBN*
	Emerging infrastructure	*No action*	*Private investments through promoting national ambitions*	*Facilitate investments/ deployment by easing processes*	*Partial gov. funded, executed by private sector*	*Gov. financed infrastructure company*
	Regulatory liberalization	*No action - existing licenses and regulation*	*Full ICT sector liberalization*			
DIGITAL ECOSYSTEM	Company incubation	*No funding or incubation*	*Start-up awards & small-scale scholarships*	*Bring stakeholders together to foster investment & incubation*	*Provision of capital for startups & incubation programs*	*Establish government-owned funds and incubators*
	Company incentivization	*No action*	*Promote Oman as ICT hub*	*Support in obtaining incentives on a case-by-case basis*	*Directing the incentives to be applied for ICT company types*	*Implementation of the incentives*
	Technology innovation	*No investment*	*Promote selected technology fields for growth*	*Facilitate collaboration between public & private research*	*Drive research in predefined technology fields with funds*	*Establish regional labs & R&D centers, pilot projects*
	Gov't service enhancement	*Hands-off, independent devt. & implementation*	*Provide voluntary architectural guidelines*	*Provide advisory services on devt. and implementation*	*Define mandatory architecture, control budgets, audits*	*Define and implement services across entities*
DIGITAL CAPABILITIES	Digital people inclusion	*No digital divide initiatives and funding*	*Publish ICT usage guidelines, marketing*	*Gov't subsidies for devices and training (led by private sector)*	*Develop "Digital divide" training programs and fund them*	*Develop & provide training programs, devices & facilities*
	Digital business inclusion	*No involvement*	*Promotion for ICT adoption*	*Support in ICT solution selection*	*Incentives/ subsidies/ mandate for adopting ICT solutions*	*Develop and push solutions for businesses*
	Digital safety	*Hands-off, independent devt. & implementation*	*Promote awareness through campaigns*	*Develop and publish security, privacy and protection laws*	*Define landscape, control budgets, conduct audits*	*Establish and operate all digital-safety related infrastructure*
	ICT school education	*No involvement in education*	*Collaborate with educational institutions*	*Propose ICT educ. plans, ICT scholarships*	*Develop & fund ICT educ. plans, and curriculums*	*Establish ICT schools and courses*
	ICT tertiary education	*No involvement in education*	*Collaborate with educational institutions*	*Propose ICT educ. plans, ICT scholarships*	*Develop & fund ICT educ. plans, and curriculums*	*Establish ICT colleges/ courses/ incentives*
	ICT workforce	*No involvement in trainings*	*Encourage private sector to train employees in ICT*	*Collect training req. and match companies w/ training providers*	*Identify S/D gaps, develop training req.,& subsidize*	*Identify S/D gaps, dev. training req., & establish train. institutes*
INSTITUTIONAL GOVERNANCE						*Define & implement clear roles & resp. in ICT governance*

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Red outline indicates current situation | Blue indicates options under consideration

We identified two strategic options per sub-pillar that are plausible but differ in the government involvement

		Extent of involvement in the market: Very low	Low	Medium	High	Very high
		Role: "Do nothing"	"Promote"	"Facilitate"	"Drive"	"Own"
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INSTITUTIONAL GOVERNANCE						*Define & implement clear roles & resp. in ICT governance*

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Red outline: Current situation | Indicates rejected option | Indicates proposed option by consultant

We recommend one option across each pillar for the government's role[1]

	Extent of involvement in the market	Very low	Low	Medium	High	Very high
	Role	"Do nothing"	"Promote"	"Facilitate"	"Drive"	"Own"
INFRA-STRUCTURE	Broadband expansion	No public funding or coordination	Develop national ambitions and promote private investments	Gov't gap. funding, private/ operators led	Partly gov. funded, executed by private sector	Government owned NBN
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Red outline indicates current situation | Blue indicates options under consideration

We recommend one option across each pillar for the government's role[1], which we assume to be the 'preferred option'

		Extent of involvement in the market →	Very low	Low	Medium	High	Very high
		PREFFERED OPTION	Role	"Do nothing"	"Promote"	"Facilitate"	"Drive"	"Own"
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In case 1) the gov't attributes less importance to the ICT sector or 2) the oil price is plummeting, the role of the gov't[1] needs to be adjusted

		Extent of involvement in the market	Very low	Low	Medium	High	Very high
		Role	"Do nothing"	"Promote"	"Facilitate"	"Drive"	"Own"
FALL BACK OTION							
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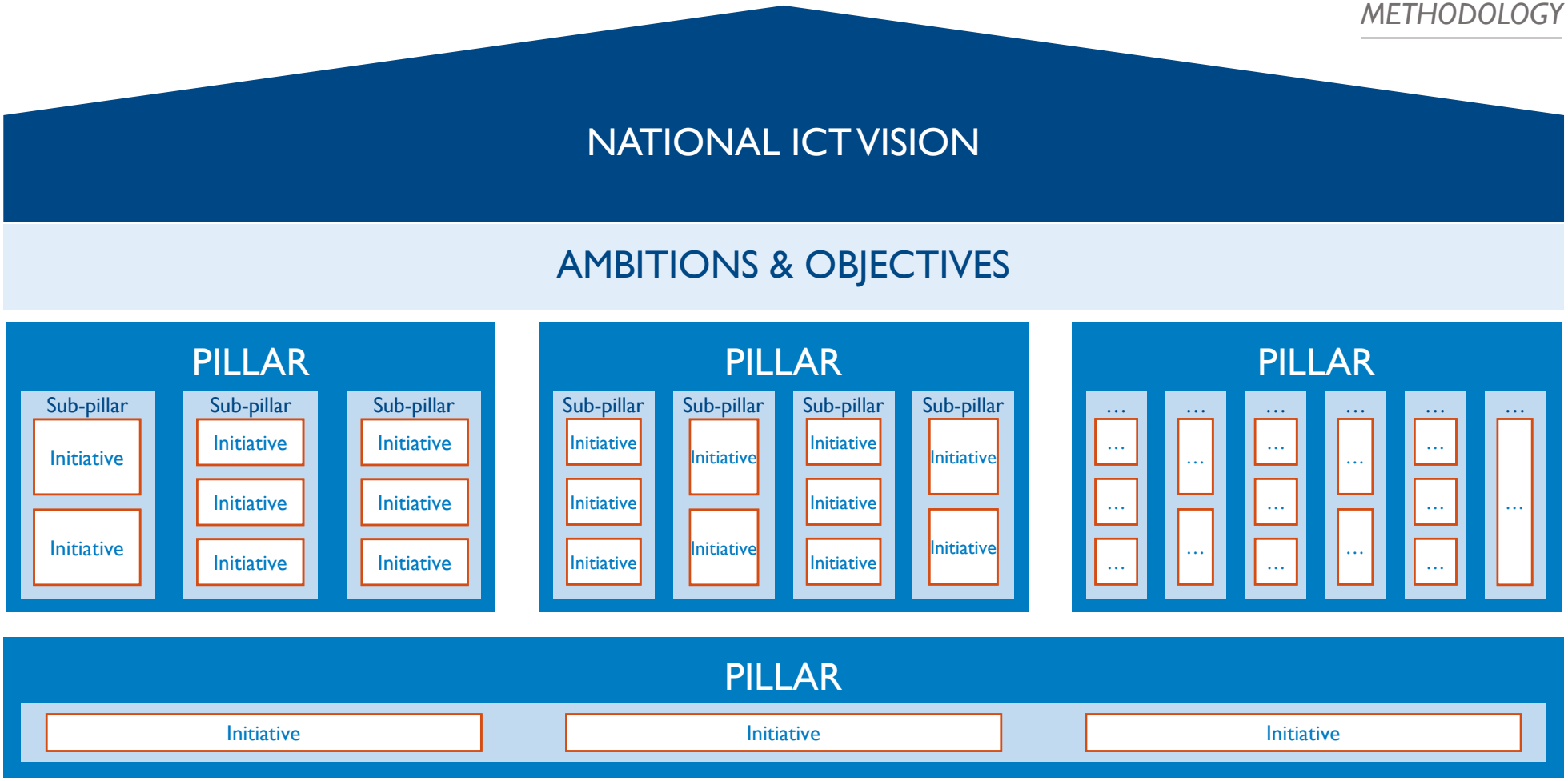
For the chosen strategic options, we have developed initiatives under each sub-pillar

METHODOLOGY



Source: Arthur D. Little

Pillars | Sub pillars | Initiatives

The initiatives are classified based on the "OMN framework" according to their nature of impact, i.e. fix-, enhance-, innovate the market

O – Overcome existing obstacles

Fix the market structure and performance to achieve existing policy objectives

M – Modernize the sector

Enhance the market, by removing existing barriers and addressing enablers

N – Nurture new opportunities

Look beyond core telecom and IT services, local markets for offering ICT services

8 initiatives are defined under the 3 sub-pillars within the Infrastructure pillar

Infrastructure Pillar

1 Broadband Expansion

1.1 Unified national broadband infrastructure investment and implementation plan — O

- *Recognizing high-speed internet as legal right*
- *Review and adapt existing broadband plan*
- *Detailed broadband plan including technology choice, area classification*
- *Rollout selection methodology*
- *Investment plan and gap identification*

1.2 Broadband implementation supervision — O

- *Master plan and operational plan development*
- *PMO for issue resolution and ensuring progress*
- *GIS updates*

2 Emerging Infrastructure

2.1 Emerging tech infrastructure blueprint — III

- *Clear targets and national objectives*
- *Framework for ecosystem dev. (5G, IoT, etc.)*
- *Smart city pilot launch*
- *Smart city platform facilitation*

2.2 Active and passive infrastructure sharing — O

- *Optimizing rollout processes*
- *Infra sharing with non-telcos*
- *Guidelines for sharing infra for new tech.*
- *GIS setup and infrastructure database setup*

2.3 DC & cloud infrastructure development — III

- *Setup of DC freezone and incentives*
- *IXP establishment and offering dark fiber / int'l connectivity for strategic IT providers*
- *Clear stance on data hosting and classification*

3 Regulatory Liberalization

3.1 Regulatory policies and frameworks — O

- *Review and publishing new telecom act and licensing framework*
- *Publishing the data protection and privacy laws*

3.2 Liberalized licensing regime — O

- *Move towards authorization/notifications regime*
- *Level playing field for all players*
- *Public investment reduction*
- *Framework for permitting encryption, OTT, etc.*

3.3 Agile regulatory regime — III

- *Clear publication on license obtaining processes*
- *Licensing process easement*
- *Sandbox approach for new technologies*
- *Monitoring technologies for intervention*

Source: Arthur D. Little

Pillars | Sub pillars | Initiatives | Overcome existing obstacles | Modernize the sector | Nurture new opportunities

Same as Tanfeedth (ICT & 4IR Lab project)

10 initiatives are defined under the ~~3~~ 4 sub-pillars within the Digital Ecosystem pillar

Digital Ecosystem Pillar

4 Company Incubation

4.1 Start-up funding & financing programs — II
- *Encourage global VCs to invest*
- *Co-invest with established VCs*
- *ICT and SME startup database*
- *Startup listing / financing facilitation*

4.2 Private sector capacity for incubation — II
- *Matchmaking between private sector and startups for incubation*

4.3 Support in accessing new markets — II
- *Marketing support*
- *Gov't procurement from SMEs*
- *Collaboration with Ithraa*
- *Market studies and reports*

5 Company Incentivization

5.1 Incentives for large investors — III
- *Dedicated funds for incentives*
- *ICT focused freezones offering benefits for investors*
- *Favorable FDI policies*

5.2 FDI promotion — III
- *Marketing and promotional activities on ICT sector*
- *Reports on status of the ICT sector and opportunities available*

6 Technology innovation

6.1 New technology testbed & research funding — II
- *Attracting international firms to do R&D in Oman, focus on industry outcomes*
- *Provide partial funding, resources*

6.2 Grant & patent support program — II
- *IP promotion committee*
- *Rewards and recognition for registering IP*

6.3 Crowdsource tech R&D — II
- *Problems that can be resolved through crowdsourcing IP*
- *Platform for crowdsourcing*
- *Registration of new IP*

7 Gov't service enhancement

7.1 Government transformation plan — O
- *Digital first approach to gov. services*
- *Mandatory architecture, integration requirements, KPIs, …*
- *Budget control for e-gov*
- *Mandatory online services*
- *Execution support*

7.2 Open data policy and databank — III
- *Open data platform (incl. real time data)*
- *Open data strategy & development plan*
- *Open data policy and legislation*
- *Mobile apps and web apps support*

Source: Arthur D. Little

Pillars | Sub pillars | Initiatives | Overcome existing obstacles | Modernize the sector | Nurture new opportunities

Same as Tanfeedth (ICT & 4IR Lab project)

14 initiatives are defined under the 6 sub-pillars within the Digital Capabilities pillar (1/2)

Digital Capabilities Pillar (1/2)

8 Digital people inclusion

8.1 Digital inclusion fund — O
- *Creation of digital inclusion fund*
- *Application parameters and criteria*
- *Application sorting criteria for release of funds*

8.2 ICT education centers and equipment — O
- *Revision of existing inclusion efforts*
- *Education centers for target groups*
- *Liaison with social and community groups*
- *Distribution of low cost devices*

8.3 Digital inclusion curriculum & campaign — O
- *Tailoring digital inclusion curricula*
- *Classes, training resources & knowledge bases*
- *Showcasing digital home, office and city*

9 Digital business inclusion

9.1 SME digital service adoption — III
- *Mandate website address and online presence*
- *Promoting adoption of cloud services*
- *Subsidies for cloud & hosting services*
- *Policies and regulations facilitating cloud adoption*

9.2 Digital transformation advisory services — III
- *Set up of the unit*
- *Launch and promote services to all parties*
- *Offer advisory services at subsidized rates*
- *Prepare studies on digitalization applications and benefits for various sectors*

10 Digital safety & security

10.1 Cyber security awareness — III
- *Comprehensive national cyber security and safety awareness programs*
- *Cyber security guidelines*
- *Cyber security statistics in Oman*

10.2 National Cyber security plan — III
- *Review of national cybersecurity structure and governance mechanisms*
- *Implementation of Data Privacy & Protection policies*

10.3 National Cyber Security Cooperation Framework — III
- *Establishment of body for liaising with other governments*
- *Stakeholder roles, responsibilities and processes*

Source: Arthur D. Little

Pillars | Sub pillars | Initiatives | Overcome existing obstacles | Modernize the sector | Nurture new opportunities

Same as Tanfeedth (ICT & 4IR Lab project)

14 initiatives are defined under the 6 sub-pillars within the Digital Capabilities pillar (2/2)

Digital Capabilities Pillar (2/2)

I1 ICT School Education

I1.1 Compulsory ICT education — III

- *Compulsory programming/coding courses in secondary schools*
- *Update ICT curriculum*
- *Basic ICT certification for students*
- *Funding for ICT teacher availability and training*
- *Tools and resources for schools to impart ICT education*

I1.2 ICT exposure programs — III

- *ICT related competitions for real-life problems*
- *Joint initiative with MoE*

I2 ICT Tertiary Education

I2.1 ICT curriculum collaboration — III

- *Working group on curricula development*
- *ICT industry-needs assessment & alignment*
- *Universities & stakeholder communication loop*
- *Support for curriculum quality control*

I2.2 ICT college/ university establishment — III

- *Program to attract global university to Oman*
- *Funding and approvals for the university*
- *Establishment of local campus*

I2.3 ICT scholarships — III

- *Parameters for scholarship awarding, incl. courses and duration*
- *Obtaining funding commitment*
- *Selection mechanism and monitoring mechanism*

I3 ICT Workforce

I3.1 National ICT skills action and training program — III

- *Market requirements identification*
- *Development of program goals, audience, content*
- *Training curriculum development*
- *Partnerships for reskilling and training*
- *Tracking industry stakeholder satisfaction*

Source: Arthur D. Little

Pillars | Sub pillars | Initiatives | Overcome existing obstacles | Modernize the sector | Nurture new opportunities

Same as Tanfeedth (ICT & 4IR Lab project)

3 initiatives are defined under the Institutional Governance pillar

Institutional Governance Pillar

14.1 ICT Executive League

O

- *Defining league members*
- *Organizational structure/working groups for ICT topics,*
- *Rules of participation and coordination mechanisms*
- *Formalization of the league*

14.2 ICT GDP contribution mechanism

III

- *Collaboration with NCSI to establish mechanisms for calculating ICT contribution to GDP incl.*
  - *Conducing surveys*
  - *publishing standalone ICT/digital economy report, with details*

14.3 ICT sector-level decision processes

O

- *Fair and transparent process for decision making on ICT related topics*
- *Governance model for escalation of ICT related issues within the sector and in the cabinet*
- *Monitoring implementation and deviation from the process*

Now
MTC

Source: Arthur D. Little

Pillars | Sub pillars | Initiatives | Overcome existing obstacles | Modernize the sector | Nurture new opportunities

Same as
Tanfeedth (ICT & 4IR Lab project)

We propose a total of **35** initiatives along the three OMN clusters, with the majority targeted towards enhancing the market & removing barriers

O Overcome

Broad-band exp.	■ Unified NBB infra. investment plan update ■ Broadband implementation supervision
Emerging infra	■ Active and passive infrastructure sharing
Regu-lation	■ Regulatory policies and frameworks review and publishing ■ Move towards liberalized licensing regime
Gov. service	■ Government transformation plan refresh
Digital ppl. incl.	■ Digital inclusion fund set-up ■ ICT education centers development ■ Digital inclusion curriculum and campaigns
~~Govern-ance~~	~~■ ICT executive league establishment~~ ~~■ Clear processes for ICT sector decision making~~

III Modernize

Emerging infra	■ Emerging tech. infrastructure blueprint development ■ Data center and cloud infrastructure development
Regu-lation	■ Agile regulatory regime establishment
Comp. incent.	■ Incentive mechanisms for large ICT investors ■ FDI promotion
Gov. service	■ Open data policy and roadmap development
Digital biz. incl.	■ SME digital services adoption improvement ■ Digital transformation advisory services establishment
Digital safety	■ Cybersecurity awareness creation ■ National cybersecurity plan development ■ National cybersecurity cooperation framework development
School edu.	■ Compulsory ICT education in schools ■ ICT exposure program for school students
Tertiary edu.	■ ICT curriculum collaboration for tertiary education ■ Scholarship program for gifted ICT students ■ Establishment of international ICT college/univ
Work-force	■ National digital business certification program
Gov.-ernanc	■ ~~Measuring ICT contribution to GDP~~

II Nurture

Company incubation	■ Start-up funding and financing programs ■ Private sector incubation capacity enhancement ■ Startup promotion and assistance in accessing new markets
Tech. innovation	■ Funding and testbeds for new technologies ■ Grant and patent support program ■ Crowdsourcing technology R&D

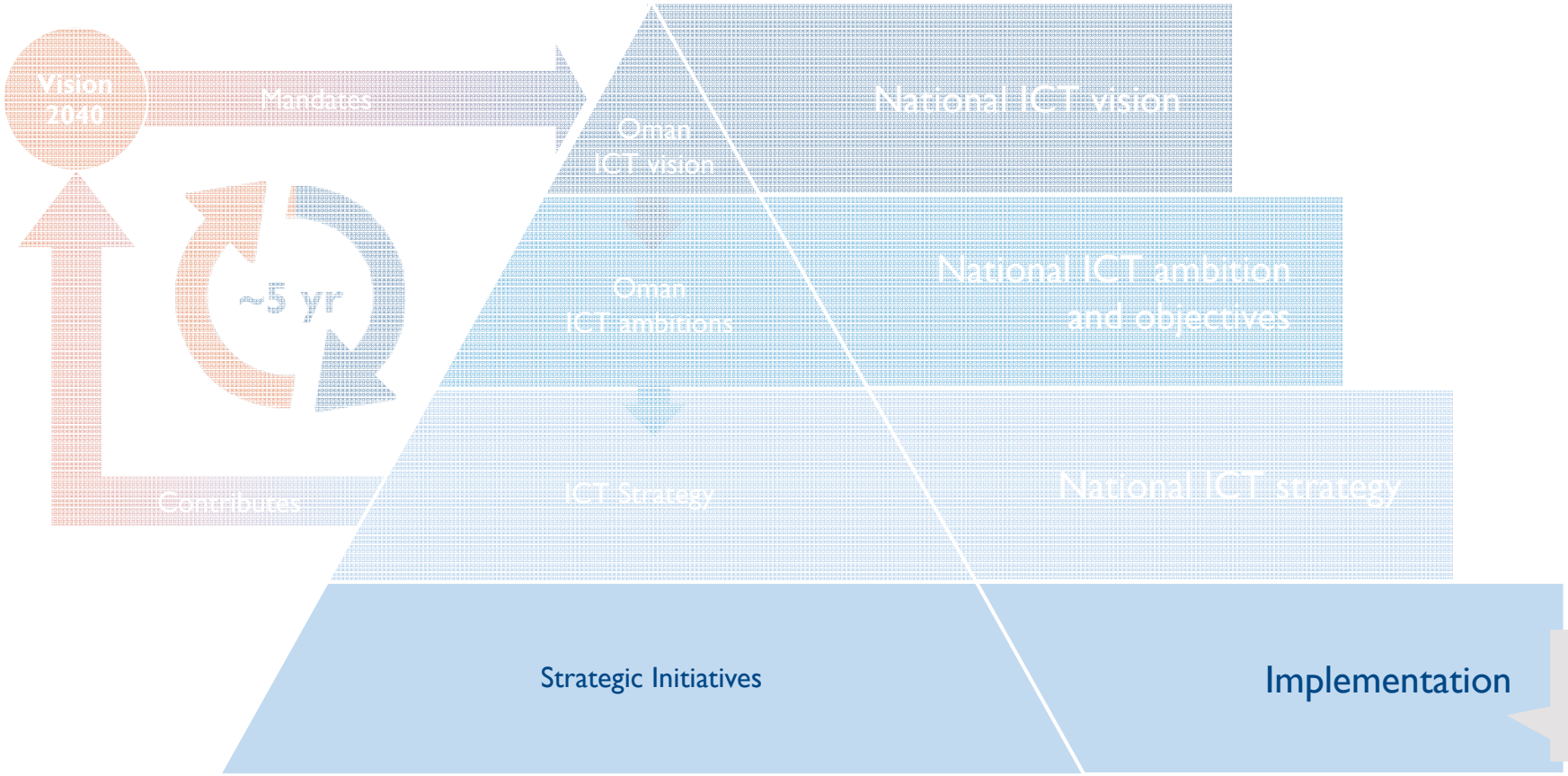
Strategic pillars

- Infrastructure
- Digital Ecosystem
- Digital Capabilities
- ~~Institutional~~ ~~Governance~~

Source: Arthur D. Little

Agenda

National ICT strategy – Approach



Initiatives Detailing and Rationale

ICT objective	1	2	3
Responsible	Policy maker*		

Strategic initiative	1.1	Unified national broadband infrastructure investment and implementation plan	Sub pillar	Broadband expansion

Objective & scope

- Review and adapt unified national broadband infrastructure investment and implementation plan

Deliverables & outcome

- Announced 10 Mbps connection as legal right
- Universal Service policies & regulations
- Fiber rollout and take-up rate

KPIs

- FTTH/B coverage; FTTH/B take-up rate
- Penetration of schools/ hospitals
- Average BB speed, High speed wireless BB cov.

Main activities

- High-speed internet as a legal right:
  - Announce 100 Mbps for an affordable price as a legal right for all residents in Oman
  - Define and issue/ update necessary policies and laws
- Affordable ultrafast broadband for institutes of socio-economic relevance:
  - Ensure affordable 100 Mbps connections for all public educational institutions and healthcare providers (incl. CAPEX and OPEX)
- Perform area classification based on GIS analysis
- Determine technology choice for each area (including choices such as satellite capacity leasing vs. owning)
- Develop, communicate and monitor plans for phasing-out of copper technologies
- Define methodology to select roll-out entity for unviable areas (telcos, OBC, alternative players, …)
- Prepare investment plan from the government side (gap funding)

Required capabilities

- Network economics; financial modeling; GIS-based analysis
- Regulatory, ROW, USO funding knowledge
- PR & marketing capabilities

Dependencies & risks

- Approved government funding
- Collaboration with municipalities for easing ROW
- Collaboration with/ enforcement of operators

Timeline & budget

Key activities	2019	2020	2021	2022	2023
Project setup & planning					
Update program					

Budget (in mOMR)	0.77	-	-	-	-

*) Today, 'policy maker' would imply MOTC and ITA. However, we propose a revision of the sector governance (initiative 14.1) to have a holistic and mutually exclusive governance with a single entity on top accountable for policy making and sectorial promotion.

The UK and Finland are two of many examples of countries aiming to establish broadband as a legal right for its citizens

EXAMPLE

Affordable broadband access

- UK aims to provide 10 Mbps connection as a legal right to all consumers, in the Digital Economy Bill introduced in July 2016
- UK government has a current USO mandate of "at least 2 Mbps BB under £400 per year to all UK residents"
- To achieve this, government also provides subsidies for satellite connections to those addresses which fulfill certain criteria, such as no current access nor plans under current deployment schemes, to broadband connectivity at speeds promised by the USO (Universal Service Obligation)

BB as a legal right

- Finland was the 1st country in the world to make broadband a legal right for every citizen in 2010
- Under the universal service subscription, Finland entities consumers to get 1 Mbps connection to home or business (increased to 2 Mbps in Nov. 2015) excluding the last mile
- Universal service includes the access of BB at reasonable price – about 30-40 EUR per month (estimated in 2010)

Source: Ofcom, FICORA, Arthur D. Little

Among others, the EU and the USA are committed to ensure affordable broadband for institutions with socio-economic relevance

EXAMPLE

Affordable BB for institutions of socio-economic relevance

- EU Target 2025: All main socio-economic drivers, such as schools, universities, research centers, transport hubs, all providers of public services such as hospitals and administrations, and enterprises relying on digital technologies, should have access to extremely high speed gigabit connectivity (allowing users to download/upload 1 gigabit of data per second)

Affordable BB in schools and libraries

- E-rate program: Financial support provided for affordable internet and telecommunication access to schools and libraries nationwide
- Amount of funding depends on status of school (rural/urban, level of poverty etc.)
- Program funded through universal service fee (17.9% of end-user interstate and international telecommunications revenues) charged to companies that provide interstate and/or international telecommunications services
- Universal Service Administrative Company (USAC) administers the universal service fund at the direction of the Federal Communications Commission

Source: European Commission, FCC USA, Arthur D. Little

Globally many countries have efforts in place – both public and private – to retire copper networks to facilitate fiber deployment

EXAMPLE

Governmentally/regulatory-driven

FCC NEWS from the Federal Communications Commission

Media Contact:
Mark Wigfield (202) 418-0253
mark.wigfield@fcc.gov

For Immediate Release

FCC STREAMLINES APPROVAL PROCESS FOR NETWORK TECHNOLGY TRANSITIONS

New Framework Will Expedite Transitions While Ensuring Crucial Features Remain

FCC Votes to Hasten Copper Retirement and Notification Process, Hopeful for IP/Fiber Upgrades

The FCC today adopted rules that would make it easier for telecom service providers to replace traditional copper infrastructure with fiber (…)

(…) the commission said the new rules "allow carriers to invest in modern networks rather than devote scarce resources to outmoded legacy services.

Philip Hammond MP, Chancellor (United Kingdom)

"(…) And we'll go further, by committing to finish the job – and deliver a nationwide full-fiber to the premises network by 2023. Running both [copper and fiber networks] indefinitely will not benefit either the consumer or the industry, so we must start thinking now about that switchover and how to sharpen the incentives for industry to move customers away from copper and on to fiber (…)"

Operator-driven

Swiss Sunrise to Sunset Copper Broadband in Huawei-Led 5G Plan

Swiss operator Sunrise is to replace its copper-based broadband services with a 5G-powered mobile alternative (…)

(…) the goal was to substitute 5G for those ADSL and VDSL technologies -- which deliver residential broadband over last-mile copper connections -- in most places (…)

Telkom calls time on copper cabling

The telco group is shifting its customers to fibre and mobile – and is on the hunt for fibre-based acquisitions

by NICK HEDLEY

Even if the financial benefits may not be immediately determinable, there is a consistent commitment to sunset copper infrastructure to make room for fiber

Source: FCC, CBI, Sunrise, Telkom Group, Arthur D> Little

Initiatives Detailing and Rationale

ICT objective	1	2	3
Responsible	Regulator		

Strategic initiative	1.2	Broadband implementation supervision	Sub pillar	Broadband expnsion

Objective & scope

- Oversee implementation of broadband across the country as per the revised plan

Deliverables & outcome

- National broadband progress reports

KPIs

- Progress against project plan (%)

Main activities

- Develop a plan to follow up on the broadband initiatives
- Develop a master plan for the initiatives, and determine accountability, roles and responsibilities
- Develop an integrated operational plan
- Periodically measure the progress of broadband indicators and identify the risks and challenges that require intervention
- Support data storage designs to be used by the GIS team
- Monitor development of the broadband market and ongoing initiatives, specifically on pressing issues and opportunities for immediate improvement
- Identify and roll out communication and public relations activities, including presentations on specific topics to wider audience

Required capabilities

- Program management and reporting

Dependencies & risks

- Risk of being considered as a reporting role, instead of active program management role

Timeline & budget

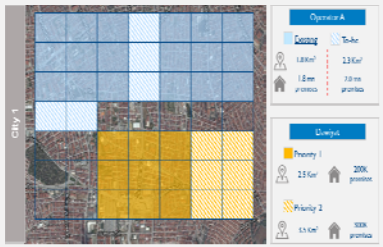
Key activities	2019	2020	2021	2022	2023
Launch program					
Manage program					
Update program					

Budget (in mOMR)	-	5.83	9.63	11.54	11.54

The broadband strategy needs to be updated and a clear implementation plan should be articulated, involving all the telcos in the market

1 Area delineation

- Develop methodology to identify area delineation with similar characteristics such as socio-economic status, geographical terrain, existing network availability and future network requirements
- Develop profile of different areas and assign them into different categories



2 Area prioritization

- Develop prioritisation criteria
- Identify technology for roll out for each of the criteria based on defined criteria such as techno-economic viability, socio-economic impact etc.
- Develop area prioritisation based on business case
- Seek operators' preference for each area

3 Roll out plan

- Develop operator wise prioritisation based on the potential level of funding required by each operator
- Alignment with operators
- Develop area wise/ operator wise roll out plan

4 Roll out monitoring

- Develop operator wise prioritisation based on the potential level of funding required by each operator
- Alignment with operators
- Develop area wise/operator wise roll out plan

Source: Arthur D. Little

A dedicated broadband realization taskforce is required to ensure continuous supervision and monitoring of broadband roll out

PROJECT EXAMPLE

Broadband implementation supervision activities

Planning and performance	■ Define the scope of initiatives ■ Define the initiative targets in line with Vision 2020	■ Define initiative timelines ■ Monitor market evolution
Finance and controlling	■ Assign initiative budgets and ensure financial feasibility of targets ■ Oversee the disbursement of subsidy	■ Monitor the finances and cash situation ■ …
Geo-intelligence	■ Set up the GIS system and database ■ Operate GIS systems and tools	■ Generate geo insights for target setting and monitoring ■ …
Project management	■ Monitor the implementation of initiatives ■ Coordinate with stakeholders to ensure initiatives are on track	■ Manage the initiative risks and resolve issues/ disputes ■ …
Communications	■ Define the communication requirements for initiatives ■ Conduct the required communication	■ Gauge public engagement for initiatives ■ …
Others	■ Contracting with stakeholders as required ■ …	

Source: Arthur D. Little

Initiatives Detailing and Rationale

ICT objective	4	5
Responsible	Policy maker*	

Strategic initiative	2.1	Emerging tech infrastructure blueprint	Sub pillar	Emerging infrastructure

Objective & scope

- Develop emerging tech infrastructure blueprint incl. objectives, targets, standards for emerging infrastructure

Deliverables & outcome

- Smart city pilot projects
- Architectural framework and requirements for emerging techs.

KPIs

- Global smart city ranking (rank/position)
- Technology specific blueprint as per plan

Main activities

- Communicate clear targets and national objectives for emerging infrastructure such as 5G, IoT, Smart Cities
- Develop a comprehensive framework to facilitate the development of ecosystem in the country for IoT, 5G (specifications, licensing, switching and roaming, addressing and numbering, competition and quality, privacy and security, …)
- Plan, fund & launch selected Smart City pilot projects across leading municipalities
- Facilitate the launch of a common smart city platform through the private sector, e.g.
  - Engage in PPP with private sector, the latter collecting revenues for two years, before handing over to government (see for example toll gates)

Required capabilities

- Technical knowhow about new technologies
- Design and execution of Private-Public-Partnerships (PPP)

Dependencies & risks

- Funding for pilots and implementation
- Collaboration with ministries, municipalities, utilities etc.
- Coordination/alignment with existing rollout efforts, e.g. IoT

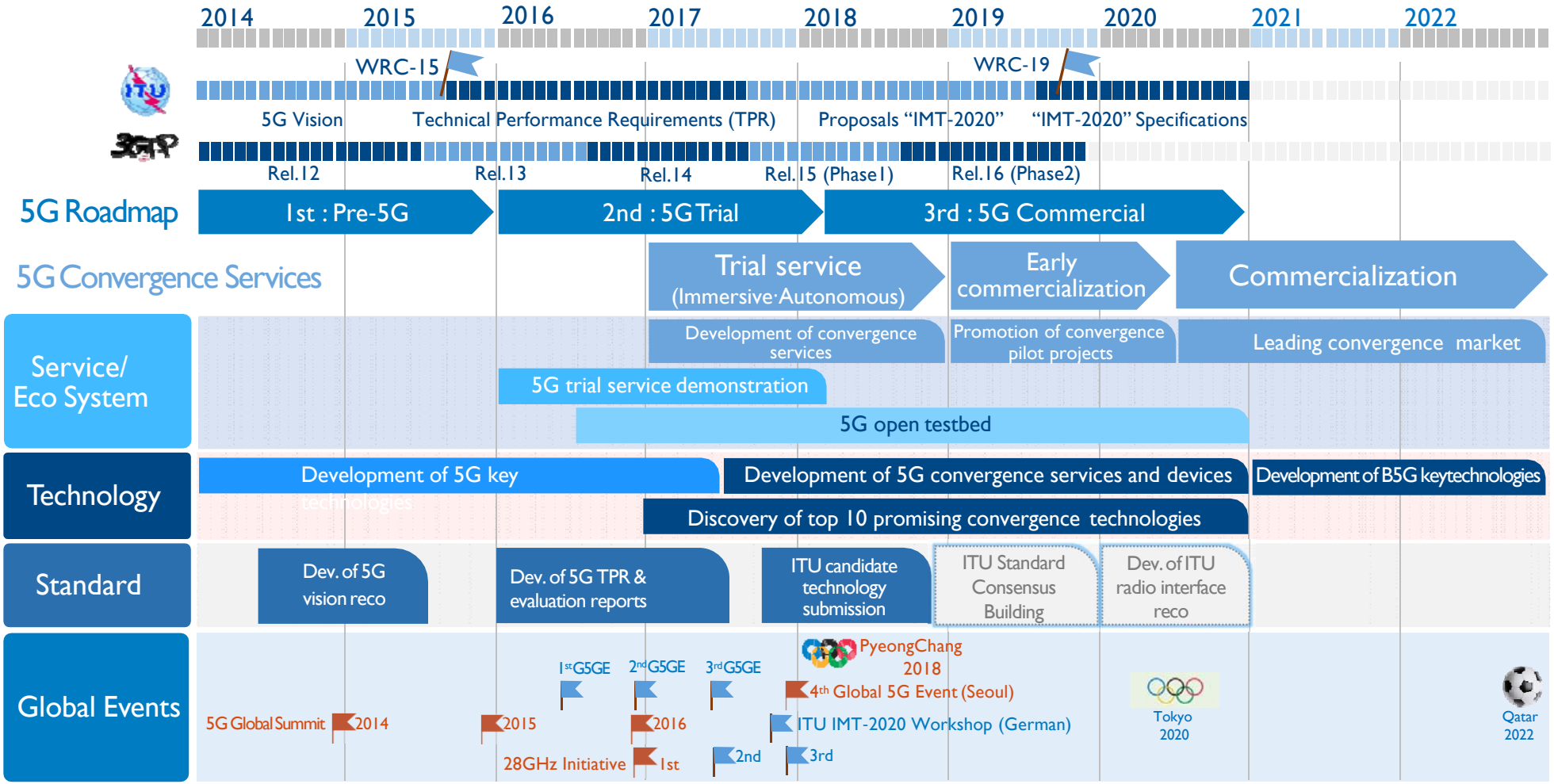
Timeline & budget

Key activities	2019	2020	2021	2022	2023
Project setup & planning					
Launch program					
Manage program					
Update program					

Budget (in mOMR)	0.77	3.7	0.46	0.60	0.74

*) Today, 'policy maker' would imply MOTC and ITA. However, we propose a revision of the sector governance (initiative 14.1) to have a holistic and mutually exclusive governance with a single entity on top accountable for policy making and sectorial promotion.

In South Korea, 5G was identified as a key accelerator of 4IR, hence detailed development roadmaps have been prepared for its deployment…



Source: Korea telecom 5G deployment roadmap

[1]BS:Base station

[2]UE: User equipment

…along with commercialization plans for led by KCC and MSIP in partnership with operators and academia

5G wireless plan (2017-2020)

Description

Commercialize 5G by 2020

- Collaboration between the government (MSIP, KCC), private companies (Operators) and academia
- Initiatives for necessary infrastructure initiated (i.e. Frequency bands for 5G cellular services; KT tests technologies, such as mmWave and mu-mimo[1])
- **Objectives:**
  - Allow wide-spread use of IoT
  - Achieve 25 Gbps transmission speed
  - Achieve leadership in 5G technology

Policies and initiatives

- Korea has completed auctioning off spectrum for 5G to telcos and is set to begin its rollout in December 2018
- The auction was successful thanks to KCC's objection to terrestrial broadcasters lobbying for exclusive rights:
  - SK Telecom and KT each won 100MHz of the 3.5GHz spectrum, while LG Uplus clinched 80MHz. All three telcos secured 800MHz of the 2.8GHz spectrum
  - In total, the telcos paid USD 3.19 B for the spectrum

Key learnings

- Early proactive involvement in roll-out of 5G technologies is required to gain competitive advantage and become a leader in this technology
- Regulators have to be involved to enable faster rollout through forward looking measures (such as spectrum allocation and initiating collaboration among different stakeholders involved)

Source: Ministry of Science, ICT and Future Planning, Arthur D. Little analysis
[1]mu-mimo = multi-user, multiple input, multiple output

Initiatives Detailing and Rationale

ICT objective	1	2	3	4	5
Responsible	Regulator				

Strategic initiative	2.2	Active and passive infrastructure sharing	Sub pillar	Emerging infrastructure

Objective & scope

- Enable active and passive infrastructure sharing for existing and new technologies

Deliverables & outcome

- Comprehensive infra. sharing agreement
- ICT infrastructure GIS-system
- Active mobile infrastructure sharing

KPIs

- Customer switched to other provider (#)
- Coverage of GIS-tool (% of area)
- Active sharing agreements (#)

Main activities

- Optimize infrastructure rollout processes and approvals required
- Evaluate open access feasibility and benefits, and the underlying requirements
- Engage with non-telecom entities (municipalities, utilities, etc.) to facilitate access to their infrastructure for telecoms
- ICT infrastructure information availability:
  - Ensure timely availability of (fiber) infrastructure information of existing and/or planned projects of operators, utilities and others
  - Develop "ICT infrastructure map" (GIS-system)
- Develop/adapt guidelines for passive and infrastructure sharing for 5G technologies
- Develop and maintain database of infrastructure available for sharing

Required capabilities

- Policy & regulatory expertise (esp. infrastructure sharing, in-building infrastructure access, enforcement, InfraCo)
- IT knowledge, GIS system know-how, project mgmt. know-how

Dependencies & risks

- Other ministries/agencies for easing rollout approval process
- Close collaboration between operators for infrastructure sharing and sharing infrastructure information

Timeline & budget

Key activities	2019	2020	2021	2022	2023
Project setup & planning					
Launch program					
Manage program					

Budget (in mOMR)	1.93	0.39	0.39	0.39	0.39

The European Union established Rights of Way regulations and asks its member states to ensure its execution

EXAMPLE

ROW regulations

- The EU directive 2002/21/EC outlines EU provisions on the 'Rights of Way' for the roll-out of networks and associated facilities
- In essence Article 11 (Rights of Way) within the directive asks members states to ensure that:
  - Any request for the right to install facilities (on a public/ private property) by public/ other communication providers shall be dealt with promptly and without discrimination by a competent authority
  - Effective structural separation of the body deciding request for 'Rights of Way' from entities owning/controlling telecommunication providers
  - Effective mechanisms available to the communication provider to appeal against decisions to an entity independent from either parties
- Amended in 2009; Provision of greater power and responsibilities for NRAs (National Regulatory Authorities)
  - NRAs should coordinate the acquisition of 'Rights of Way', making all information available on their website
  - NRAs should ensure holders of 'Rights of Way' are encouraged to share facilities after adequate public consultation; especially for PIS and AIS*

Source: European Commission, Arthur D. Little analysis *Passive and Active Infrastructure Sharing

France, Germany, India, KSA have all pursued initiatives towards infrastructure sharing

EXAMPLE

Fixed infrastructure sharing

- French regulator, ARCEP mandated telecom operators to share fiber local loop in 2008
- Major operator, France Telecom, provides access to its existing ducts or cabinets following a "cost-based pricing" to other operators

"Infrastruktur Atlas"

- "Infrastruktur Atlas" contains spatial data about infrastructure which may be shared for BB network implementation as an initiative by the regulator the Ministry
- Revision of Telecom Act in 2012 builds the parent act for gathering data
- Information includes fiber optic lines, empty ducts, radio towers, masts and radio stations etc.; web application is live since December 2012

Mobile infrastructure sharing

- In 2016, India's Department of Telecom has amended competition rules to allow for both passive (which is already allowed) and active infrastructure sharing (AIS)
- In India, AIS is limited to "antennae, feeder cable, Node B, radio access network and transmission system"

Duct sharing

- Reference offer for access for telcos specifics that 50% of installed new duct capacity should be reserved for other service providers
- Other service providers can requests to use this capacity based on an access agreement. The installing telco is not permitted to use this reserve capacity for 5 years

Source: ARCEP, TelecomAsia, BNetzA, BMWi ,Arthur D. Little analysis

Countries across Europe have pursued national centralized infrastructures atlases to facilitate infrastructure sharing

EXAMPLE

National centralized infrastruc-ture atlas

UK: National Joint Utilities Group is mapping existing underground infrastructure (incl. 2m km of telecom cabling)

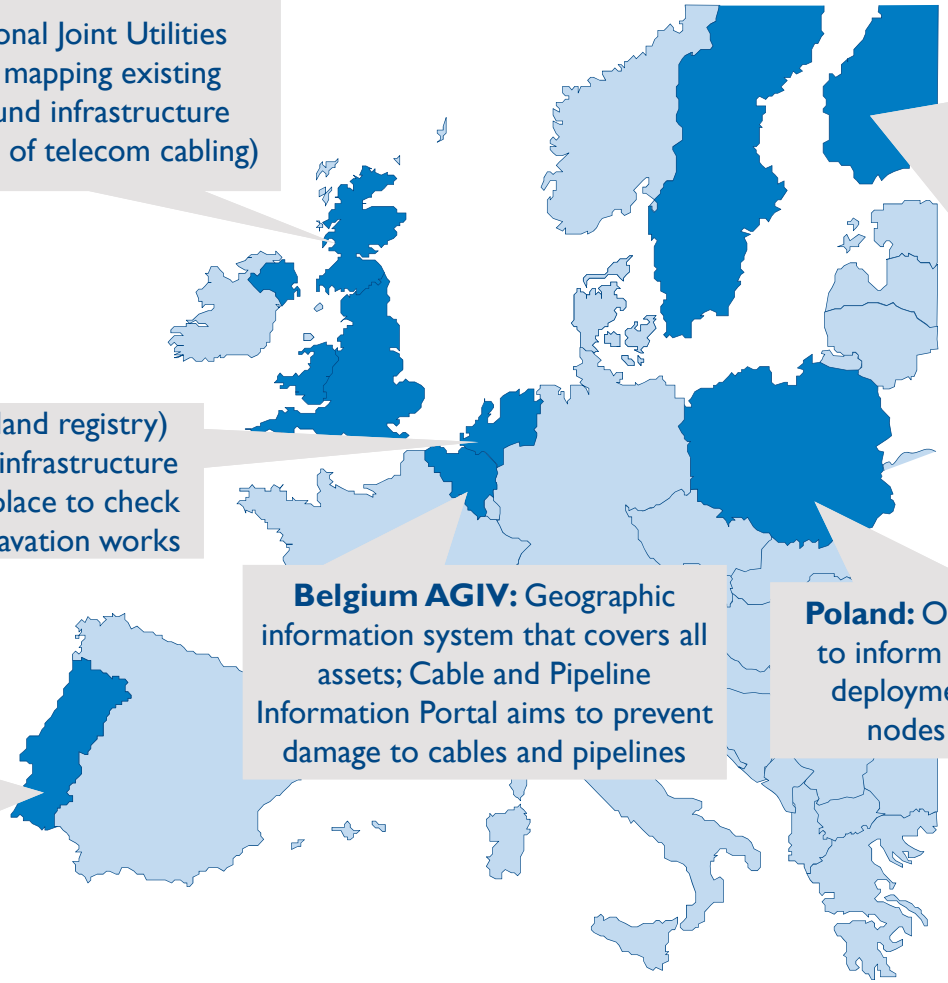
Finland, Sweden: Civil works database for co-deployment between telcos and utilities; on-going project for a map that shows existing and planned broadband infrastructure projects

Netherlands: Kadaster (land registry) maintains registry of cable infrastructure in the Netherlands; law in place to check the registry before any excavation works

Belgium AGIV: Geographic information system that covers all assets; Cable and Pipeline Information Portal aims to prevent damage to cables and pipelines

Poland: Operators are required to inform regulator about new deployments incl. position of nodes and connections

Portugal: Regulator began CIS initiative in 2009; Mandatory if you own or operate infrastructure to update the registry; incumbent required to publish available space in its ducts



Source: Analysys Mason, Arthur D. Little

Initiatives Detailing and Rationale

ICT objective	6	13
Responsible	Policy maker*	

Strategic initiative	2.3	Data center and cloud infrastructure development	Sub pillar	Emerging infrastructure

Objective & scope

- Encourage development of the data center and cloud infrastructure through the private sector

Deliverables & outcome

- Subsidy scheme, promotion campaigns
- Data Center free zone

KPIs

- Data centers set up (#)
- Market for data centers captured (%)
- Global rank in cloud infrastructure (#)

Main activities

- Assess and select financial incentives and subsidies for Data Centers (e.g. capital subsidy based on business plan, interest-free loan, reduced energy prices, dedicated real estate)
- Study and consider establishment of Data Center free zone close to submarine cable landing stations
- Facilitate the establishment of neutral Omani IXP to attract global data center, cloud and content providers
- Review interconnection policy to allow strategic IT players to have dual connectivity and direct access to IXPs
- Study possibility of offering "dark fiber" and international connectivity/ landing stations at globally competitive prices for strategic IT providers
- Communicate clear stance on data classification and hosting
- Encourage energy-efficiency through guidelines and regulatory support

Required capabilities

- Data Center trends know-how
- Regulatory know-how, free zone experience
- Promotion & marketing

Dependencies & risks

- Content regulations
- Collaboration with e.g. Ministry of Commerce (business registration) and Ministry of Finance (funding) for free zones

Timeline & budget

Key activities	2019	2020	2021	2022	2023
Project setup & planning					
Launch program					
Manage program					

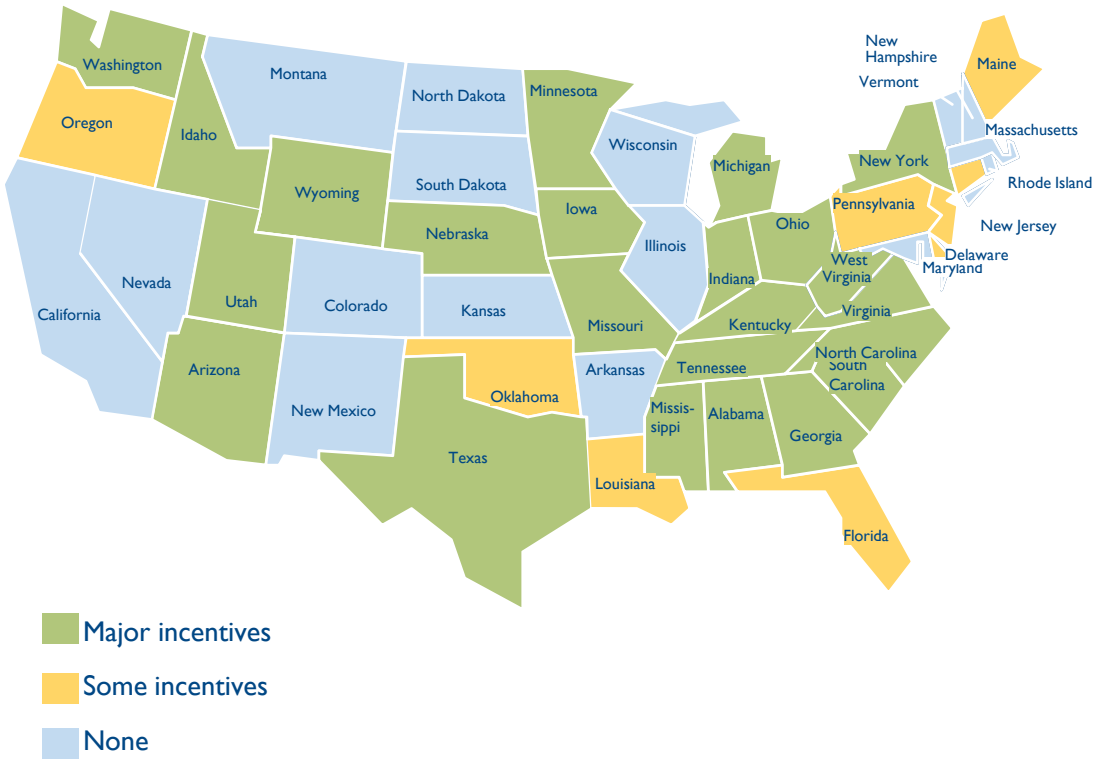
Budget (in mOMR)	0.92	2.08	0.92	0.92	0.92

*) Today, 'policy maker' would imply MOTC and ITA. However, we propose a revision of the sector governance (initiative 14.1) to have a holistic and mutually exclusive governance with a single entity on top accountable for policy making and sectorial promotion.

Most states in the US have legislations in place that encourage development of the datacenter & cloud infrastructure through the private sector

EXAMPLE

Data center incentive per state



- Most states have legislations in place for **incentives for data centers**
  - E.g. Alabama: "Economic Incentive Act of 2012" provides for DC specific tax rebates
- Incentives for data centers focused on measures to **minimize operating costs** e.g. tax abatement programs (in tiers depending on conditions like investment amounts, number of jobs created etc.)

Source: Datacenter dynamics, Arthur D. Little

Public initiatives to facilitate and attract investments in local data center and cloud infrastructure are a global phenomena

EXAMPLE

Data center tax rebates

- Finnish government amended law on electricity tax to reduce the tax paid by data center companies in Finland
- ~60% reduction in tax on electricity for data centers, effectively reducing the price of electricity by ~14%
- Benefits limited to data centers that fulfilled certain conditions- data center must be the primary business of the company and the minimum power usage of the data center must be 5 MW

Cloud regulations

- Cloud computing regulation and licensing regime in KSA under development
- Aim to create a favorable environment for cloud infrastructure and security, leading to higher demand for data centers in the long run
- A three-category licensing scheme for Cloud Service Providers (CSPs) one of which is the "Cloud Infrastructure and Services License" (CISL). The license will cover CSPs with datacenters or other key cloud infrastructure in Saudi Arabia, and those processing or storing sensitive user content (i.e. 'Level 3' user content, as defined in Article 3.3 of the draft regulation)
- Restrictions in place regarding the cross border transfer Level 3 User Data

Source:, Invest in Finland, CITC, Arthur D. Little

IXPs can offer substantial benefits to Oman in terms of greater affordability, throughput and new services in the internet services market

Potential benefits of IXPs for internet services market in Oman

ILLUSTRATIVE

Greater affordability

- In absence of IXPs, the **local internet traffic** is also **routed through the more expensive long distance link** to the international backhaul
- IXPs can eliminate the need for routing local traffic through expensive international links thereby **reducing the per MB cost** of international backhaul. As a result, **prices of internet services to the end users** could lower hence **increasing the affordability**

Improved speeds

- IXPs can help **reduce the traffic from national internet backbone to backhaul internet network** hence **improving the throughput time** for international IP transit
- **More bandwidth becomes available** for local users because of the lower costs of local capacity
- Local links are often several times faster because of **reduced latency** in traffic as it makes fewer hops to reach the destination

New services

- IXPs can help **develop new local content providers** and services in Oman, these services usually rely upon high speed low cost connections
- Availability of faster local links and a larger user base via IXPs **encourage content and service providers to develop more advanced local services** which require low latency connections (e.g. Multimedia streaming, real-time HD communication, etc.)

Source: Arthur D. Little

Initiatives Detailing and Rationale

ICT objective	7	8	9
Responsible	Regulator		

Strategic initiative	3.1	Regulatory policies and frameworks	Sub pillar	Regulatory liberalization

Objective & scope

- Review and publish pending regulatory policies and frameworks

Deliverables & outcome

- Updated, approved and issued Telecom Act

KPIs

- Approved deliverables as per schedule (%)

Main activities

- Review and publish new telecom act and licensing framework
- Publish the data protection and privacy laws

Required capabilities

- Telecom Act knowledge, international regulations knowledge
- Legal knowledge, public consultation experience
- Technical knowledge & ICT technology know-how

Dependencies & risks

- Current Telecom Act

Timeline & budget

Key activities	2019	2020	2021	2022	2023
Project setup & planning					
Launch program					
Update program					

Budget (in mOMR)*	Ongoing, no new additional costs

*) Includes budget for all strategic initiatives related to the regulatory liberalization cluster

Initiatives Detailing and Rationale

ICT objective	7	8	9
Responsible	Regulator		

Strategic initiative	3.2	Liberalized licensing regime	Sub pillar	Regulatory liberalization

Objective & scope

- Move towards liberalized licensing regime - towards General Authorizations and Notifications

Deliverables & outcome

- New licensing regime issued

KPIs

- Approved deliverables as per schedule (%)
- Market concentration (in HHI)

Main activities

- Review and update regulatory and licensing regime (according to best-practices) to improve market efficiencies – move towards a authorization/notifications-based licensing regime
  - Review policies & regulations, such as market entry, rights & obligations, competition, consumer protection, access to scarce resources
  - Update necessary regulation/ policies (incl. MVNO licensing to reflect new regulatory framework, net neutrality, licensing fees, rollout obligations etc.)
- Create a level playing field for all players, with same set of rules and licenses
- Reduce public involvement where in principle it feasible for private sector to invest, e.g. divest/list OBB, TowerCo, etc.
- Encourage investments in the sector from the private sector and from utilities and municipalities (for fiber)
- Develop sophisticated framework for permitting encryption
- Develop a clear policy on OTT and IP based services, and address potential regulatory asymmetry issues

*) Consolidated budget in 3.1

Required capabilities

- Regulations & licensing knowledge, international licensing regime knowledge, legal knowledge
- Public & stakeholder consultation experience

Dependencies & risks

- Revised Telecom Act

Timeline & budget

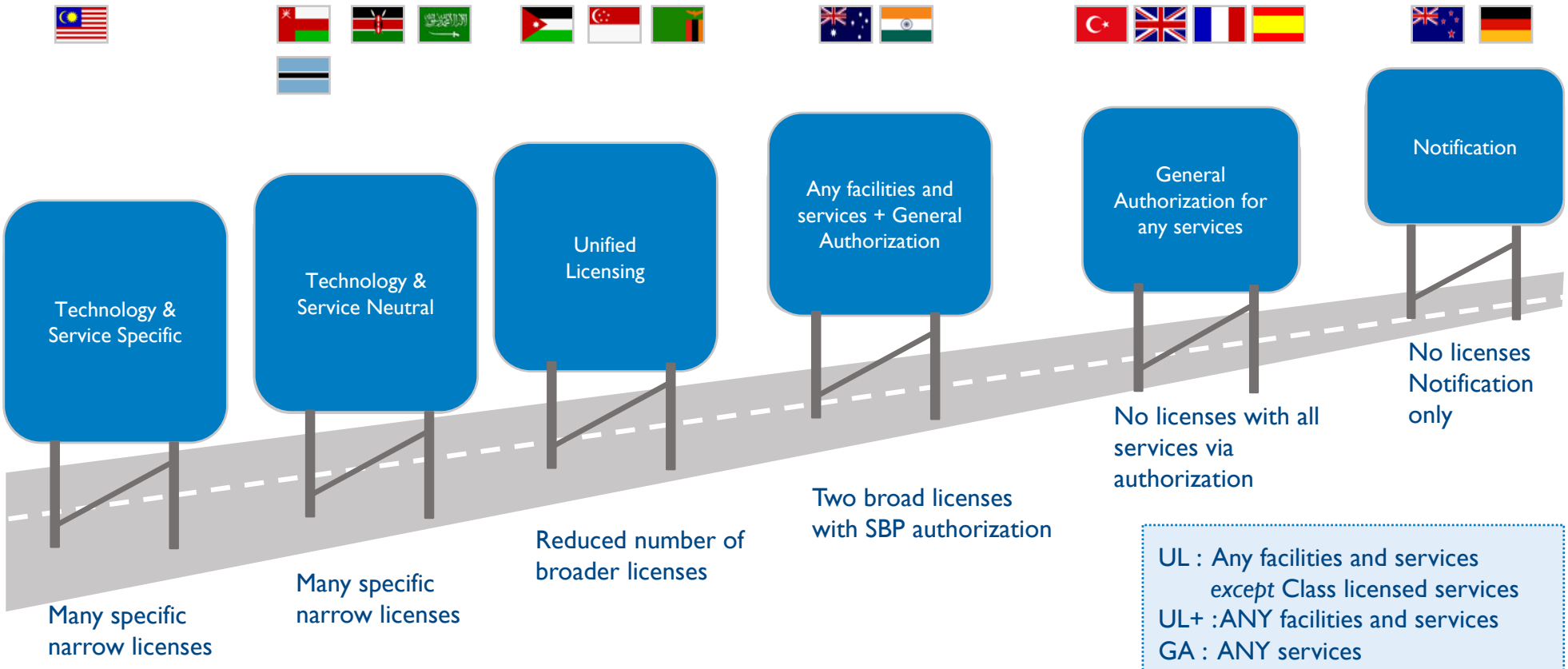
Key activities	2019	2020	2021	2022	2023
Project setup & planning					
Launch program					

Budget (in mOMR)*	2.31	0.39	0.39	0.39	0.39

The existing licensing framework is restrictive and has potential for improvement

PHASE 2

Regulatory and Licensing Framework Roadmap



UL : Any facilities and services *except* Class licensed services
UL+ : ANY facilities and services
GA : ANY services

Source: Arthur D. Little analysis SBP: Service based provider

Note: Benchmark countries include global leaders and regional peers. Other countries selected to highlight the variety across the spectrum of options

Initiatives Detailing and Rationale

ICT objective	7	8	9
Responsible	Regulator		

Strategic initiative	3.3	Agile regulatory regime	Sub pillar	Regulatory liberalization

Objective & scope

- Establish an agile regulatory regime

Deliverables & outcome

- Sandbox approach
- Regulatory stance on new technologies

KPIs

- Published regulations/stance on new technologies (#)
- Startups engaging in new technologies (#)

Main activities

- Clearly publish the means and processes to obtain the licenses
- Ease the process of obtaining licenses (partially addressed by publishing the new telecom act)
- Develop sandbox approach for regulating new technologies and clearly publish/communicate the approach to the market (especially startups and innovation ecosystem stakeholder)
- Monitor new technologies that require regulatory intervention

Required capabilities

- Understanding of working and implications of new technologies
- Regulations & licensing knowledge,
- Public & stakeholder consultation experience

Dependencies & risks

- Revised Telecom Act
- Collaboration with other institutions, both public and private sector

Timeline & budget

Key activities	2019	2020	2021	2022	2023
Project setup & planning					
Launch program					
Manage program					

Budget (in mOMR)*	Covered as part of liberalized regulatory regime budget

*) Consolidated budget in 3.1

Many topics are currently disrupting the ICT scene and emerging without any set regulation, and are best controlled using the sandbox approach

EXAMPLE

Benefits of using the sandbox approach

DISRUPT

New topics and emerging technologies introduced, no regulation available

ENGAGE

No reference for regulations to be used. Startups engaged to operate in such fields

OBSERVE

Startups are used as a pilot and observed to conclude on potential issues faced

CREATE

Regulations are created on-the-go depending on arising issues/need from observed activities

REFINE

Just like in a sandbox, regulations are created and refined continuously until a solid framework is reached

Source: Arthur D. Little analysis

Initiatives Detailing and Rationale

11

ICT objective	10	11	12	13
Responsible	Policy maker*			

Strategic initiative	4.1	Start-up funding & financing programs	Sub pillar	Company incubation

Objective & scope

- Initiate effective start-up funding & financing programs providing VC capital, alternate funding & financing mechanisms for tech startups, and incentives for investors

Deliverables & outcome

- Co-invest Startup fund established
- Financing products available from banking sector
- Stock market listing requir. updated

KPIs

- Startups financed by fund (#)
- Investment volume (OMR)
- Listed ICT companies on MSM (#)

Main activities

- Encourage global VCs to invest in Oman-based startups - build database of investors and proactively market startups to them
- Co-invest with established VCs in startups with relevance for Oman
  - Define categories of startups in which the government is willing to invest
  - Define VCs with whom the government is willing to invest
  - Define maximum co-invest percentage and investment caps
  - Develop standard terms & conditions reference model for investments
- Develop ICT start-up and SME database, accessible to potential investors
- Identify ICT start-up specific financing products required and collaborate with Central Bank for banks to offer the products (e.g. project financing, exim products)
- Collaborate with stock exchange to facilitate startups to list on the stock exchange and raise capital to identify their value

Required capabilities

- Funding and startup knowledge
- Promotion & marketing

Dependencies & risks

- Allocation of funds
- Availability of relevant and innovative startups
- Central Bank and stock market regulator (MSM)

Timeline & budget

Key activities	2019	2020	2021	2022	2023
Project setup & planning					
Launch program					
Manage program					
Update program					

Budget (in mOMR)	-	11.47	11.88	12.23	12.52

*) Today, 'policy maker' would imply MOTC and ITA. However, we propose a revision of the sector governance (initiative 14.1) to have a holistic and mutually exclusive governance with a single entity on top accountable for policy making and sectorial promotion.

The Korean government now initiates several programs to foster the ICT start-up ecosystem through an array of agencies

Case Study: Government powered ICT ecosystem

EXAMPLE

KISED

- Program to **foster start-up ecosystem** with measures comprising several policies:
  - Start-up education (university & school)
  - Start-up infrastructure/ university network
  - Commercialization
  - International exchange

Startup Visa

- OASIS – new startups **VISA program** for foreigners
- Program eases to get **working visa** for Korean tech start-up
- **Eased process** for creative and talented start-ups with **no patent** to fulfill the requirements

STARTUP ALLIANCE

- Program aims at being a **connector** for start-ups with established ICT companies and helps Korean startups go global
- **Initiatives:**
  - Seminars/ conferences
  - Networking/ meetup
  - Support in global expansion
  - Advocacy activities

Key learnings

- **Government initiates several programs to foster start-up ecosystem** in South Korea through multiple agencies:
  - Funding for start-ups
  - Entrepreneurship education
  - Ease business formation process for local and international entrepreneurs
  - International exchange
- Despite the government's efforts, **several obstacles in the ICT ecosystem exist:**
  - Regulation/ legal barriers in implementing creative services
  - ICT manpower shortage
  - Concentration of start-ups on software and applications

Source: KISED website, Start-Up Alliiance website, The Korea Herald, The Wall Street Journal, Forbes, Arthur D. Little analysis

Enterprise SG's investment arm SEEDS Capital co-invests with private investors in local startups with strong IP and global market potential

Enterprise Singapore

SEEDS Capital

EXAMPLE

INVESTMENT PHILOSOPHY

As the investment arm of Enterprise Singapore, SEEDS Capital supports the growth of promising Singapore-based startups. We co-invest with independent investors in innovative startups with strong intellectual content and global market potential.

We partner startups to commercialise and expand globally by leveraging the expertise and strategic networks of our co-investment partners, in areas such as technology translation, commercialisation and market expansion.

INVESTMENT COMMITMENT

	General tech	Deep tech
Investment cap for each startup	S$2M from SEEDS Capital	S$4M from SEEDS Capital
Co-investment ratio (SEEDS Capital: co-investor)	7:3 up to the first S$250K from SEEDS Capital; 1:1 thereafter, up to S$2M	7:3 up to the first S$500K from SEEDS Capital; 1:1 thereafter, up to S$4M

Network and reach

- 500+ deep tech startups, and over 40 incubators, accelerators and venture capital firms

Focus areas

- Advanced Manufacturing & Engineering (AME), Health & Biomedical Sciences (HBMS), and Urban Sustainability & Solutions (USS), other emerging technologies such as Fintech, AI, and Agri-tech

Co-investment approaches

- With appointed co-investment partners in strategic, nascent industries:
  - Partners appointment through Calls-For-Proposals
- With other third party co-investors into startups in all industries:
  - Startups may approach SEEDS Capital for co-investments with third-party co-investors
  - Assessing eligibility of co-investors and startups

Source: Enterprise Singapore, Arthur D. Little

Initiatives Detailing and Rationale

11

ICT objective	10	12	13
Responsible	Policy maker*		

Strategic initiative	4.2	Private sector capacity to incubate businesses	Sub pillar	Company incubation

Objective & scope

- Enhance private sector capacity to incubate businesses

Deliverables & outcome

- Matchmaking network

KPIs

- Incubation partnerships (#)

Main activities

- Prepare list of screened start ups with understanding of their incubation needs, e.g. physical space, knowledge/mentorships, access to markets, etc.
- Identify list of potential private incubators across sectors
- Monitor the ICT sector to identify collaboration opportunities between startups and potential private sector incubators/corporate venturer
- Facilitate joint product/innovation partnerships and/or reselling opportunities between our startups and corporations

Required capabilities

- Stakeholder management
- Matchmaking capabilities

Dependencies & risks

- Willingness of private sector to spend effort
- Willingness of startups to engage with large Omani companies

Timeline & budget

Key activities	2019	2020	2021	2022	2023
Project setup & planning					
Launch program					
Manage program					

Budget (in mOMR)	1.16	0.12	0.12	0.12	0.12

*) Today, 'policy maker' would imply MOTC and ITA. However, we propose a revision of the sector governance (initiative 14.1) to have a holistic and mutually exclusive governance with a single entity on top accountable for policy making and sectorial promotion.

Gov't backed online database Startup SG Network enables local players across 30 tech sectors to profile, connect and seek partnerships

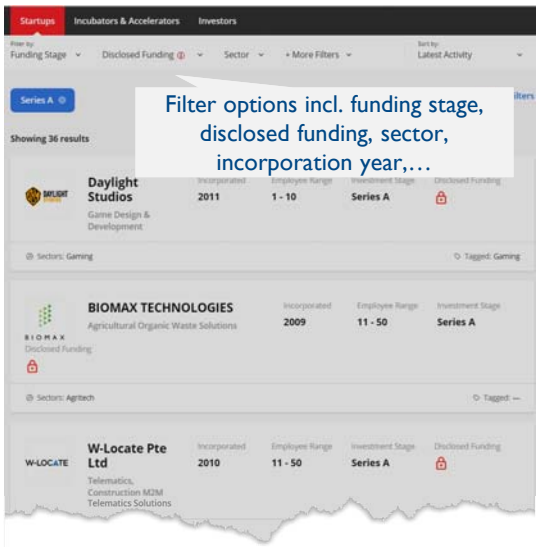
STARTUP SG NETWORK

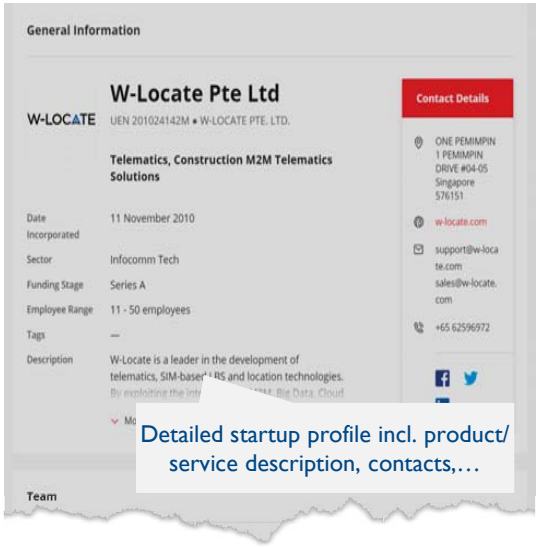
Startup SG Network

EXAMPLE

DIRECTORY

~3,000 startups whose profile are automatically ported to the network if they are registered on ACRA*



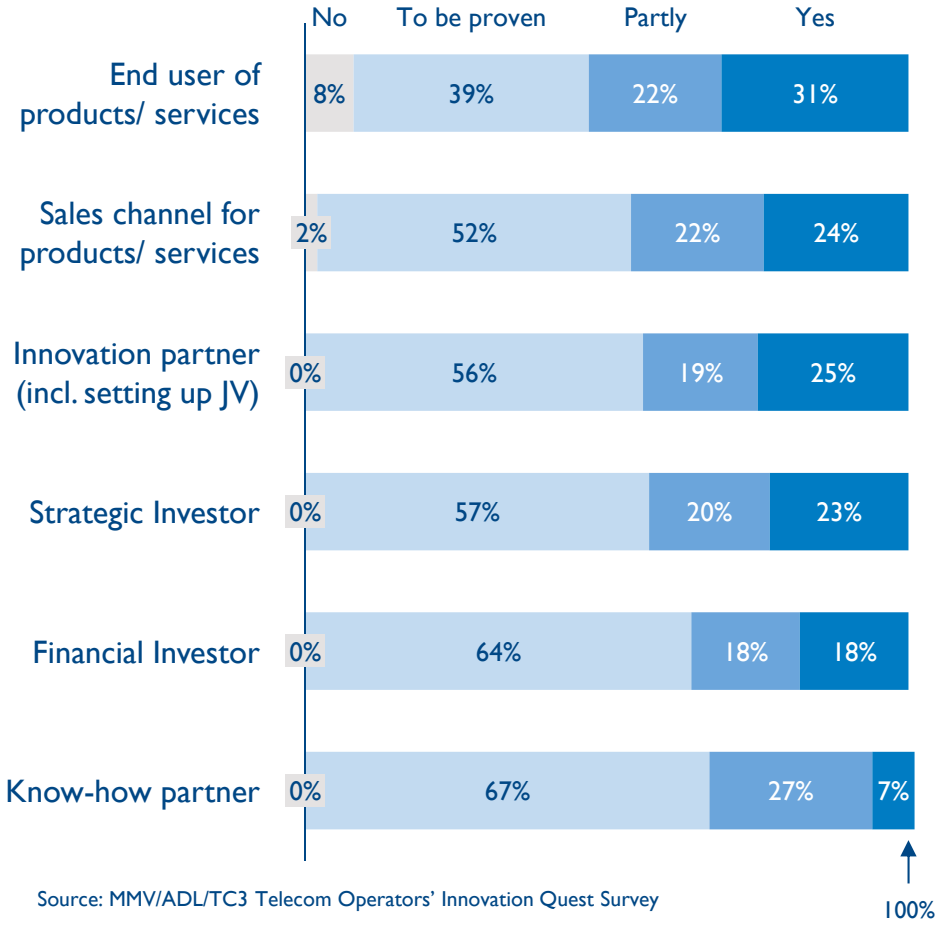


- **Bridges the gap** between startups and investors
- Provides **three directories**, i.e. startups, incubators & accelerators, and investors with detailed profiles
- Additional **programs** to support startups E2E:
  - **Founder**: mentorship capital grant to first-time entrepreneurs with innovative business ideas, i.e. will **match $3 for every $1 raised** by the entrepreneur
  - **Infrastructure**: Provides startups with the **spaces** that they need to grow, experiment and flourish
  - **EntrePass**: Facilitate the entry and stay of global entrepreneurial talent who can complement our local skillsets
  - **Loan**: Government-backed loans, i.e. Micro loans and venture loans

Source: Startup SG Network, Arthur D. Little
*) Accounting and Corporate Regulatory Authority

Established private sector companies and startups could both benefit from match-making and incubation

Key Priorities from Startups' Perspective



Source: MMV/ADL/TC3 Telecom Operators' Innovation Quest Survey

Key benefits for established companies

- **Startups as opportunities to embrace** as opposed to considering them as threats
- **Focus on Joint value creation** rather than owning
- Startups rooted inside or **working with / for your business**
- **Business units closely involved** throughout the entire process

Initiatives Detailing and Rationale

11

ICT objective	10	12	13	15
Responsible	Policy maker*			

Strategic initiative	4.3	Startup support in accessing new markets	Sub pillar	Company incubation

Objective & scope

- Promote startups and assist them in accessing new markets for their products

Deliverables & outcome

- Regular market studies/reports
- "Made in Oman"-label established
- Links between Omani start ups and foreign clients established

KPIs

- Startup revenue generated abroad (OMR)

Main activities

- Promote and provide marketing support for local ICT services/ products, software and apps, i.e. Government website with all applications "made in Oman"
- Mandate a proportion of government IT contracts to be sourced from local startups and SMEs
- Collaborate with Ithraa to identify opportunities for startups in global markets and support them (financially) in contacting potential customers, especially in Africa, ME
- Conduct market studies and publish reports (if export-oriented, team up with Ithraa) on hot topics and opportunities that Oman startups could focus on, e.g.
  - Become a hub for offering services and connectivity to Africa
  - Content hosting for Arab region
  - DR site for other countries, Arabic analytics, Arabic customization and software development)

Required capabilities

- Technological knowhow
- International networking
- Promotion & marketing

Dependencies & risks

- Execution alignment with Ithraa
- Startup capabilities and willingness to venture abroad

Timeline & budget

Key activities	2019	2020	2021	2022	2023
Project setup & planning					
Launch program					
Manage program					

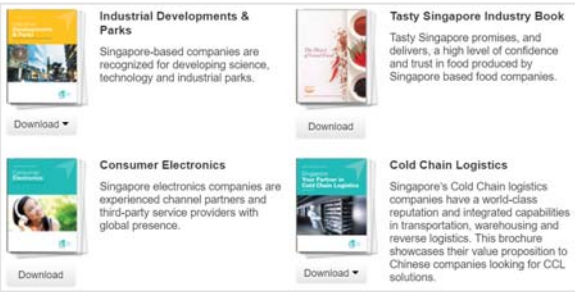
Budget (in mOMR)	-	0.47	1.87	1.87	1.87

*) Today, 'policy maker' would imply MOTC and ITA. However, we propose a revision of the sector governance (initiative 14.1) to have a holistic and mutually exclusive governance with a single entity on top accountable for policy making and sectorial promotion.

IE Singapore supports startups with various initiatives to access global markets

Creating awareness

Country and industry specific reports on overseas opportunities for Singapore SMEs



Industry specific reports targeted at foreign companies on how Singapore companies can support them in the region

Education and support

Export readiness assessment toolkit:
Online assessment tool to assess capabilities level for exporting

Export strategy workshops:
Assistance in identifying challenges and developing export strategies

Export clinics:
Providing training on technical and admin aspects of export operation

iAdvisory seminars:
Insights on market opportunities & challenges from industry experts

Market research workshops:
Coaching on conducting market research and access to tools

Overseas business matching:
Facilitate introduction of potential agents, customers to SMEs

Financial support

MRA

Market readiness assistance grant:
70% of eligible costs, capped at SGD 20K SGD per company per year to support new market entry, trade-fair participation, etc.

EDG

Enterprise development grant:
70% of costs such as 3rd party consultancy fees, software and equipment, and incremental internal manpower cost for venturing overseas

iMAP

International marketing activities program:
50-70% of eligible core expenses including exhibition rental space, booth construction, publicity and fair or mission consultancy costs

Source: IE Singapore, Arthur D. Little

The ministry should publish studies to enable the private sector to identify and invest in attractive opportunities

ICT sub-topics	Cost efficiency	R&D	Skilled resources	Low skill resources	Capital intense	Access	Overall attractiveness
HW design	○	●	●	◔	◔	○	Highly IP dependent
HW manufacturing	●	◑	◑	◕	●	○	Efficient machinery & labor required
HW sales	◑	○	◔	◑	○	●	Access to region for re-exports
HW servicing	●	◑	◑	◕	○	◑	Low value add, cost-focused
SW development	◑	◕	●	◔	◑	○	Attractive if innovative ideas are available
SW customization	◑	◔	◕	◔	◔	○	Attractive; skill enhancement required
SW testing	◑	◔	◑	◔	◔	○	Attractive; skill enhancement required
SW integration	◕	◔	●	◔	○	●	Difficult to compete with low cost markets
SW maintenance	◕	○	●	◔	○	●	Difficult to compete with low cost markets
E-commerce service	◑	◔	◕	○	◔	◕	Attractive due to geographical location
Dig. content creation	○	○	●	○	○	●	Attractive due to linguistic advantage
Analytics solution	◑	◕	●	○	○	◑	Attractive for niche such as Arabic analytics
Call center solution	●	○	◑	●	◔	◑	Difficult to compete with low cost markets
DC & cloud solution	●	◔	◑	◔	●	◕	Attractive due to geographical location
Telecom services	◑	◑	◑	◕	●	●	Attractive for international transit
Oman's positioning	*Weakness compared to global markets*	*Weakness for mature tech.*	*Strength – in numbers*	*Not aligned with nat'l preferences*	*Uncertain*	*For Middle East & Africa*	

Source: Arthur D. Little

Low attractiveness Medium attractiveness High attractiveness

Initiatives Detailing and Rationale

ICT objective	10	14	16
Responsible	Policy maker*		

Strategic initiative	5.1	Incentive mechanisms for large ICT investors	Sub pillar	Company incentivization

Objective & scope

- Develop and implement incentive mechanisms applicable to large ICT investors

Deliverables & outcome

- Incentivization fund approved
- Free zones and/or digital corridors established

KPIs

- Companies in free zones/digital corridors (#)
- Local FANGA operations presence (#)

Main activities

- Obtain dedicated funds / budget to implement incentive mechanisms
- Establish ICT focused "free zones" / digital corridors - with benefits such as single window clearance, reduced rent and utilities, relaxed Omanization requirements, zero tax, simplified Visa process
  - Establish mechanisms in collaboration with ROP to offer special category of visas and long-term residence to experts/genius
  - Establish a team to support MoCI / Ithraa to establish single window clearance mechanism for large ICT investors
  - Establish local content requirements to obtain gov't subsidies to increase share in value chain
  - Provide Omani employees with salary paid by the government for certain period of time
- Revise FDI policies with respect to foreign ownership, e.g.
  - Review upper foreign investments limits/single largest shareholder
  - Assess on a case-by-case basis wherever it is likely an investment will result in access to modern technology

Required capabilities

- Stakeholder management, project management
- International relationships
- Promotion & marketing

Dependencies & risks

- Public funding
- Authorized to design, manage and implement incentives

Timeline & budget

Key activities	2019	2020	2021	2022	2023
Project setup & planning					
Launch program					
Manage program					
Update program					

Budget (in mOMR)	4.62	10.03	18.02	22.25	16.48

*) Today, 'policy maker' would imply MOTC and ITA. However, we propose a revision of the sector governance (initiative 14.1) to have a holistic and mutually exclusive governance with a single entity on top accountable for policy making and sectorial promotion.

Entrepreneurs and business owners can take their company to one of the many freezones in UAE, where 100% ownership can be maintained

Freezone attractiveness for FDI

ICT freezones in offer a range of incentives for firms to set up shop within them, including:

- 100% exemption from personal income tax and corporate taxes for 50 years with a possibility of 100% ownership
- Complete repatriation of profits
- Digital voice and high-speed data networks offered at competitive prices
- One-stop-shop service dealing with the administrative and regulatory side of doing business

Source: Oxford business group

ICT freezones

DUBAI INTERNET CITY

Dubai Internet City is Middle East's largest Free zone IT setup with intent to help telecom and IT business flourish offering retail products and advertisement services in large business parks

DUBAI OUTSOURCE CITY

Dubai Outsource Zone supports outsourcing business set ups in call center, business processes, human resource, information technology and back office operations

Dubai Silicon Oasis Authority

Silicon Oasis authority is the place for all technology driven modern industries in information technology space like E- services, data centers, telecoms, networking, etc.

*In 2004, the DIC formed the **Dubai Outsource Zone (DOZ),** which together with the DIC now makes up **TECOM's ICT cluster** – the **largest** in the **MENA** region*

A potential investigation area for setting up a ICT free zone is the area between Al Madam and Hatta, which is separated by Oman

CONCEPTUAL

Potential ICT free zone area outside Muscat

Description

- A **potential area for a free zone** outside Muscat could be the **area around Highway 5** (E44) on the Omani side, between Al Madam and Hatta
- **Vast, cross-border commuter belt** (~100 km) of more than 4.5 mn people
- **Credible alternative** for Omani commuting on a daily basis from Sohar and other northern cities **to Muscat**

Obstacles

- Al Madam and Hatta **country border opening** (30 minutes time saving)

Source: Arthur D. Little

Initiatives Detailing and Rationale

11

ICT objective	10	14	16
Responsible	Policy maker*		

Strategic initiative	5.2	FDI promotion	Sub pillar	Company incentivization

Objective & scope

- Promote Oman as destination for FDI to increase maturity of ICT sector facilitated by foreign know how and funds

Deliverables & outcome

- FDI policies updated
- Made in Oman fund established

KPIs

- ICT sector FDI inflow (OMR)

Main activities

- Undertake marketing and promotional activities focused on ICT sector opportunities
- Collect information and publish reports on the status of the ICT sector and the opportunities available periodically

Required capabilities

- Promotion and marketing capabilities

Dependencies & risks

- Funding
- Inter and Intra agency coordination, e.g. Ministry of Finance, Ministry of Commerce

Timeline & budget

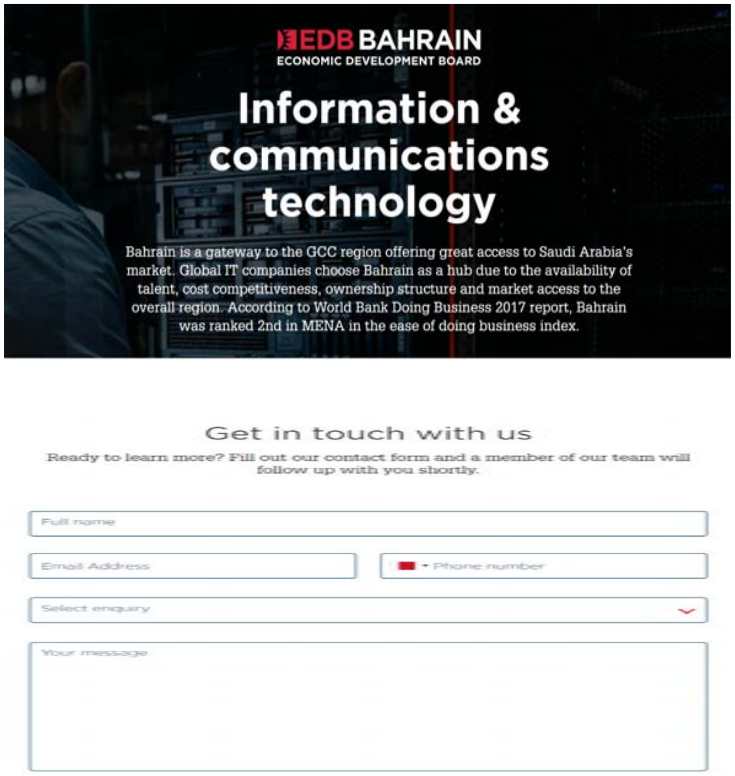
Key activities	2019	2020	2021	2022	2023
Project setup & planning					
Launch program					
Manage program					
Update program					

Budget (in mOMR)	0.19	2.16	2.16	2.16	2.16

*) Today, 'policy maker' would imply MOTC and ITA. However, we propose a revision of the sector governance (initiative 14.1) to have a holistic and mutually exclusive governance with a single entity on top accountable for policy making and sectorial promotion.

Countries in the GCC are actively engaging in both push and pull marketing for FDI to attract and facilitate investments in the ICT sector

Marketing for ICT FDI : Bahrain (Example)



Push

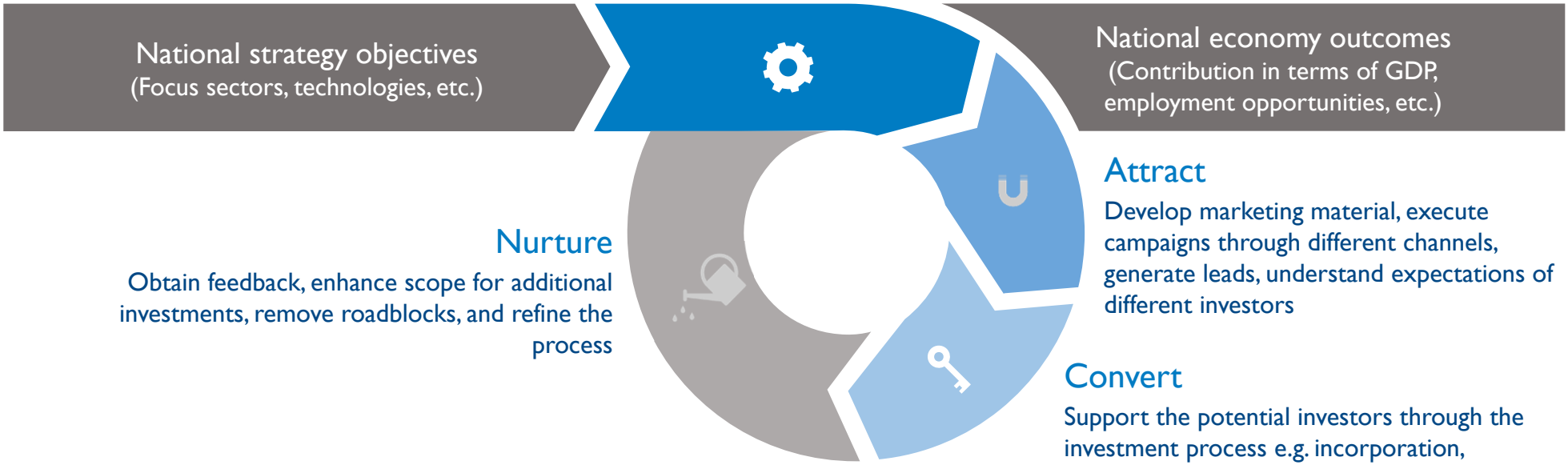
Actively contacting potential investors and improve awareness and visibility of the market for FDI

Pull marketing

Dedicated channels available for Investors who are attracted towards the country to establish contact, understand the processes and start with the investment process

Source: EDB Bahrain, Arthur D. Little analysis

The marketing efforts consist of multiple steps, starting with the national ICT strategy and ending with outcomes for the national economy



Source: Arthur D. Little analysis

The components of the marketing should be customized for ICT sector, starting from defining the audience to following-up on marketing activities

Components of communication

1 Target Audiences

- In which areas do we want to attract investments? e.g. telecom infra, innovative solutions, ICT services
- What are the companies to be involved? e.g. Microsoft, Amazon, telecom operators, start-ups, …
- Who needs to be involved or informed and to which extent? e.g. coordinating with ITHRAA for events, with MOCI during the convert phase, with industry regulators for updating policies / making concessions, etc.

2 Messages

- What are the advantages Oman can offer specifically in terms of ICT? e.g. high speed connectivity to most of the world, human capital in terms of ICT engineers, cybersecurity infrastructure, …
- What are the advantages Oman can offer in general? e.g. stable environment, investor protection, business-friendly policies, lifestyle for owners and employees, etc.
- What opportunities we want to highlight to different audiences? e.g. ICT solutions for O&G industry

3 Channels/ Events

- Which communication channels/events are specifically selected for each audience? e.g. engaging directly with relevant HQ units of global firms, expos, investor forums
- Which messages are to be communicated in each channel? What should be the timing for each message?
- What are the channels for outside-in communication to receive requests and follow up on them?

4 Follow-up

- What are the support mechanisms available for investors, if they want to follow up on the communication through various channels?

Source: Arthur D. Little analysis

The ICT sector should have dedicated resources to develop and execute the marketing activities for attracting investment into the sector

Strategy & processes

- ICT sector needs a strategy to identify focus areas for industry development – already in progress through the National ICT Strategy Framework development
- Processes need to established to conduct the marketing activities in a well-defined manner, across multiple stakeholders

Budget

- A budget should be defined for the ICT sector to engage in marketing activities in targeted markets to attract investments

Resources

- Dedicated resources within the sector are required, as they would be more aware of areas / opportunities where foreign investments could be solicited
- Dedicated teams and resources are required for the sector to: conduct research and develop material, coordinate with other local agencies to facilitate on-ground activities, follow-up on leads, etc.

Source: Arthur D. Little analysis

Initiatives Detailing and Rationale

11

ICT objective	10	12	16	28
Responsible	Policy maker*			

Strategic initiative	6.1	New technology testbed & research funding	Sub pillar	Technology innovation

Objective & scope

- Establish funds to offer testbeds and perform R&D for new technologies in cooperation with global ICT companies

Deliverables & outcome

- Research centers established

KPIs

- Research centers (#)
- FDI in research centers (OMR)

Main activities

- Identify major challenges/ research problem faced by industry to be solved through ICT, which are of mutual interest to international firms
- Interact with potential companies to fine tune
- Catalyze and orchestrate R&D activities towards industry development outcomes and to achieve economic impact
- Provide partial funding of facilities, equipment, ongoing cost, etc.
- Mandate Omani research trainees/scientists to be part of the research team with financial incentives
- Support new and, if available, existing private sector R&D programs, which have demonstrated strong performance w.r.t to industry potential

Required capabilities

- Understanding about new technologies
- Global networking skills
- Basic and applied research

Dependencies & risks

- Reluctance of funding requirements without immediate financial impact/business case

Timeline & budget

Key activities	2019	2020	2021	2022	2023
Project setup & planning					
Launch program					
Manage program					
Update program					

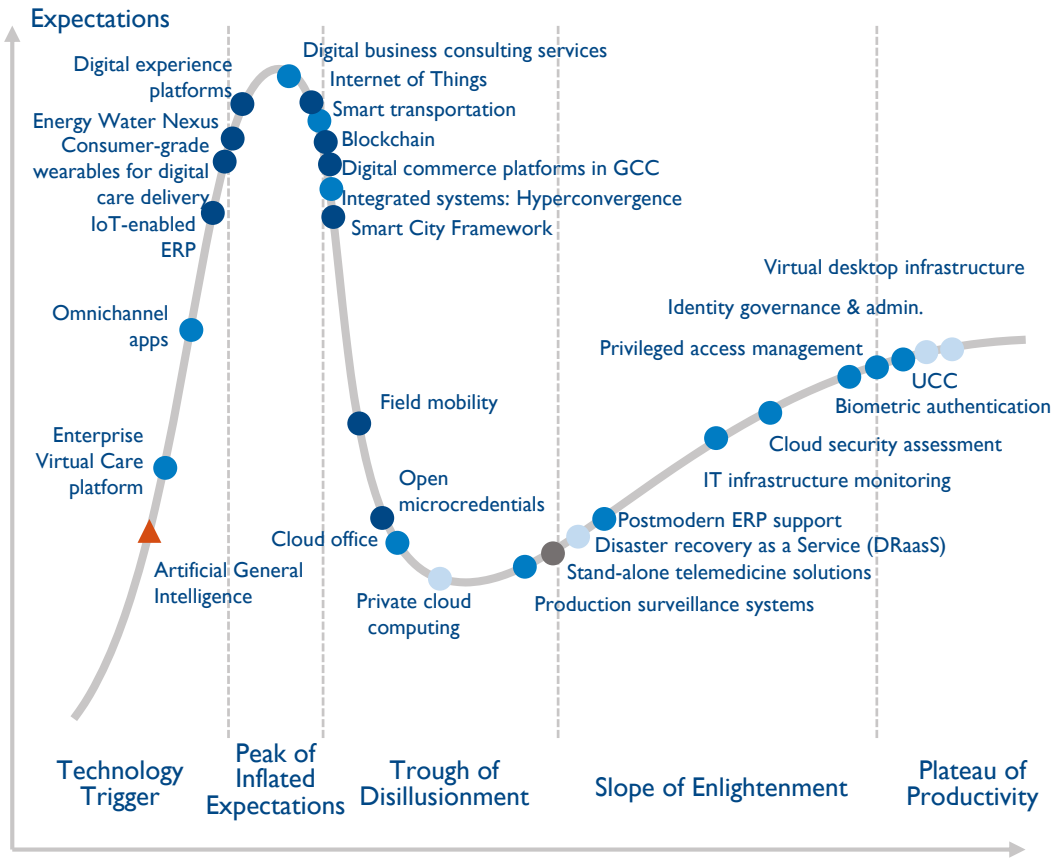
Budget (in mOMR)		6.29	6.66	6.81	7.01

The ICT Hype Cycle for Middle East highlights that traditional software activities are highly relevant for the market

ICT Hype Cycle for GCC

July 2017

CONCEPTUAL



Source: Gartner, Arthur D. Little

less than 2 years | 2 to 5 years | 5 to 10 years | more than 10 years | obsolete before plateau

- Most activities in the Middle East are focused on **traditional software activities**
- **Very few core ICT technologies** in the Hype Cycle are **considered as new** and upcoming globally

Implications

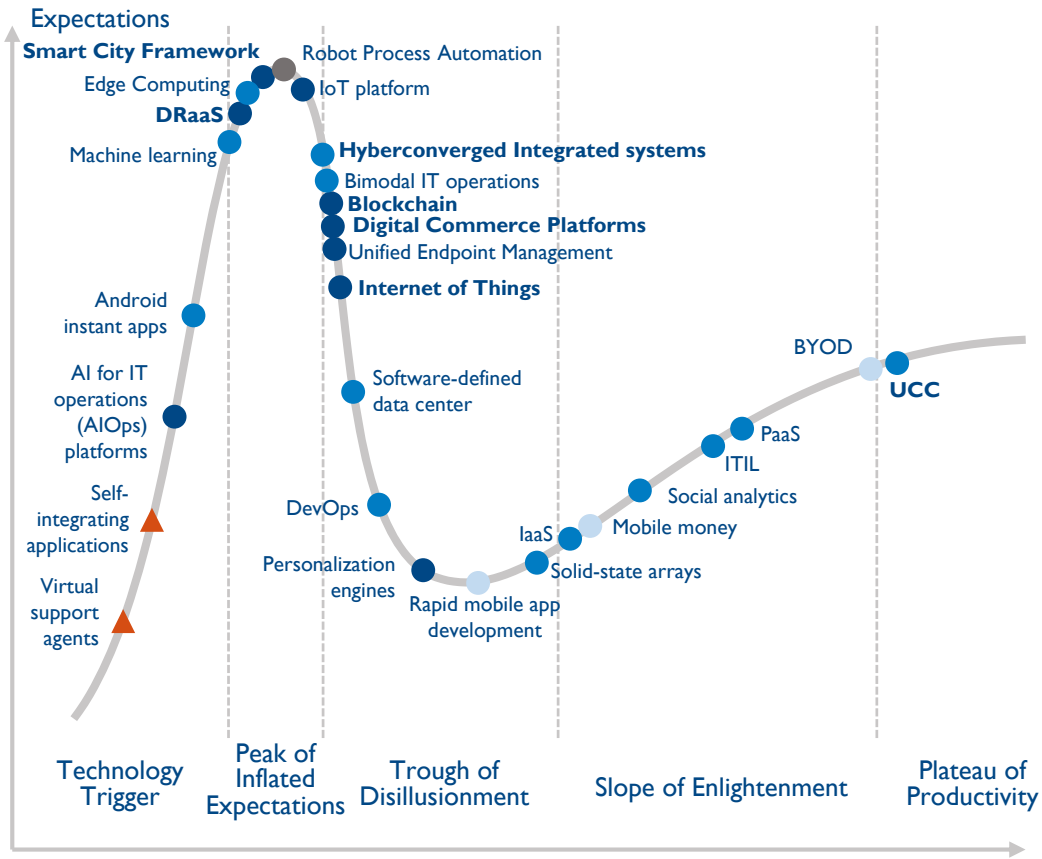
- Serving local/regional demand requires Oman to **focus on traditional software activities**
  - **Software development** on these technologies are **advanced in other markets,** offering **no advantages to Omani companies**
  - **Testing, customization**, etc. are areas which Oman could focus on in the local and regional market

We believe it is worthwhile to also look at other ICT focused emerging economies to get a better view on what is on the global CIO agendas

ICT Hype Cycle for ICT focused emerging economy

CONCEPTUAL

July 2018



Source: Gartner, Arthur D. Little

Bold technologies are also covered in the GCC Hype Cycle

less than 2 years | 2 to 5 years | 5 to 10 years | more than 10 years | obsolete before plateau

- 28 key technologies and capabilities for digital transformation that are important for local Indian IT leaders
- Focus is on three stages of digital business delivery, i.e. (1) **designing**, (2) **delivering** and (3) **scaling**, the latter being the primary objective of Indian CIOs
- Doing it right requires **continued investment in proven technologies** and **balanced investment in emerging technologies** that sustain growth

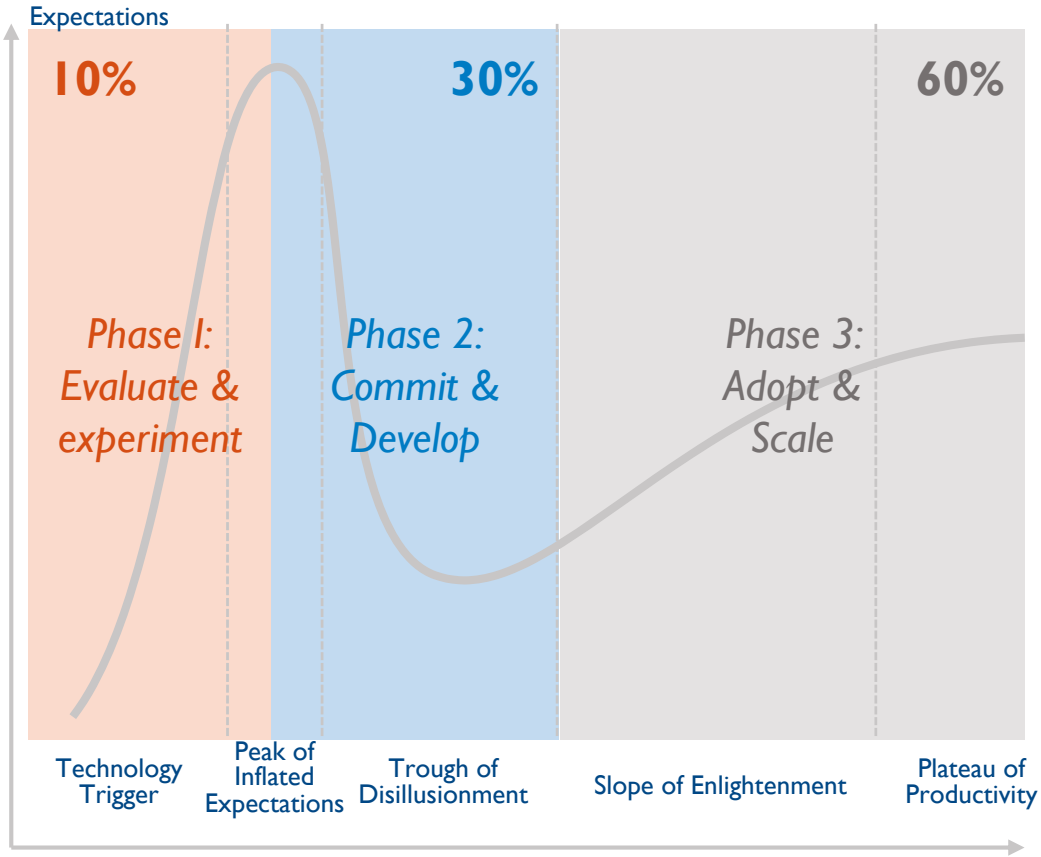
Implications

- Technologies are consistently on **different expectation level**
- **Limited overlap** between GCC and other Hype Cycles
- **Only broader terms**, e.g. Blockchain, Smart City Framework can be **overserved universally**

Rather than betting on a single technology, we propose to spread the risk by investing a 10-30-60 ratio into R&D and skill development

CONCEPTUAL

Investment ratio rationale per Hype Cycle expectation stage



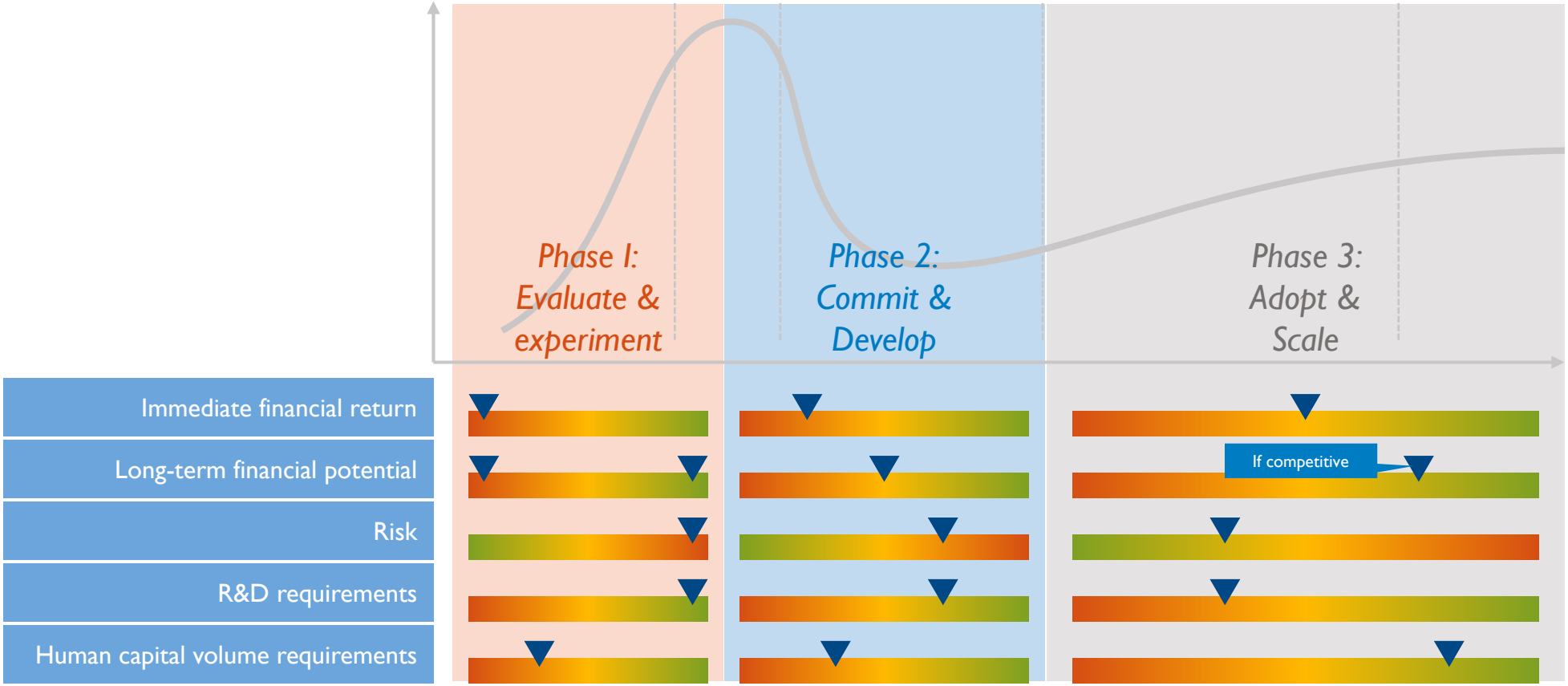
- Phase I (*Media-triggered publicity with a limited number of success stories*): Conduct **applied research** with limited resources, scout for venture opportunities
- Phase 2 *(Fading of fame with a steady path towards the vale of tears)* : Conduct **pilots** and establish **proof-of-concept gateways**, i.e. go vs. no-go
- Phase 3 (*Indicative technology benefits with gradual mainstream adoption*): Review **applicability**, make **adoption decision** and scale with quick **skill-enhancement and training programs**
- Investment ratio rationale considerations
  - Short-term financial return
  - Long-term financial potential
  - Skill requirements
  - Technology requirements
  - Competitive intensity

Source: Arthur D. Little

Rather than betting on a single technology, we propose to spread the risk by investing a 10-30-60 ratio into R&D and skill development

ILLUSTRATIVE

Investment ratio rationale per Hype Cycle expectation stage



Source: Arthur D. Little

We recommend not placing all the bets on one or two technologies as the risks are potentially unlimited

Technology obsolescence and delays

Technologies **obsolete** before becoming mainstream

- Ultra-wide broadband
- RSS Enterprise
- 802.16 WiMax
- Desktop Linux for Business
- Mesh networks

Technologies **delayed** due to implementation constraints

- WS-Enabled Business Models
- Public Authentication Services
- Tera-Architecture

Technologies **hyped** for long, with recent progress

- Speech recognition
- Internet micropayments
- Data analysis

Technologies staying at **early stage** for long periods

- Quantum Computing
- Brain/Computer Interfaces (Human augmentation)
- Context delivery

Selecting technologies for investments and upskilling requires constant collaboration with the industry and need to be frequently updated

Source: Gartner Hype Cycles, Icon Ventures, Arthur D. Little

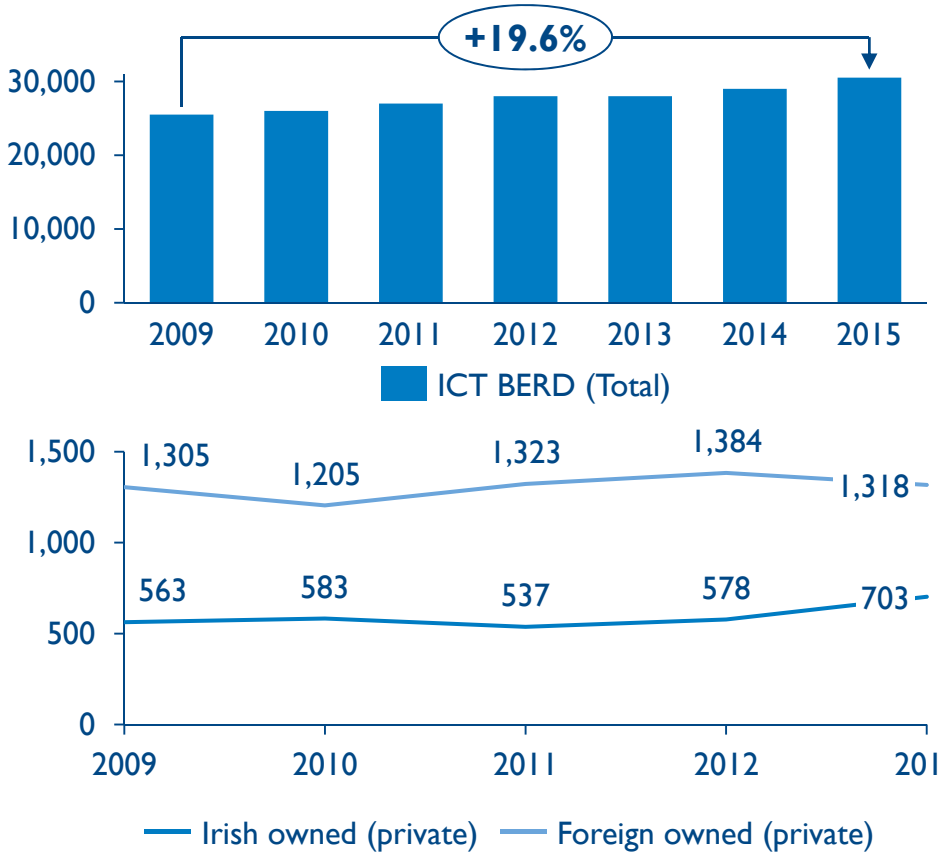
Ireland emphasizes on the importance of R&D and its contribution, and supports publicly-funded research centers for locals and MNCs

Research centers in Ireland

- The Government has provided funding to establish industry led research centers
- The centers are resourced by highly qualified researchers associated with institutions who are empowered to undertake market focused strategic R&D for the benefit of the industry
- This is a joint initiative between Enterprise Ireland and IDA Ireland allowing Irish companies and MNCs to work together in these centers

Business expenditure on R&D (BERD)

(EUR M)

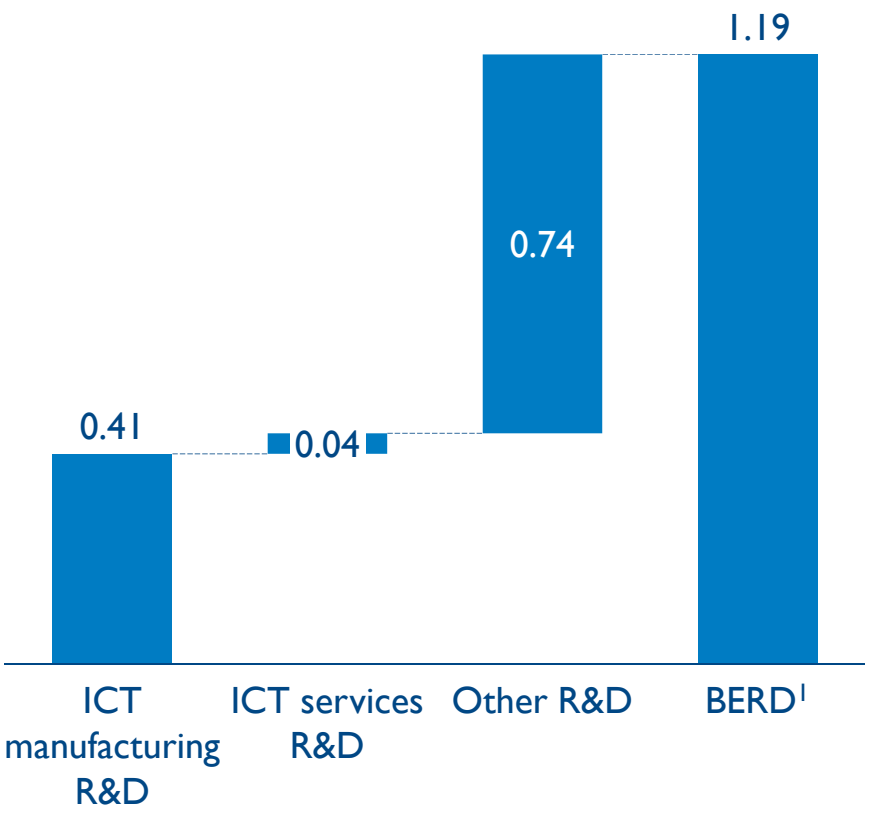


Source: European commission, Enterprise Ireland, IDA Ireland

Singapore also supports R&D in ICT through various initiatives funded by the Economic Development Board

R&D contribution to GDP

(%, 2015)



Latest initiatives

Fusionopolis:
World class science & technology research hub including institutes for data storage, infocomm, computing, manufacturing technologies, etc.

ECOLAB:
Integrated estate management systems, ICT integration, and energy management labs

NTU ecocampus:
Large scale integrated living labs for ICT integration, energy management, and e-mobility

A*STAR[2]:
Institute for infocomm research focusing on data mining, security (cryptography, digital forensics, image understanding, and language technologies

Source: OECD, Economic development board Singapore
[1]Business Expenditures on R&D
[2]Agency for science, technology, and research

A good example is Singapore which focuses on specific initiatives for industry collaboration and economic outcomes

White space: To support large scale funding initiatives for breakthrough solutions supporting national priorities (benefits realized in 5-10 years)

Urban Solutions & Sustainability	Health & Biomedical	…	Services & Digital Economy

Industry alignment fund – Collaboration Project

To develop, integrate digital innovation capabilities to meet national priorities, raise productivity and support key services, create sustainable economic opportunities and high quality jobs.

Academic research: To foster academic research (multi-disciplinary, independent, and support for principal investigators)

Innovation & enterprise: To enhance the maturity of upstream IPs and drive industry adoption

Manpower: To develop young scientific talent through scholarships and PhD training programs

Purpose:
- Develop industry-ready capabilities in alignment with public sector research
- Develop multidisciplinary integrated programs with early industry involvement
- Supports programs demonstrating strong track record of success and industry potential

Criteria for support:
- Potential for industry development and economic impact
- Alignment to domain strategic objectives
- Value creation and value capture in Singapore
- Attract corporate R&D spending and investments
- Differentiation and competitiveness at regional or global level

Who is eligible?
- Public research institutions in collaboration with corporates

Source: RIE 2020, A-Star Singapore, Arthur D. Little analysis

Initiatives Detailing and Rationale

11

ICT objective	10	12	16	28
Responsible	Policy maker*			

Strategic initiative	6.2	Grant and patent support program	Sub pillar	Technology innovation

Objective & scope

- Launch a grant and patent support program to fund research and patent development (for universities and private sector companies) focused on problem solving through digital

Deliverables & outcome

- IP promotion committee
- IP promotion platform

KPIs

- ICT-related patents (#)

Main activities

- Establish IP promotion committee
- Committee to establish a process for evaluating IP and if considered worthwhile, provide support for registration including in US if worthwhile
- On successful registration of IP, innovators get financial award and recognition
- A monthly list of innovators published on Ministry of Science and Technology website
- On successful registration of X or more IP, admitted to national hall of fame with a significant monetary award

Required capabilities

- Understanding about new technologies
- Funding allocation mechanisms, policies & procedures
- IP protection laws

Dependencies & risks

- Local research centers/testbeds
- Possibility of research replication

Timeline & budget

Key activities	2019	2020	2021	2022	2023
Project setup & planning			■		
Launch program			■		
Manage program			■	■	■
Update program					

Budget (in mOMR)			3.85	3.85	3.85

*) Today, 'policy maker' would imply MOTC and ITA. However, we propose a revision of the sector governance (initiative 14.1) to have a holistic and mutually exclusive governance with a single entity on top accountable for policy making and sectorial promotion.

IP Reach is an Int@J initiative to connect ICT IPs from Jordan with potential customers

EXAMPLE

Int@J IP Reach

Sector specific ICT solutions

Attachment possibility for company market material

Brief solution description incl. number of clients and quotation request

- Int@j's IP Reach initiative provides **direct access to ICT IPs in Jordan from different sectors** (Health, education, research, insurance, entertainment, media, etc.)
- Int@j is also responsible of **organizing existing IPs and introducing emerging ones**, thus encouraging under-promoted conceptual and technical assets

Source: int@j IP Reach, Arthur D. Little

Initiatives Detailing and Rationale

11

ICT objective	10	12	16
Responsible	Policy maker*		

Strategic initiative	6.3	Crowdsource technology R&D	Sub pillar	Technology innovation

Objective & scope

- Develop initiatives to crowdsource technology R&D to enable innovative products and solutions to be created by startups

Deliverables & outcome

- Open Innovation and Crowdsourcing platform

KPIs

- Submitted and solved challenges (#)
- Submitted solution propositions (#)
- Participating enterprises and solvers (#)

Main activities

- Private and public sector list of ICT technical challenges that they need to be crowd sourced and the economic impact it would have if a solutions is found
- ICT Ministry evaluates the suggestions and develop a custom program in terms of the prize, duration and any other criteria
- For each program, establish a committee to manage the program which include the concerned ministry and company
- Publish a program on the website (platform)
- Evaluate the inputs
- If IP is developed, register the IP jointly with the innovator

Required capabilities

- Promotion and awareness
- Stakeholder coordination and management

Dependencies & risks

- Involvement and participation of private sector and individuals

Timeline & budget

Key activities	2019	2020	2021	2022	2023
Project setup & planning					
Launch program					
Manage program					
Update program					

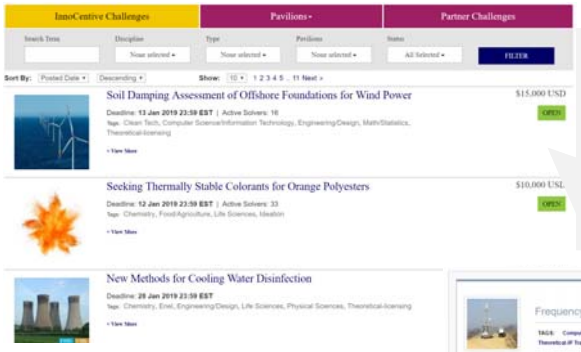
Budget (in mOMR)		0.39	0.39	0.39	0.39

*) Today, 'policy maker' would imply MOTC and ITA. However, we propose a revision of the sector governance (initiative 14.1) to have a holistic and mutually exclusive governance with a single entity on top accountable for policy making and sectorial promotion.

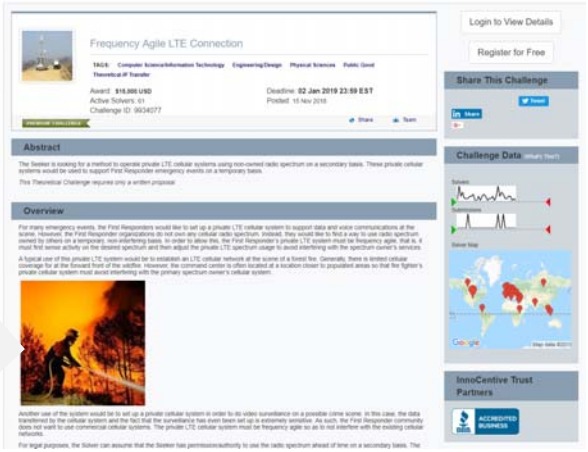
Innocentive is an open innovation and crowdsourcing platform for organizations to put their unsolved problems out to the crowd

EXAMPLE

Innocentive Open Innovation and Crowdsourcing



Challenge Center for challenges overview incl. search terms, discipline, type and reward



Detailed challenge description incl. number of active solvers and challenge, solver map and submissions

- **Open innovation and crowdsourcing** platform to enable organizations to put their unsolved problems and unmet needs, which are framed as 'Challenges', out to the crowd to address:
  - **Workshop** led by PhD-educated 'Challenge Experts' to identify and clearly define/formulate appropriate problems
  - **Submission within 1-3 months** with solutions varying from short proposals to experimentally validated solutions
- The platform as more than **390k 'Solvers' from 190+ countries**, with 60%+ Master's level and above
- Total of **2,000 challenges** run with 160k+ proposed solutions, and awarded more than 20m USD since 2001

*"There will always be **someone smarter outside of your team or organization**; getting a **diverse range of fresh perspectives** is **key to effective problem solving**"* – Alph Bingham, InnoCentive Co-Founder

Source: Innocentive, Arthur D. Little

Initiatives Detailing and Rationale

ICT objective	18	19
Responsible	Gov't CIO	

Strategic initiative	7.1	Government Transformation plan	Sub pillar	Gov't service enhancement

Objective & scope

- Refresh the Government Transformation plan based on the digital-first approach and complete the execution

Deliverables & outcome

- Digitization of government services

KPIs

- Government services requests fulfilled online (%)

Main activities

- Develop a digital-first approach to government services
- Define mandatory architecture, integration requirements, service levels and KPIs for e-government services
- Define and control budget for all e-government initiatives (across Ministries) and monitor/audit implementation (execution to be done by the Ministries)
- Mandate selected government services to be fully performed online
- Offer execution capabilities (through outsourcing to pvt sector) for Ministries to implement the e-government services

Required capabilities

- Business process reengineering
- Software development, vendor management
- Project management

Dependencies & risks

- Collaboration across ministries and public agencies incl. coordination of funding

Timeline & budget

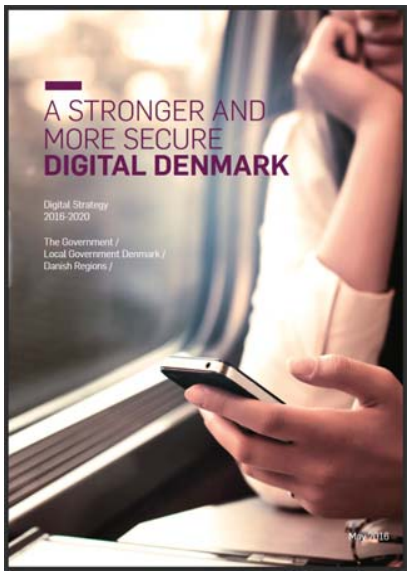
Key activities*	2019	2020	2021	2022	2023
Project setup & planning					
Launch program					
Manage program					

*) To be determined and aligned with existing ITA e-government transformation plan

Budget (in mOMR)	21	21	6	6	6

Denmark ranks #1 in e-government and aims to facilitate access and communication between citizens and the government through technology

E-government strategy



Denmark's digital strategy 2016-2020
Foundation for the central, regional, and local governments digitization

Initiative examples

Digital post
e Boks.dk

- Single digital letterbox for official communications with citizens
- Mandatory for citizens over the age of 15

NemID
NEM ID

- Official digital signature for public digital services (online authentication and confidentiality)
- Used for online banking, e-Boks (digital post), local public authorities self-services, insurance services, tax return
- 2-layer protection:
  - Password
  - Code card with 1 time codes
- PKI based technology

Source: Danish agency for digitization

Denmark has achieved advanced positioning in e-governance by addressing issues at the root-level

Cutting red tape

- New technology can simplify admin processes in public authorities:
  - Collecting/ providing data to public authorities to enhance efficiency
- Recognized equal importance of legislation in cutting red tape
  - New approach to legislation requiring laws written to be digitization-ready

Burden hunting

- Method to eliminate burdens (red tape) from businesses regulation:
  - Civil servants monitor businesses through interviews, mapping user journeys, etc.
  - Burdens are identified[1]
  - Suitable regulations are defined to simplify processes

Digitization-ready legislation

- Complex legislation[2] prevents efficient and digital public admin
- Legislation digitization allows simpler case processing
- As of summer 2018, legislation digitization became mandatory
- 7 defined principles for digitization readiness assessment

Mandatory digitization

- Gradual transition to mandatory digital self-services and communication
- Introduced in 4 waves with increasing number of services digitized at each wave
- Mandatory digital-only post (e-Boks)

Source: Danish agency for digitization

[1]Burdens can be as simple as finding the right NACE code at registration, or as complex as defining a suitable consumer law

[2]With several exceptions, vague terms or many procedural requirements

Self service was made mandatory for citizens for ~90 government services, and was implemented gradually through 4 phases

Wave 1, December 2012

1. Healthcare card
2. EU healthcare card
3. Admission to daycare
4. Admission to elementary school
5. Admission to after-school care
6. Enrolment in higher education
7. Change of address
8. Registration of outdoor activities
9. State education loan
10. Obtaining hunting license

Wave 2, December 2013

1. Financial support regarding a place in a day-care facility
2. Enrolment in after-school
3. Finan. sup for after-school
4. Finan. supp for funeral
5. Support towards AT[1]
6. Marriage condition verification
7. Change of naming
8. Duplicate driving license
9. Passport request
10. Private criminal record
11. Support from Danish arts Foundation
12. Support from Danish arts Council
13. Prints of income tax returns
14. Reopening complaint cases
15. Info on departure from DK
16. Info on government premises loaned and leased to citizens
17. Name/address protection
18. Loan for property tax
19. Info of general practitioners
20. Info on rats
21. Funeral/ cremation
22. Info on a stolen bicycle
23. Statement of paternity
24. Foreign income tax return
25. Advance tax assessment
26. Enlarged income tax return
27. Limited tax liability
28. Environmental complaints

Wave 3, December 2014

1. Building planning permission
2. Designation of premises and outdoor areas
3. Parental responsibility, child's residence, contact with child
4. Legal separation, divorce, maintenance payments
5. Paternity/co-maternity statements
6. Adoption
7. Child support
8. Maintenance payments during marriage
9. Tenant deposit loan
10. Special use of private shared roads (digging, works)
11. Special use of public roads
12. Parking permits
13. Housing benefits
14. State pension
15. Deferred pension
16. Disability pension calculation
17. Collection of maint. payment
18. Child allowance, etc.
19. Heating allowance
20. Maternity/paternity benefits
21. Children/youth allowance
22. Info on weapons/ explosives
23. Info waste mgt.
24. People registered at address
25. Local directory and marketing protection
26. Isolated unprotected standard information from the CPR[2]
27. Attestations under the Civil Registration System Act

Wave 4, December 2015

1. Sickness benefit
2. Personal allowance
3. Health allowance
4. Increased health allowance
5. Aviation certificates
6. Driver's certificate (bus)
7. Driver's certificate (freight)
8. Subsidize medicine purchased in other EU country
9. Residence permit extension with spouse reunification
10. Extension of child's residence with family reunification
11. Permanent residence because of asylum/ family reunification
12. Passport for foreigners
13. Regist. for hunting license test
14. Access to records at Danish National Archives
15. Retrieve child protection certificate
16. Access to data in the CPR
17. Retrieval of criminal record
18. Authorization for pesticide/ herbicide spraying personnel and vendors
19. Reporting to The Register of Voluntarily Barred Gamblers
20. Reporting a game bag
21. Airline passenger complaint
22. Appeal to patient compensation board on decisions of patient compensation association
23. Complaint against health personnel to disciplinary board
24. Complaint against health services to national agency for patients' rights and complaints
25. Reporting inadvertent incident to patient safety database

Source: Source: Danish agency for digitization
[1]Assistive technology
[2]Danish civil registration system

Application *Request* *Payment* *Reporting/ complaints*

Initiatives Detailing and Rationale

ICT objective	17
Responsible	Gov't CIO

Strategic initiative	7.2	Open data policy and databank	Sub pillar	Gov't service enhancement

Objective & scope

- Develop open data policy and databank road map covering various datatypes (static and real-time data, availability, accessibility, etc.)

Deliverables & outcome

- National Open Data policy
- Dedicated Open Data portal

KPIs

- Worldwide rank in Open Data Index
- # of datasets available on portal
- # of apps/ services using open data (in #)

Main activities

- Mandate the establishment of an open data platform providing access to static and real-time data
- Develop national Open Data strategy & development plan to create an Open Data ecosystem betw. governm., private sector, developers, academia, media practitioners, citizens and civil society organizations
- Develop national Open Data policy & legislation
  - Clarify data ownership and usage
  - Clarify data classification and privacy
  - Guidelines and mandate to share information
- Develop central digital Open Data platform to make data available for re-use for innovative mobile and web applications
  - Increase # of available datasets
  - Ensure timely availability of data (as well as real-time data)
  - Provide APIs for developers
  - Enhance program with private data
- Define and manage the budget for the implementation and monitor the execution by NCSI

Required capabilities

- Project management and coordination skills
- Technical management incl. data base planning, data management and web development

Dependencies & risks

- Alignment with eGovernment and NCSI initiatives, collaboration with gov. entities
- Data privacy and protection laws

Timeline & budget

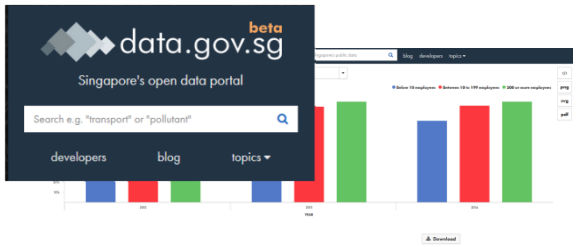
Key activities	2019	2020	2021	2022	2023
Project setup & planning					
Launch program					
Manage program					

Budget (in mOMR)	0.96	2.89	-	-	-

Singapore's open data platform aims to provide businesses or individuals access to public data

Open Data – data.gov.sg

Open Data platform



- Launched in 2011 as an initiative by the Ministry of Finance and managed by IDA
- **>8,800 datasets** from 70 public agencies
- Data sets are categorized to 8 categories, such as Economy, Education, Environment, Finance, Health, Infrastructure, Society, Technology, Transport
- Portals offers possibility to download datasets (as CSV) and an API for developers
- **>100 apps have been created** using government's open data

OneMap

- OneMap is **a geospatial data sharing platform** – an integrated map system for government agencies to deliver location-based services and information
- It is used by the private sector and the community to create useful and value-added services
- OneMap offers **its real-time data** through APIs for developers

Key learnings & implications

- Open Data is **an important input factor for value-adding services and apps**
- Open Data portals and policies have to **go beyond a digital data repository** – offering data in easy accessible, machine readable, up-to-date or even real-time format
- **Collaboration and participation across public agencies** has to be ensured to create a relevant dataset – shared Open Data policies and principles are an appropriate means

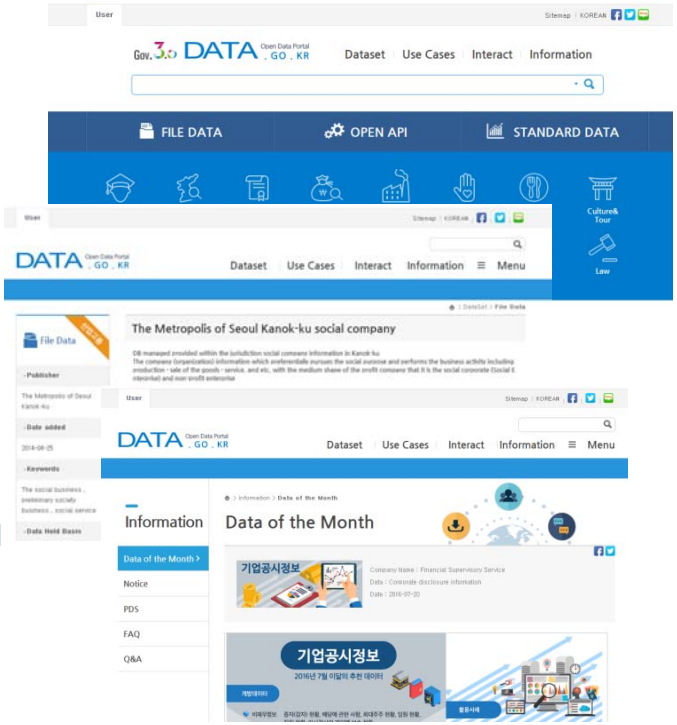
Source: IDA, data.gov.sg, Singapore Land Authority, Arthur D. Little analysis
Note: Singapore selected for benchmarking as it is a global leader in ICT

Korea passed a bill in 2013 with the citizens' right to use open data, after which gov't agencies shared data & contributed to the Open Data Portal

Open Data – data.go.kr

Open Data platform

- Open data ecosystem in Korea started from **Act on Provision and Active Use of Public Data** enacted on June 27, 2013
  - Citizen's right to use open public data
  - Mandate public sectors incl. government agencies and quasi-public organizations to provide data
  - Establishment of Open Data Strategy Council
- Principal agency is the Korean Ministry of the Interior (MOI)
- National Information Society (NIA) Open Data Center under the MOI provide specific policy and technical support
- Increase of open data rate from 16.1% in 2013 to about 50% in 2015
- Currently there are **9,259 sets of government data available** – from 16 categories



Source: Gov.lab, Data.go.kr, Open Data 500, Arthur D. Little analysis
Note: Korea selected for benchmarking as it is a global leader in ICT

Key learnings & implications

- An Act is the basis for further initiatives as the development of an Open Data Portal – **a government-led initiative** to create value-add services in the country
- **Expert organizations** help to enforce the policies and ensure government agencies are sharing their data

Initiatives Detailing and Rationale

ICT objective	20
Responsible	Policy maker*

Strategic initiative	8.1	Digital inclusion fund	Sub pillar	Digital people inclusion

Objective & scope

- To financially support initiatives designing, researching or delivering digital inclusion programs

Deliverables & outcome

- Digital inclusion fund

KPIs

- Internet users (%)
- Funded projects/initiatives (#)
- Released funds (OMR)

Main activities

- Create and finance the Omani Digital Inclusion Fund
- Determine application parameters and criteria, i.e.
  - Who can apply? E.g. charities, not-for-profit organization, social enterprises
  - Where? E.g. Limited to rural/remote areas
  - Maximum amount
  - Duration of funding
- Develop application scoring criteria for releasing funds, e.g.
  - Idea
  - Outcomes for targeted groups
  - Alignment with wider agendas
  - Value for money
  - Robustness/Evidence for evaluation

Required capabilities

- Project management
- Funding allocation mechanisms, policies & procedures
- Business case, financial modeling understanding

Dependencies & risks

- Funding

Timeline & budget

Key activities	2019	2020	2021	2022	2023
Project setup & planning					
Launch program					
Manage program					

Budget (in mOMR)	Dependent on other initiatives in this subpillar

*) Today, 'policy maker' would imply MOTC and ITA. However, we propose a revision of the sector governance (initiative 14.1) to have a holistic and mutually exclusive governance with a single entity on top accountable for policy making and sectorial promotion.

Initiatives Detailing and Rationale

O

ICT objective 20

Responsible Policy maker*

Strategic initiative 8.2 ICT education centers and equipment

Sub pillar Digital people inclusion

Objective & scope

- Establish education centers and equipment to bridge digital divide

Deliverables & outcome

- ICT educational centers/facilities set up
- IT equipment distributed
- Digital champions/ambassadors appointed

KPIs

- ICT education centers/facilities (#)
- Distributed computers (#)

Main activities

- Review and align with existing inclusion efforts
- Make digital literacy easily accessible to communities and co-locate classes with services that complement broadband
  - Establish education centers in low income and rural areas and fund training programs for "left-out" segments
- Liaise with social service agencies, tribal leaders, community anchor institutions including community media organizations, libraries, faith-based organizations, schools, civil rights organizations and foundations
- Develop ambassadors within each community, and leverage the "train the trainers" concept to further spread knowledge and training
- Distribute free/low-cost refurbished computers

Required capabilities

- Project and stakeholder management

Dependencies & risks

- Cooperation of other public and private institutions
- Broadband availability in rural and remote areas

Timeline & budget

Key activities*	2019	2020	2021	2022	2023
Manage program					
Update program					

**) Existing ITA efforts and initiatives need to be considered. These should continue until end of 2019 and afterwards require a revision and alignment with overall strategy*

Budget (in mOMR)		4.83	4.83	4.83	4.83

*) Today, 'policy maker' would imply MOTC and ITA. However, we propose a revision of the sector governance (initiative 14.1) to have a holistic and mutually exclusive governance with a single entity on top accountable for policy making and sectorial promotion.

ICT objective	20
Responsible	Policy maker*

Strategic initiative	8.3	Digital inclusion curriculum and campaign	Sub pillar	Digital people inclusion

Objective & scope

- Develop and rollout focused inclusion curricula and awareness campaigns

Deliverables & outcome

- Digital literacy curricula developed and implemented
- Training sessions conducted
- Marketing campaigns rolled out

KPIs

- Trained residents/classes conducted (#)
- Internet users (%)
- Digital showcases/ roadshows (#)

Main activities

- Tailor digital literacy curricula to meet local needs and provide digital literacy training with relevant content and services accordingly, e.g. access to locally relevant news, service provider, and teach basic digital literacy skills, such as browsing, emails, typing
  - Include privacy, security, green ICT and data storage concerns and incorporate online safety into digital literacy curricula
- Adopt group classes rather than personalized one-on-one trainings to ensure that digital literacy is contextualized and relevant
- Publish digital life knowledge and skills training resources and knowledge bases
- Launch e-learning and information portal for left-out segments (to be leveraged after the basic learning is in place)
- Showcase the digital home/office/city and green ICT initiatives

Required capabilities

- Learning and curriculum development
- Teaching skills
- Promotion and marketing knowledge

Dependencies & risks

- Willingness to participate
- Broadband availability in rural and remote areas
- Availability of ICT education centers/facilities and equipment

Timeline & budget

Key activities*	2019	2020	2021	2022	2023
Manage program					
Update program					

**) Existing ITA efforts and initiatives need to be considered. These should continue until end of 2019 and afterwards require a revision and alignment with overall strategy*

Budget (in mOMR)	0.77	1.93			

*) Today, 'policy maker' would imply MOTC and ITA. However, we propose a revision of the sector governance (initiative 14.1) to have a holistic and mutually exclusive governance with a single entity on top accountable for policy making and sectorial promotion.

Initiatives Detailing and Rationale

ICT objective	21	22	23
Responsible	Policy maker*		

Strategic initiative	9.1	SME digital service adoption	Sub pillar	Digital business inclusion

Objective & scope

- Improve SME adoption of digital services

Deliverables & outcome

- Cloud usage guidelines
- Online cloud portal
- Reviewed and updated policies & regulations

KPIs

- Businesses in online directories (%)
- Adoption of cloud services (%)

Main activities

- Mandate SMEs to provide a website address at the time of registration
- Mandate every business to have entries in online directories
- Encourage SMEs to market/sell/products/services via e-commerce channels by promotion and provision of relevant applications/tools
- Promote adoption and usage of cloud services
  - Develop guidelines for cloud usage and transition for enterprises, especially SMEs
  - Conduct awareness campaigns and transition support for cloud services and "Green" ICT usage of enterprises
  - Launch cloud service certifications and accreditation (e.g. through dedicated online cloud service portal)
- Develop and launch cloud and hosting subsidy program, especially for domestic SMEs
  - Provide subsidies & incentives for cloud services
  - Provide subsidies & incentives to host content locally
- Review policies & regulations and ensure facilitation of cloud adoption

Required capabilities

- Project management
- Promotion and marketing knowledge

Dependencies & risks

- Laws on cybersecurity and data protection
- Willingness of adoption and change of SMEs

Timeline & budget

Key activities	2019	2020	2021	2022	2023
Project setup & planning					
Launch program					
Manage program					

Budget (in mOMR)			0.12	0.18	0.23

*) Today, 'policy maker' would imply MOTC and ITA. However, we propose a revision of the sector governance (initiative 14.1) to have a holistic and mutually exclusive governance with a single entity on top accountable for policy making and sectorial promotion.

There are multiple examples of best practices of PPPs on assisting SMEs with their digital transformation

EXAMPLE

WKÖ (*Wirtschaftskammer Österreich*) launched "**SME DIGITAL**", a new digitalization program in cooperation with the Federal Ministry of Economic Affairs that provides support to SMEs in grasping and using the business opportunities arising from digital transformation

- Program includes **financial support, consulting services, events, webinars, analysis tools and training programs**
- Vast array of digital topics such as, **online shops and e-commerce**, **social media**, **CRM-tools, cloudification, Data security and cybercrime**

- Greek SME association (ESEE) makes several contributions to help its members with digitalization, e.g. **FeelSafe** initiative for **security of online transactions**, as well as the provision of **access to their free website builder**
- Cooperative effort between ESEE, the Greek Police, the Department of Electronic Crime, and the Ministry of Interior and Administrative Reconstruction

- German Federation of Skilled Crafts (ZDH) is responsible for several practices **helping SMEs with digitalization**
- The Skilled Craft IT Competence Centre, funded by the Federal Ministry for Economic Affairs (BMWi), is a **national network of competence centers** providing local craft companies with access to IT know-how specifically tailored to their needs
- Leadership role in **promoting focus areas**, e.g. expand IT-based offerings, digital process management, new production and automation technologies,

Source: Wirtschaftskammer Österreich, Hellenic Confederation of Commerce & Entrepreneurship, Zentralverband des Deutschen Handwerks, Arthur D. Little

Initiatives Detailing and Rationale

ICT objective	21	22	23
Responsible	Policy maker*		

Strategic initiative	9.2	Digital Transformation Advisory Services	Sub pillar	Digital business inclusion

Objective & scope

- Accompany organizations and corporations during their digital transformation journey

Deliverables & outcome

- Digital Transformation Advisory Services established

KPIs

- Enterprise customers (#)

Main activities

- Develop the mandate and operating model for the unit
- Obtain the necessary authorities for the unit to operate in Oman and advice entities on their digital transformation
  - Define and offer advisory services - at subsidized rates - to adopt digital solutions
  - Prepare studies on digitalization applications and benefits for different sectors
  - Offer trainings to other sector employees to work on digitalization
- Equip the unit with required resources and launch operations
  - Utilize expert freelancers and/or consultants in the launching phase for knowledge development and transfer
  - Gradually replace with own talent, e.g. functional and industry-specific
- Launch and promote services to all parties

Required capabilities

- Technical and functional understanding of technology trends and implications
- Consulting and analytical capabilities with ability to deliver messages

Dependencies & risks

- Long-term institutional commitment
- Availability of suitable candidates
- Sectorial acceptance

Timeline & budget

Key activities	2019	2020	2021	2022	2023
Project setup & planning					
Launch program					
Manage program					

Budget (in mOMR)		0.19	0.39	0.39	0.39

*) Today, 'policy maker' would imply MOTC and ITA. However, we propose a revision of the sector governance (initiative 14.1) to have a holistic and mutually exclusive governance with a single entity on top accountable for policy making and sectorial promotion.

Initiatives Detailing and Rationale

ICT objective	24
Responsible	Policy maker*

Strategic initiative	10.1	Cybersecurity awareness	Sub pillar	Digital safety

Objective & scope

- Design and execute campaigns to create cybersecurity awareness among residents and enterprises

Deliverables & outcome

- Safety & security awareness campaign
- Cyber safety & security guidelines
- Training & "certification" program
- Cyber safety & security statistics

KPIs

- Web user safety (in %) (through regular survey)

Main activities

- Develop and launch comprehensive national cyber safety & security awareness and promotion program (e.g. safe & secure internet usage campaign) for private users, establishments, and government agencies
- Develop and launch cyber safety & security guidelines for private users, establishments and government agencies
- Study and publish safety & security statistics in Oman on a regular basis

Required capabilities

- Safety and security expertise, i.e. network security, online safety expertise
- Marketing & promotion

Dependencies & risks

- National Cyber Safety & Security plan

Timeline & budget

Key activities	2019	2020	2021	2022	2023
Manage program					
Update program					

Budget (in mOMR)		1.93	1.93	1.93	1.93

*) Today, 'policy maker' would imply MOTC and ITA. However, we propose a revision of the sector governance (initiative 14.1) to have a holistic and mutually exclusive governance with a single entity on top accountable for policy making and sectorial promotion.

The NCSA serves as the cybersecurity awareness and education vehicles for the Department of Homeland Security in a private-public partnership

StaySafeOnline
Powered by: National Cyber Security Alliance

National Cyber Security Alliance (NCSA)

EXAMPLE

End-to-end cybersecurity awareness for consumers and businesses incl. a comprehensive resource library

Multi-channel approach incl. webinars

Timely and contextual campaigns

Background

- Founded in 2001
- **Private-public partnership** between Department of Homeland Security, private sector sponsors and non-profits

Goal

- Create and implement **broad-reaching education and awareness efforts** to empower users at home, work and school with the **information they need** to keep themselves, their organizations, their systems and their sensitive information **safe and secure online and encourage a culture of cybersecurity**

Strong cross-sectorial commitment

- High-level executives as board members from MCNs such as AT&T, Bank of America, Cisco, Facebook, Google, Intel, and others

Source: NCSA, Arthur D. Little

Strategic initiative 10.2 National Cyber Security Plan

Sub pillar: Digital safety

Objective & scope

- Develop a comprehensive "National Cyber Security Plan" To reduce security breaches, cyber attacks and cyber crime in Oman through prevention and protection

Deliverables & outcome

- Cyber security governance mechanism
- Data protection law
- Awareness on cyber security & data protection

KPIs

- # of security breaches, cybersecurity awareness
- Web user safety, protected PCs/ devices
- Privacy violations; cybersecurity rankings

Main activities

- Review and align with existing efforts of ITA on National Cyber Security
- Review national cybersecurity structure and governance mechanisms
  - Review current cybersecurity decrees and laws
  - Review mandate and scope of cybersecurity-related agencies
  - Develop comprehensive national cybersecurity gov. mechanisms
- Develop and implement Data Privacy & Protection policies
  - Launch educational Data Privacy & Protection campaign
  - Provide clarity on Data Privacy & Protection through laws, regulations, and guidelines (incl. child online safety regulations)

Required capabilities

- Cybersecurity know-how, i.e. network security, online safety
- Data Privacy & Protection expertise, Data Law know-how
- Marketing & awareness campaign, training & coordination

Dependencies & risks

- Collaboration of government agencies and ITU

Timeline & budget

Key activities*	2019	2020	2021	2022	2023
Project setup & planning					
Launch program					
Manage program					
Update program					

*) *To be determined and aligned with existing ITA efforts*

Budget (in mOMR)	0.58				

*) Today, 'policy maker' would imply MOTC and ITA. However, we propose a revision of the sector governance (initiative 14.1) to have a holistic and mutually exclusive governance with a single entity on top accountable for policy making and sectorial promotion.

The 2018 version of the US cybersecurity strategy provides a framework to execute cybersecurity responsibilities during the next five years

U.S. Cybersecurity strategy

EXAMPLE

Risk Identification

- **Goal 1**: Assess Evolving Cybersecurity Risks. We will understand the evolving national cybersecurity risk posture to inform and prioritize risk management activities.

Vulnerability Reduction

- **Goal 2**: Protect Federal Government Information Systems. We will reduce vulnerabilities of federal agencies to ensure they achieve an adequate level of cybersecurity.
- **Goal 3**: Protect Critical Infrastructure. We will partner with key stakeholders to ensure that national cybersecurity risks are adequately managed.

Threat Reduction

- **Goal 4**: Prevent and Disrupt Criminal Use of Cyberspace. We will reduce cyber threats by countering transnational criminal organizations and sophisticated cyber criminals

Consequence Mitigation

- **Goal 5**: Respond Effectively to Cyber Incidents. We will minimize consequences from potentially significant cyber incidents through coordinated community-wide response efforts.

Enable Cybersecurity Outcomes

- **Goal 6**: Strengthen the Security and Reliability of the Cyber Ecosystem. We will support policies and activities that enable improved global cybersecurity risk management.
- **Goal 7:** Improve Management of DHS Cybersecurity Activities. We will execute our departmental cybersecurity efforts in an integrated and prioritized way.

Source: Department of Homeland Security

Historically, the USA has shown massive public interest in cybersecurity issues and regulations

EXAMPLE

National cyber security regulations in USA

- Cybersecurity Enhancement Act 2014
  - Provides a voluntary public private partnership to improve cybersecurity and strengthen cyber security research and development, workforce development and education and public awareness
- National Cybersecurity Protection Act 2014
  - Codifies an existing operations center for cybersecurity
- Cybersecurity Workforce Assessment Act 2014
  - Directs the Secretary of Homeland Security (DHS) to conduct an assessment of the cybersecurity workforce of the DHS annually for the next 3 years
- Cybersecurity Act of 2015
  - Promotes and encourages the private sector and US government to responsibly and quickly exchange cyber threat information
- 29 bills on cybersecurity currently under consideration, for e.g.
  - Cyber Privacy Fortification Act
  - Cyber Intelligence Sharing and Protection Act

Source: ISACA (Information Systems Audit and Control Association), Arthur D. Little

The EU's data privacy & protection program is the union's move towards the harmonization of data protection policies across EU

EXAMPLE

Data Privacy & Protection program

European Union

Timeline – Revamp of data protection law

- **< 2011** – European Data Protection Directive 96/46/EC
- **2012** – Reform of the data protection rules in EU proposed
- **2015** – Draft legislation for EU General Data Protection Regulation (GPDR)
- **2016** – Agreement on final draft of the legislation
- GPDR formally adopted and published in the EU Official Journal 'EUR-Lex'
- Implementation period
- **2018** – Year of enforcement

GDPR – description:

- Move towards harmonization of data protection policies across EU
- Covers non –EU organizations providing goods or service to data subjects in the EU as well
- Improved focus on consent by data subjects, increased administrative requirements for enterprises and the need to provide a full audit trail and new obligations on data processors like requirement to keep records of data processing activities
- Increased fees for non compliance (up to 4% of annual turnover or EUR 20m, whichever is greater)

Source: European Union, Arthur D. Little

Strategic initiative	10.3	National Cyber Security Cooperation Framework	Sub pillar	Digital safety

Objective & scope

- Develop and activate National Cyber Security Cooperation Framework

Deliverables & outcome

- National Cyber Security Cooperation Framework established
- Communication channels defined

KPIs

- # of security breaches, cybersecurity awareness
- Privacy violations; cybersecurity rankings
- International liaisons (#)

Main activities

- Establish a single national body responsible for cyber security to serve as "single point of contact" to liaise with other governments
  - Support of cross-border cooperation against transnational cybersecurity threats
  - Promote sharing of critical cyber security information across national and international stakeholders, incl. public and private institutions and experts
  - Offer environment for information sharing, research and development
  - Provide a secure information infrastructure for coordination and collaboration
  - Facilitate communications amongst stakeholders
- Define stakeholder roles and responsibilities, e.g. centralized model limited to narrow group of government agencies vs. widely distributed across the government
- Establish functional and timely interagency process to balance interest across agencies and adjudicating potential disputes

Required capabilities

- Cyber security know-how
- Stakeholder management

Dependencies & risks

- Cybersecurity laws and regulations

Timeline & budget

Key activities	2019	2020	2021	2022	2023
Project setup & planning					
Launch program					
Manage program					

Budget (in mOMR)		0.12	0.12	0.12	0.12

*) Today, 'policy maker' would imply MOTC and ITA. However, we propose a revision of the sector governance (initiative 14.1) to have a holistic and mutually exclusive governance with a single entity on top accountable for policy making and sectorial promotion.

According to GCI, Oman is among the leading nations in cybersecurity with particular strengths in legal and national capacity building initiatives

Global Cybersecurity Index 2017

#4
of 165 countries

Country	Rank	Legal	Technical	Organ-izational	Capacity bulding	Co-operation
	1					
	2					
	3					
	4					
	25					
	46					
	47					
	65					
	139					

- The ITU is commending **Oman's robust organizational structure** including a **high-level cybersecurity strategy** and **master plan** and comprehensive roadmap
- In addition, it refers to the established **eGovernance Framework** to enhance the delivery of government services in alignment with the mission of e.oman as **cybersecurity related regulation**
- In order to further enhance its ranking, Oman needs to enhance **sectoral CERT/CIRT/CSIRT** and **multilateral agreements**

A transnational cyber security cooperation framework would not only improve index ranking but help to increase the involvement of the private sector

Source: ITU Global Cybersecurity Index, Arthur D. Little

Initiatives Detailing and Rationale

ICT objective	25	26
Responsible	Policy maker*	

Strategic initiative	11.1	Compulsory ICT education	Sub pillar	ICT school education

Objective & scope

- Collaborate with Ministry of Education to offer compulsory ICT education in schools

Deliverables & outcome

- Two hours of ICT courses per week

KPIs

- Students trained in programming/coding courses (%)

Main activities

- Compulsory programming/coding courses up to class 10, ICT electives to be offered in classes 11-12
- Review and update ICT curriculum with Ministry of Education
- Establish basic ICT certification for students currently in senior secondary/ high school
- Enhance ICT teacher availability through direct funding
- Equip educational institutions with tools and resources required for delivery of revised curricula

Required capabilities

- Learning and curriculum development
- Training skills

Dependencies & risks

- Ministry of Education support and funds

Timeline & budget

Key activities	2019	2020	2021	2022	2023
Project setup & planning					
Launch program					
Update program					

Budget (in mOMR)		13.13	21.76	21.76	21.76

*) Today, 'policy maker' would imply MOTC and ITA. However, we propose a revision of the sector governance (initiative 14.1) to have a holistic and mutually exclusive governance with a single entity on top accountable for policy making and sectorial promotion.

Some of the most advanced education systems include computer science as a compulsory subject in their secondary and primary schools curricula

Countries with compulsory ICT content in schools

COUNTRY	PROGRAMMING OR CODING COURSES (% OF ENROLLED STUDENTS)	SPECIFIC DETAILS
	■ Compulsory from primary school ■ Computer science is part of the basic curriculum until year 10 (secondary school)	■ Curriculum is organized across four key strands: design, implementation, evaluation, collabo. & mgmt.
	■ Compulsory in secondary school ■ Computing courses taught in the context of a national curriculum (Key Stages 3 and 4)	■ Students are intended to learn the use of two or more programming languages, at least one of which is textual
	■ Compulsory in scientific sec. schools & in some technical schools ■ ~34% of students attend +1 informatics course	■ Computer science is taught either as a separate subject or jointly with maths, dep. on the specific curriculum
	■ Compulsory in secondary education as one of the nine main subjects	■ Secondary education in Jordan lasts two years, therefore computer science studies are limited in time

Comments *EXAMPLE*

- In many countries programing an coding is compulsory in secondary school
- In Australia, recent plans made programing even compulsory from primary school on
- KSA is aiming at making programing an integral part of secondary school education

Source: Ministry of Education and Research of Italy, Digital Technologies Foundation to Year 10 Scope and Sequence – Australian Curriculum Assessment and Reporting Authority, Gov. UK – The National Education Curriculum, Classbase – Education system in Jordan, Country Studies - Education in Jordan, Arthur D. Little

Strategic initiative	11.2	ICT exposure programs	Sub pillar	ICT school education

Objective & scope

- Develop program to expose school students to work on real ICT and technology related issues that will help advance Oman's national interests

Deliverables & outcome

- National ICT competitions

KPIs

- Competitions (#)
- Participating students (#)
- Impactful results (#)

Main activities

- Organize ICT-related competitions for high-school students in order to solve real life problems, and identify high performance students
- Suggested competitions could be:
  - Distributing a programmable device that can be configured by students to create various applications
  - Developing an online platform teaching students programming/coding skills and allowing them to compete in developing websites, mobile apps, etc.
- Assess impact of provided/winning solutions/proposition in expert panel
- Initiate discussions with Ministry of Education for a joint initiative to maximize impact

Required capabilities

- Promotion and marketing of events
- Project and event management
- Networking and relationship management

Dependencies & risks

- Students' willingness and ability to participate
- Collaboration with Ministry of Education
- Budget for launch of project, prizes/ awards and execution of events

Timeline & budget

Key activities	2019	2020	2021	2022	2023
Project setup & planning					
Launch program					
Manage program					
Update program					

Budget (in mOMR)		0.17	0.06	0.06	0.06

*) Today, 'policy maker' would imply MOTC and ITA. However, we propose a revision of the sector governance (initiative 14.1) to have a holistic and mutually exclusive governance with a single entity on top accountable for policy making and sectorial promotion.

Young ICT Explorers is a great example of PPP on how to integrate ICT school curriculum with technology related projects

Young ICT Explorers

EXAMPLE

- Non-profit competition to **encourage school students to create ICT related projects**
- **Aligned with the school curriculum** enables students to apply what they learn in their ICT/Digital Technologies classroom to develop a technology related project of their choice
- Students have the opportunity to present their project to a **judging panel of academia, industry partners and ICT professionals**
- Assessment criteria are creativity, uniqueness, quality, level of difficulty and project documentation
- Many companies, e.g. Apple and Microsoft provide students with **free copies of their professional-level developer and design tools** for this competition

Source: Young ICT Explorers, Arthur D. Little

Initiatives Detailing and Rationale

ICT objective	27	28
Responsible	Policy maker*	

Strategic initiative	12.1	ICT curriculum collaboration	Sub pillar	ICT tertiary education

Objective & scope

- Collaborate with MoHE, MoM, and universities to redefine curriculums and start new specialization programs based on demand

Deliverables & outcome

- Graduates with a degree qualification and certain abilities, which qualify him or her for activities in the ICT sector

KPIs

- Employability/satisfaction feedback from students and industry (%)
- Involved industry partners in curriculum development (#)

Main activities

- Establish working group on ICT curricula development with industry and institutional representatives
- Identify ICT industry's needs, i.e. demand req. & tech. skills profiles
- Examine existing ICT curricula and produce new ICT curricula development guidelines
- Support definition of required entry qualification for each program they offer, specifying the knowledge, skills and abilities the students are expected to have
- Ensure permanent loop of communication between universities and stakeholders, particularly local employers, in order to adjust the outcomes of the needs of the profession continuously, to keep outcomes up-to-date, and to increase employability of graduates
- Support implementation of curriculum quality control with documented results
  - Take feedback from students in terms of whether the student felt they acquired the right knowledge and skills for the job
  - Take feedback from industry in assessing the former competencies in both technical and behavioral areas following recruitment

Required capabilities

- Learning and curriculum development

Dependencies & risks

- Collaboration with Ministry of Higher Education and public and private universities/ colleges

Timeline & budget

Key activities	2019	2020	2021	2022	2023
Project setup & planning					
Launch program					
Update program					

Budget (in mOMR)	0.08	0.08	0.08	0.08	0.08

*) Today, 'policy maker' would imply MOTC and ITA. However, we propose a revision of the sector governance (initiative 14.1) to have a holistic and mutually exclusive governance with a single entity on top accountable for policy making and sectorial promotion.

Initiatives Detailing and Rationale

ICT objective	27	28
Responsible	Policy maker*	

Strategic initiative	12.2	ICT college / university establishment	Sub pillar	ICT tertiary education

Objective & scope

- Collaborate with MoHE & MoM to establish an international education institution in Oman with focus on ICT

Deliverables & outcome

- Set up of local campus of international institution

KPIs

- ICT graduates from the institution (#)

Main activities

- Identify and shortlist global universities to attract to Oman
- Develop a program to attract the university and students
  - Incentives to attract the university to Oman (e.g. land, facilities, research funding, faculty visas, etc.)
  - Incentives to attract local and international students to the university (e.g. student visas, scholarships, internship opportunities with local companies, etc.)
  - Pre-requisites for the university set-up in Oman: degrees to be offered, commonality in curriculum and faculty with main campus, student rotation programs, percentage in-take of locals, admission procedures, etc.
- Collaborate with other agencies (MoE, HEC, ROP, MoF) for obtaining funding and approvals
- Facilitate the establishment of the local campus of the university

Required capabilities

- Project management
- Promotion and marketing knowledge

Dependencies & risks

- Alignment with overall Higher Education plans

Timeline & budget

Key activities	2019	2020	2021	2022	2023
Project setup & planning					
Launch program					
Manage program					

Budget (in mOMR)			23.1	25.41	27.95

*) Today, 'policy maker' would imply MOTC and ITA. However, we propose a revision of the sector governance (initiative 14.1) to have a holistic and mutually exclusive governance with a single entity on top accountable for policy making and sectorial promotion.

UAE has a vision of establishing world-class institutions and is funding and facilitating the set up of relevant universities in the country

جامعة نيويورك ابوظبي
NYU ABU DHABI

NYU – Abu Dhabi

EXAMPLE

UAE goal	Establishing world-class educational and cultural institutions in the UAE				
Target	Attract world-renowned New York University (NYU) to set up a campus in Abu Dhabi				
Facilitating success	Government funding 99+ percent of NYUAD's revenue is from UAE government grants every year since its inception	Local students Emiratis admitted to programs in NYU are awarded the Sheikh Mohamed bin Zayed NYUAD Scholarship for Exceptional Emirati Students, covering full cost of attendance	International students Need based scholar-ships awarded to int'l students; UAE has established a 5 year student visa program, and students performing well get 10 year residency visa post-education	Student quality NYU actively worked with global schools to attract best students – only 200/9000 applicants accepted (avg. SAT verbal score of 715 and math score of 730)	Faculty Both dedicated and shared faculty available across campuses. AED 58.8 mn research grants allocated for four selected projects over a five-year period

Source: NYU, Arthur D. Little

Strategic initiative	12.3	ICT scholarships	Sub pillar	ICT tertiary education

Objective & scope

- Establish scholarship programs for gifted ICT students to specialize in ICT courses

Deliverables & outcome

- High-potential students relevant for local market requirements facilitated by gov't funding

KPIs

- Students funded (#)

Main activities

- Determine parameters of scholarship:
  - No. of students to be funded
  - Courses to be selected for which funding will be provided
  - Determine duration, e.g. only first year support vs full tenure
- Obtain funding commitment on long term basis
- Chose selection mechanism incl. award criteria
  - Financial need
  - Academic achievements
  - Leadership skills
  - Achievements in particular fields
- Promote scholarship by collaborating with PR of universities and other education institutions
- Develop monitor mechanism, e.g. periodically review financial health, ensure its serving its purpose, etc.

Required capabilities

- Networking and relationship management
- Allocation of funds

Dependencies & risks

- Alignment of funding with other institutions (private/public) and existing scholarships

Timeline & budget

Key activities	2019	2020	2021	2022	2023
Project setup & planning					
Launch program					
Manage program					

Budget (in mOMR)		0.08	0.85	0.85	0.85

*) Today, 'policy maker' would imply MOTC and ITA. However, we propose a revision of the sector governance (initiative 14.1) to have a holistic and mutually exclusive governance with a single entity on top accountable for policy making and sectorial promotion.

To cater for the human capital dimension, the government supports different authorities for trainings, and additional funds to support the TRA

Education program development

- The National Qualifications Authority (NQA) ensures the equipment of students with necessary skills by organizing trainings and continuous updates to education programs and curricula within the UAE
- The NQA also monitors market needs to bridge the gap between required skills and employment requirements
- The authority is also a partner in implementing the Dubai innovation strategy, drafted to ensure alignment of education and trainings with the latest advancements and innovations in the fields of ICT, automation, 3D printing, robotics, virtual reality, etc.

Education fund

- In addition to its ICT fund, the TRA has introduced the BETHA scholarship program aimed specifically to support students willing to specialize in ICT related sectors
- The program only supports nationals in undergraduate and graduate levels fostering technological leadership, innovation, and later on incubation support

In partnership with

Source: TRA scholarship programs, The UAE and the future of work (Mohammed Bin Rashed school of government)

ICT objective 30

Responsible Policy maker*

Strategic initiative	13.1	National ICT skills action and training program	**Sub pillar**	ICT workforce

Objective & scope

- Government, training sector and industry working together to meet Oman's high-level ICT skills needs with a ICT skills action and training plan

Deliverables & outcome

- Certified workforce that effectively addresses market requirements of local ICT players

KPIs

- Certificates awarded (#)
- Industry stakeholder satisfaction (%)

Main activities

- Investigate market requirements/ needs for certification program, e.g. through needs assessment, interviews, workshops
- Determine credentialing program, i.e. certification, accreditation, knowledge/skill-based certificates, curriculum-based certificates
- Determine program goals and audience incl. desired outcome for participants and institutions
- Develop training curriculum, course content and assessments, e.g.
  - Host advisory group (incl. industry stakeholders) brainstorm sessions and come to consensus on appropriate scope
  - Identify core competencies covered in the course based on market requirements
- Create partnerships for training and skills development through private sector aimed at selected groups
- Select delivery vehicles based on target audience preference/access, budget and objectives, e.g. self-study modules (online platform, software), face-to-face sessions, web/audio conferences
- Effectively communicate offering to target audience
- Continuously track industry stakeholder satisfaction

Required capabilities

- Learning and curriculum development
- Networking and relationship management

Dependencies & risks

- Alignment of funding with other institutions (private/public) and existing certification programs
- Collaboration with MOM and National Center for Recruitment

Timeline & budget

Key activities	2019	2020	2021	2022	2023
Project setup & planning					
Launch program					
Manage program					
Update program					

Budget (in mOMR)		0.19	0.12	0.12	0.12

*) Today, 'policy maker' would imply MOTC and ITA. However, we propose a revision of the sector governance (initiative 14.1) to have a holistic and mutually exclusive governance with a single entity on top accountable for policy making and sectorial promotion.

Government, training sector and industry need to work together to match ICT workforce supply with market demand

'ICT Workforce of the Future'-methodology*

ILLUSTRATIVE

TOP IT JOBS RECRUITED OVER THE LAST 24 MONTHS

#	Required position	% of org.
1	Application systems programmer	70
2	Network engineer	65
3	Web application developer	63
4	Data architect	55
5	Cloud computing analyst	54
6	Big data analyst	51

TOP IT JOBS TO BE HIRED OVER THE NEXT 24 MONTHS

#	Required position	% of org.
1	Application systems programmer	35
2	Information security professional	20
3	Mobile application developer	18
4	Data architect	15
5	Web applications developer	14
6	Data warehousing analyst	12

IT JOBS REPROTED AS DIFFICULT-TO-HIRE

#	Required position	% of org.
1	Web applications developer	45
2	Application systems programmer	38
3	Solution architect	35
4	Information security manager	29
5	Data architect	28
6	Data warehousing analyst	27

TOP IT SKILS RECRUITED OVER THE LAST 24 MONTHS

#	Required skills	% of org.
1	Project management	55
2	Business analytics	53
3	Business intelligence/information analytics	52

IT SKILLS IT JOBS REPROTED AS DIFFICULT-TO-HIRE

#	Required skills	% of org.
1	JAVA	42
2	Business intelligence/information analytics	41
3	Security	39

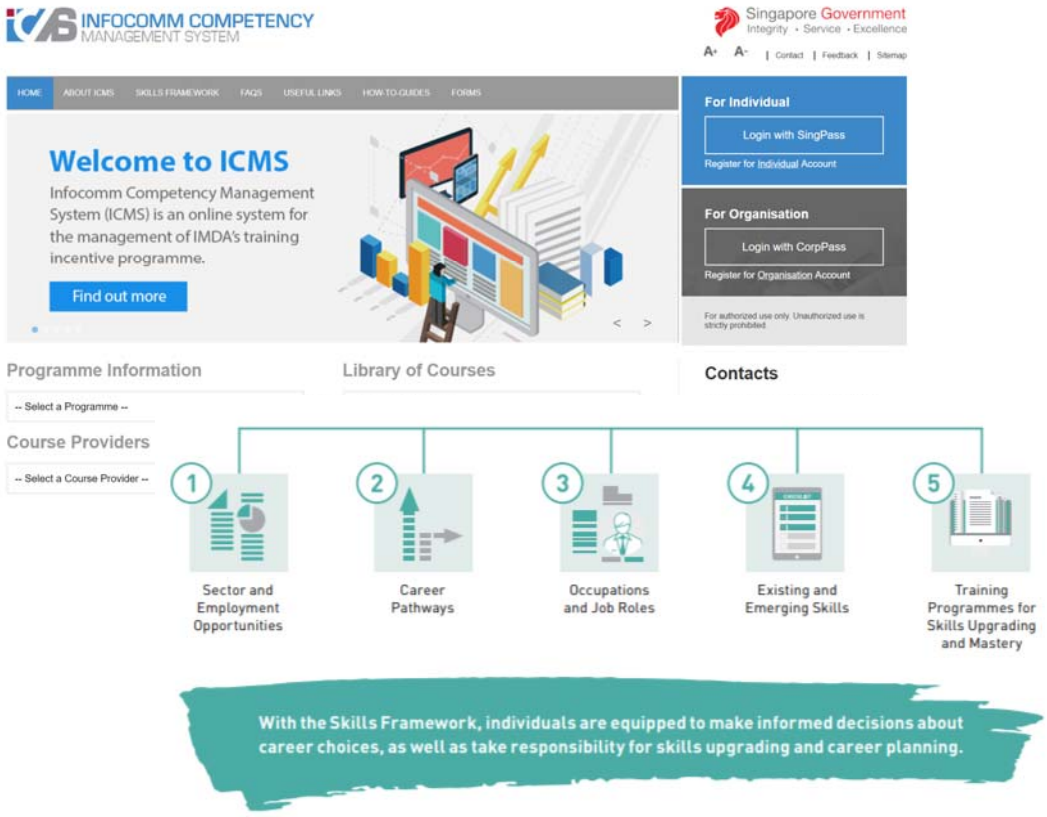
Source: Gartner Global IT Jobs and Skill Survey, Arthur D. Little

*) This slide serves as an illustration of the tasks that need to be carried out as part of the initiative. Highlighted positions and skills in the slide are not representative of Oman's current IT jobs and skill requirement landscape

Singapore builds a strong core of local ICT professionals through broad-based training courses and certifications

Critical Infocomm Technology Resource Programme Plus (CITREP+)

EXAMPLE



- The CITREP+ **supports local professionals in keeping pace with technology shifts** through continuous and proactive training
- The IMDA **collaborates with training providers** to develop and offer quality infocomm professional **development technology courses and professional certifications** that impart knowledge and skills in relevant areas
- **Funding program support** differs by two categories (organization-sponsored and self-sponsored) and five types (non-SME, SMEs, professionals, young professionals, students)
- **Financial contribution can make up to 100%** of the course and certification fees with a $3,000 cap

Source: IMDA, Arthur D. Little

Initiatives Detailing and Rationale

ICT objective	31	32
Responsible	Policy maker*	

Strategic initiative	14.1	ICT Executive League	Sub pillar	Institutional framework

Objective & scope

- Institutionalize ICT Executive League for monthly summit of CEOs of biggest ICT firms in the country to set and align agendas

Deliverables & outcome

- Aligned national ICT agenda among public and private stakeholders
- Medium for continuous strategy amendments

KPIs

- Anonymous attendee satisfaction (%)
- ICT Executive League CEO attendance (#)

Main activities

- Identify and regularly update league members
  - Ministerial participation (MOCI, MOM,…)
  - Telecom operators (Omantel, Ooredoo,…)
  - IT players, both LE and SME (Microsoft, OBC,…)
- Determine organizational structure/working groups for topics, like the "Digital Summit" in Germany e.g.
  - Oman as attractive ICT location and innovative applications for sectors
  - Digital infrastructures as enables
  - Trust, data and internet security
- Determine rules of participation and coordination mechanisms
- Formalize the league

Required capabilities

- Stakeholder management

Dependencies & risks

- Fair participation and representation of all stakeholders
- Continuous commitment of all stakeholders

Timeline & budget

Key activities	2019	2020	2021	2022	2023
Project setup & planning					
Launch program					
Manage program					

Budget (in mOMR)	0.06	0.06	0.06	0.06	0.06

*) Today, 'policy maker' would imply MOTC and ITA. However, we propose a revision of the sector governance (initiative 14.1) to have a holistic and mutually exclusive governance with a single entity on top accountable for policy making and sectorial promotion.

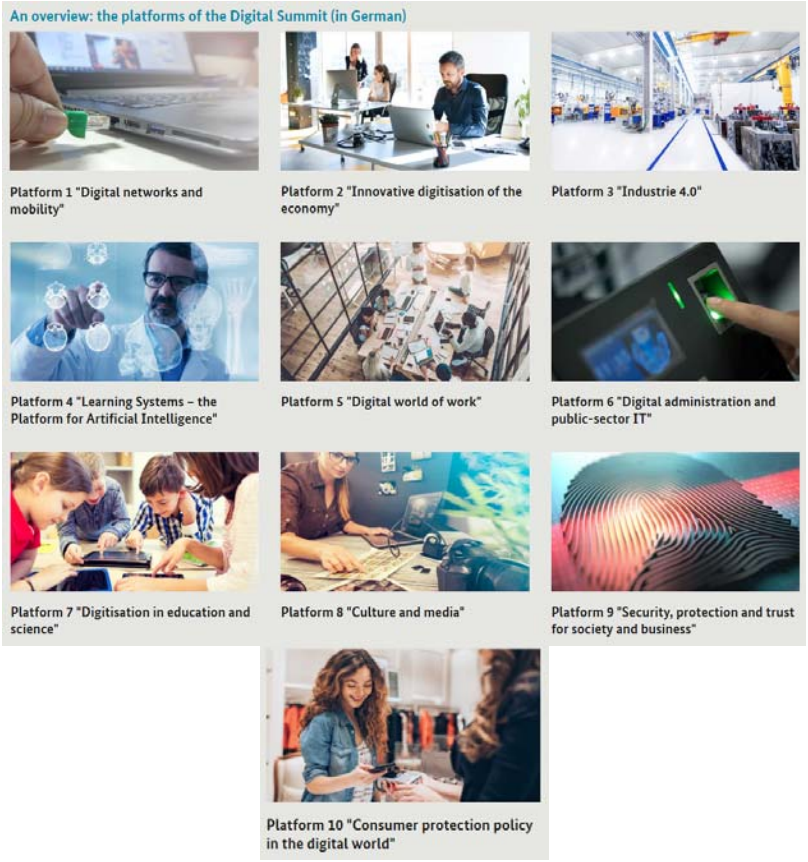
Germany's annual Digital Summit is the central platform for cooperation on shaping an advanced policy framework for the digital transformation

DE.DIGITAL

Annual Digital Summit and continuous working groups

(December 2018)

EXAMPLE



- The **Digital Summit** (previously National IT Summit) and the work that takes place between the summit meetings form the **central platform for cooperation** between government, business, academia and society as we shape the **digital transformation**
- Looks at the **key fields of action** within the digital transformation across **ten topic-based platforms** that are made up of representatives from business, academia and society
- Between summit meetings, they work together to develop **projects, events and initiatives** designed to drive digitalization in business and society
- This ensures **continuous exchange and involvement** of relevant sector stakeholders
- Main focus this year was AI, a corresponding national AI strategy has been launched shortly prior to the summit

Source: Federal Ministry for Economic Affairs and Energy Germany, Arthur D. Little

Initiatives Detailing and Rationale

ICT objective	10
Responsible	Policy maker*

Strategic initiative	14.2	ICT GDP contribution mechanism	Sub pillar	Institutional framework

Objective & scope

- Develop mechanism to measure ICT contribution to GDP

Deliverables & outcome

- ICT/digital economy statistics and report

KPIs

- Publication of ICT sector report

Main activities

- Collaborate with NCSI, MOF, MOCI, MOM, and MOHE to establish mechanisms for calculating ICT contribution to GDP
  - Conduct survey of ICT companies and activities
  - Develop input/output tables
  - Publish standalone ICT/digital economy report, with details
  - Update survey results/reports on a yearly basis

Required capabilities

- Economics and statistical capabilities

Dependencies & risks

- Resources and funds for NCSI to implement the initiative
- Mapping between ICT definitions

Timeline & budget

Key activities	2019	2020	2021	2022	2023
Project setup & planning					
Launch program					
Manage program					

Budget (in mOMR)		1.16	0.19	0.19	0.19

*) Today, 'policy maker' would imply MOTC and ITA. However, we propose a revision of the sector governance (initiative 14.1) to have a holistic and mutually exclusive governance with a single entity on top accountable for policy making and sectorial promotion.

Mechanisms should be established to calculate ICT sector's contribution to GDP

GDP contribution methods

Production approach

- Sums the "value-added" at each stage of production
- Value-added is defined as total sales less the value of intermediate inputs into the production process
- Difficult to measure, and requires input-output tables to be developed over many years

GDP = Total output of goods & services – intermediary consumption for generating goods & services

Expenditure approach

- Adds up the value of :
  - Purchases made by final users
  - Investments in machinery by companies
  - Purchases of goods and services by government and foreigners
- Difficult to differentiate between purchases made by final users and intermediate users

GDP = Consumer spending + Business investment + Gov. spending + Net exports

Income approach

- Sums the incomes generated by production
- Adds up the value of:
  - Compensation employees receive
  - Operating surplus of companies (~ EBITDA)
- All other expenses that appear in a company's P&L statement are "3rd party costs"

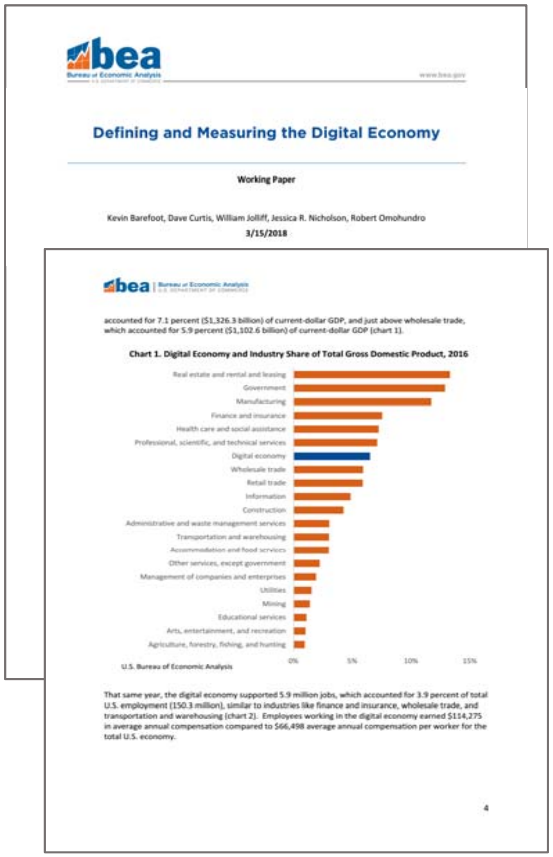
Value-added = Wages and Salaries incl. Insurance + Depreciation + Profits before Taxes

This is only a starting point. Going forward, there should be dedicated efforts to calculate ICT sector contribution at national level

Source: IMF, Arthur D. Little

Economies advanced in ICT are publishing sector specific reports to ensure that ICT contributions are tracked effectively

Recent efforts in other markets and international bodies



Source: Arthur D. Little

ICT objective	31	32
Responsible	Policy maker*	

Strategic initiative	14.3	ICT sector-level decision processes	Sub pillar	Institutional framework

Objective & scope

- Develop clear processes for ICT sector-level decision making within the country

Deliverables & outcome

- Demarcation of roles and responsibilities
- Decision making processes

KPIs

- Adherence to processes (%)

Main activities

- Assign single champion for ICT policy making and promotions
- Develop a fair and transparent process for decision making on ICT related topics
- Develop a governance model for escalation of ICT related issues within the sector and in the cabinet
- Monitor and report implementation and deviation from the process

Required capabilities

- Process development

Dependencies & risks

- Requires alignment and support from the highest levels in the country

Timeline & budget

Key activities	2019	2020	2021	2022	2023
Project setup & planning					
Launch program					
Manage program					

Budget (in mOMR)	0.97	0.97			

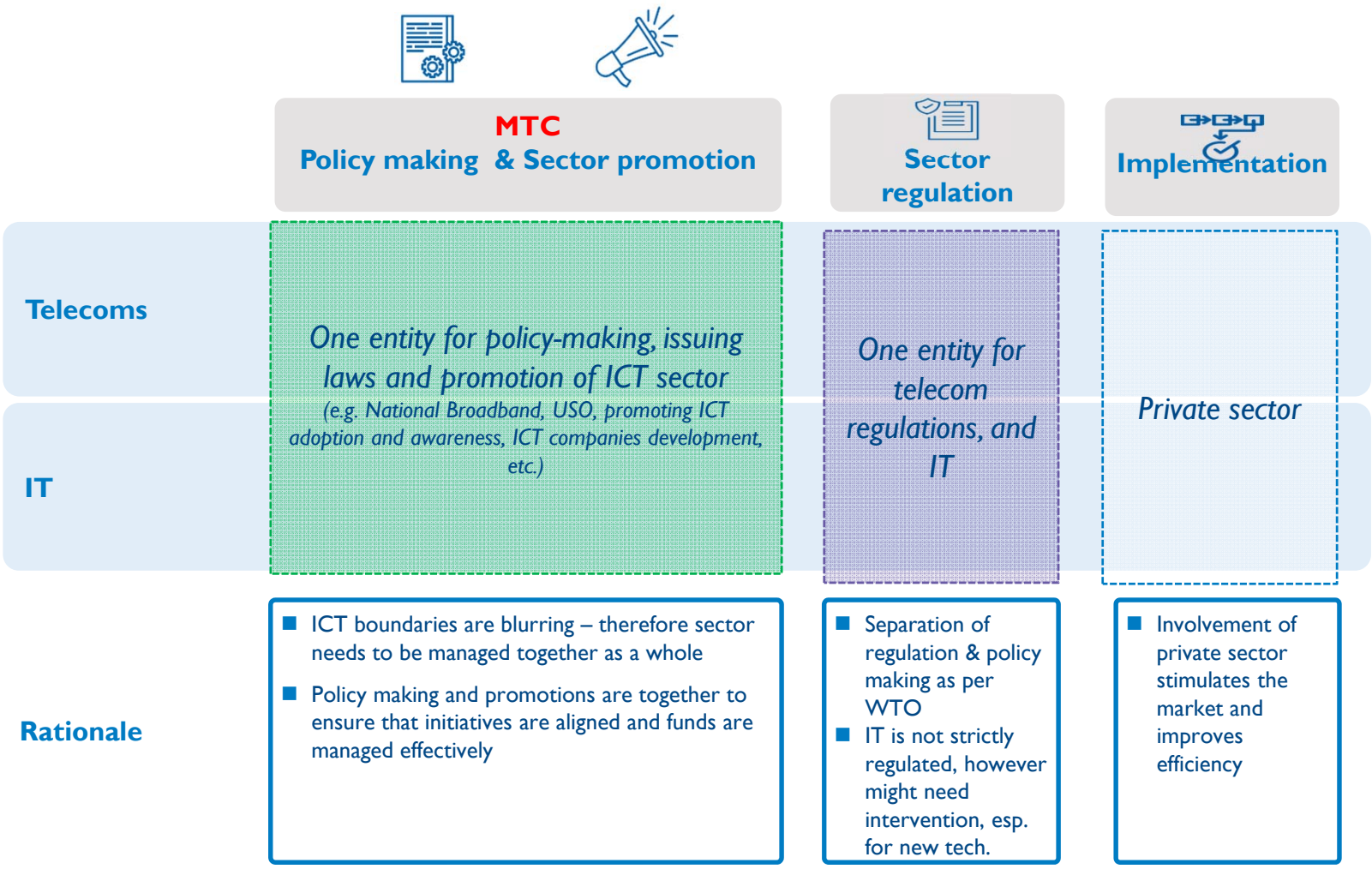
*) Today, 'policy maker' would imply MOTC and ITA. However, we propose a revision of the sector governance (initiative 14.1) to have a holistic and mutually exclusive governance with a single entity on top accountable for policy making and sectorial promotion.

A holistic and mutually exclusive ICT sector institutional hierarchy should be established

	Policy making	Sector promotion	Sector regulation	CIO for government	Implementation
Telecoms	*One entity for policy-making, issuing laws and promotion of ICT sector* *(e.g. National Broadband, USO, promoting ICT adoption and awareness, ICT companies development, etc.)*		*One entity for telecom regulations, and IT*	*One entity managing govt. ICT frameworks & initiatives* *(e-gov, architecture, security, etc.)*	*Private sector*
IT					
Rationale	■ ICT boundaries are blurring – therefore sector needs to be managed together as a whole ■ Policy making and promotions are together to ensure that initiatives are aligned and funds are managed effectively		■ Separation of regulation & policy making as per WTO ■ IT is not strictly regulated, however might need intervention, esp. for new tech.	■ Necessary for ensuring govt. implementations adhere to common framework and best practices, and are fully integrated	■ Involvement of private sector stimulates the market and improves efficiency ■ CIO – impl. role separation helps in better governance

Source: Arthur D. Little analysis

An exclusive ICT sector institutional hierarchy in the ICT sector



Source: Arthur D. Little analysis

The Chinese Ministry of Industry and Information technology was created by the state council and is responsible of the ICT sector as a whole

Ministry governance

MINISTRY OF INDUSTRY AND IT

- Minister of information industry
- Commission of science, technology, and industry for national defense
- State council informatization office
- National development and reform commission

ICT related Responsibilities

- ***Drafting policies***
- ***Developing strategies***
- ***Managing ministry budget***
- ***Insurance of product safety***
- ***Supervision of internal activities[1]***
- ***Others[2]***

Source: The US-China business council, Ministry of industry and information technology

[1]Security safeguards, confidential work, and letters of complaints

[2]Electronic information, telecommunications management, sector promotion, radio, software, civilian-military integration, raw and semi finished materials

In KSA, the Ministry of Communications and Information Technology champions the sector through its 4 agencies and defined responsibilities

MCIT agencies

Technology industry and digital capacities agency
Supporting human capital in ICT

Communications and digital infrastructure agency
Policies and regulations for infrastructure dvpt.

Support shared services agency
Supporting as enabler to meet optimal internal performance

Planning and development agency
Set strategic plans and policies for development of the ministry and ICT sector

MCIT responsibilities

Supervising the ICT sector
Ensuring comprehensiveness and socio-economical contribution

Setting up policies and laws
Ensuring the development and fair regulation of the ICT sector

Ensuring stakeholder alignment
Coordinating between government departments to align on ICT relevant issues

Representing KSA globally
Representing the kingdom in conferences and events involving ICT sector

Source: Ministry of Communications and Information Technology
Note: KSA selected for benchmarking due to its regional relevance

The Ministry of Communications and Information oversees the development of policies, strategies, and national libraries for ICT

MCI agencies

Cybersecurity agency of Singapore
National body overseeing cybersecurity strategy, education, outreach, and industry development

Infocomm media development authority
Develop and regulate infocomm and media sectors

National library board
Promote learning and information literacy by providing a global information service and network

Personal data protection commission
Promote and foster data protection between businesses and consumers

MCI responsibilities

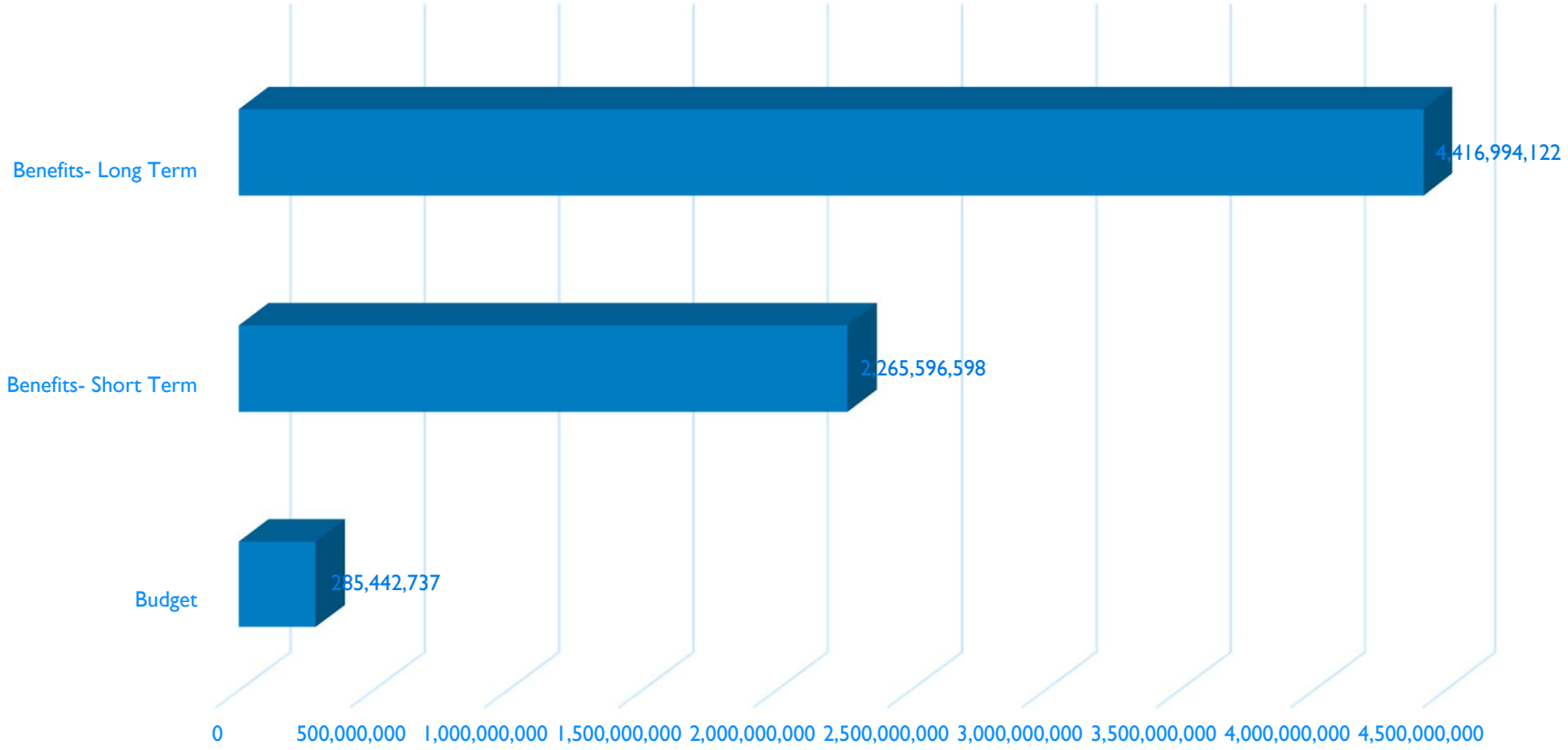
Oversee development of ICT
Oversee development in Infocomm technology, cybersecurity, media, and design sectors

Reinforce information literacy
Support the national library service, national archives, and public libraries

Develop policies
Develop the government's information and public communication policies

Source: Ministry of Communications and Information Technology of Singapore
Note: Singapore selected for benchmarking as it is a global leader in ICT as per many indices (including WEF, EIU, Network readiness, etc.)

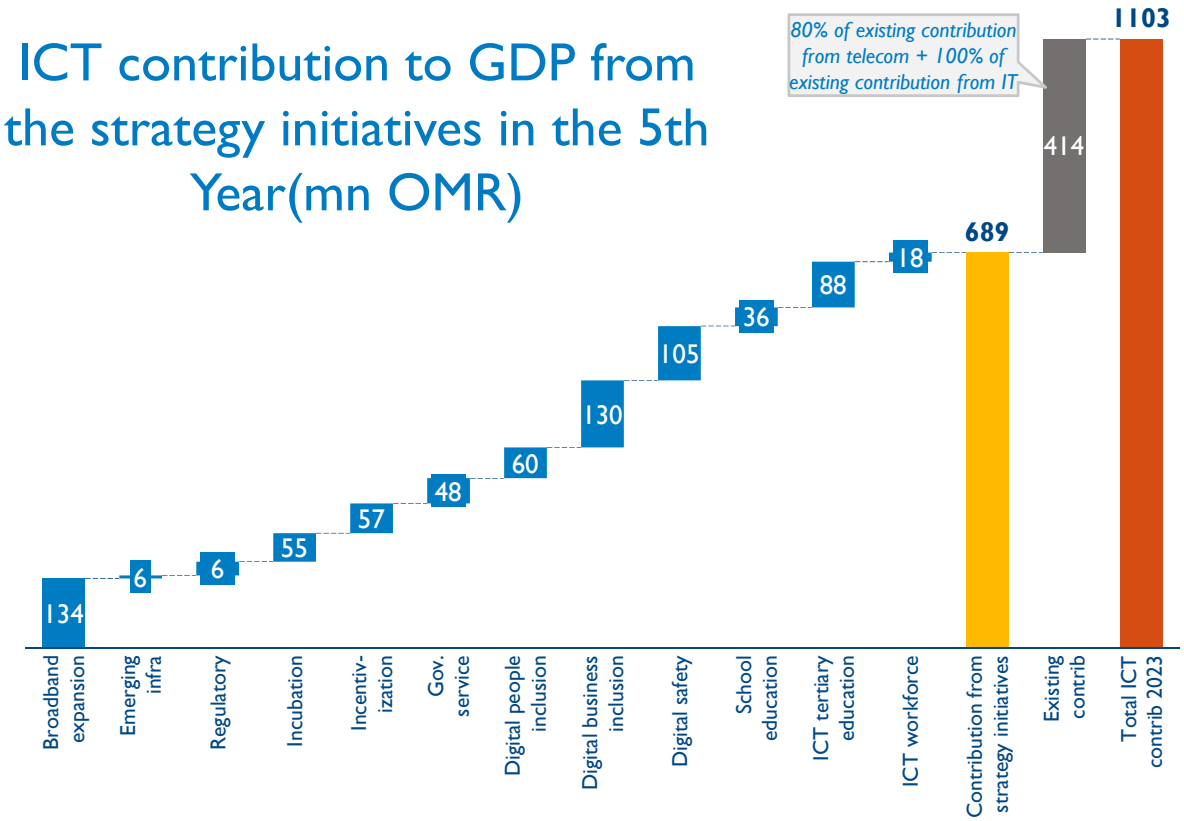
The initiatives are estimated to cost OMR 285 mn in next 5 years, and are expected to result in significant benefits in short terms and the long-term



ICT contribution to GDP

In the 5th year of implementation , the GDP contribution from the ICT sector is expected to be ~ OMR 1,103 mn

ICT contribution to GDP from the strategy initiatives in the 5th Year(mn OMR)



Source: Arthur D. Little analysis

- The GDP contribution in 5th Year consists of the new strategic initiatives and the contribution from existing activities
- The strategy initiatives are estimated to contribute OMR 689 mn in 5th year.
- The GDP contribution from the strategic initiatives come from the direct benefits and a part of the indirect and induced benefits realized by the 5th year.
- The existing activities in the telecom and IT sectors are expected to contribute OMR 414 mn in 5th year:
  - Only 80% of telcos' existing contribution is expected to continue in 5th year (as significant investments have been made already in the market). New investments are considered as part of the strategy initiatives
  - Existing contribution of IT companies is expected to continue in 5th year.
- Each year delay is expected to have impact of 2-3% on these projects.

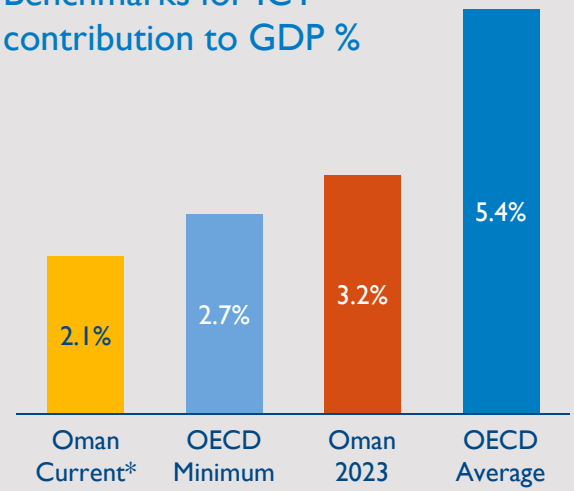
The ICT sector will contribute ~3.0% of Oman's GDP in 5th year, which is equivalent to 4.3% of Oman's 2016 GDP

Objective: The ICT sector to contribute **~3.0%** of Oman's GDP# in 5th Year

OMR
1.10 bn
contribution to GDP in 5th Year

Equivalent to approximately
4.3%
of 2016 GDP
(2.1 x existing contribution)

Benchmarks for ICT contribution to GDP %



Source: NCSI, IMF, Arthur D. Little analysis
Based on GDP estimate for 2023 in current prices from IMF
* Based on data available for 2016

The 35 initiatives under 4 Pillars are estimated to cost OMR 285 mn in next 5 years. All initiatives which has overlap with other strategy initiatives has been rationalized.

1.Broadband Expansion	
1.1	Unified national broadband infrastructure investment and implemen
	250,000
1.2	Broadband supervisio
	38,074,650

2.Emerging Infrastructure	
2.1	Emerging tech infrastruc
	6,267,800
2.2	Active and p infrastructu
	0
2.3	DC & cloud infrastructure developmen
	4,851,000

3.Regulatory Liberalization	
3.1	Regulatory policies and framewo
	0
3.2	Liberalized
	962,500
3.3	Agile regul
	0

4.Company Incubation	
4.1	Start-up funding & financing
	48,098,500
4.2	Private sec incubation
	1,617,000
4.3	Support in accessing new markets
	6,066,667

5.Company Incentivization	
5.1	Incentives for large investors
	70,878,250
5.2	FDI promot
	346,500

6.Technology innovation	
6.1	New technology testbed & researc
	26,774,440
6.2	Grant & pat program
	11,550,000
6.3	Crowdsour
	1,540,000

7.Gov't service enhancement	
7.1	Government transform
	0
7.2	Open data p
	3,850,000

8.Digital people inclusion	
8.1	Digital inc
	0
8.2	ICT educatio centers and equipment
	962,500
8.3	Digital inclusion curriculum & campaig
	19,320,000

9.Digital Business Inclusion	
9.1	SME digital service adoption
	0
9.2	Digital transformation advisory se
	673,750

10.Digital Safety & Security	
10.1	Cyber security awaren
	400,000
10.2	National Cyber security plan
	100,000
10.3	National Cyber Security Cooperat
	200,000

11.ICT School Education	
11.1	Compulsory ICT educatio
	63,214,175
11.2	ICT expos
	346,500

12. ICT Tertiary Education	
12.1	ICT curriculum collab
	385,000
12.2	ICT college/ university establis
	0
12.3	ICT sch
	2,618,000

13. ICT Work Force	
13.1	National ICT skills action and training progra
	192,500

14.Institutional Governance	
14.1	ICT Exec
	0
14.2	ICT GDP contribution mechanis
	0
14.3	ICT sector level decision processe
	0

~ Total Requirement **285 mn OMR**

Note : Tanfeedh allocation should be considered while executing for all the greyed out initiatives*

A successful initiative execution along the three pillars is critical to enhance the competitiveness of the ICT sector for Oman

The ICT strategy dogma

ICT time travel: What could have been if the ICT strategy would have been carried out five years ago – A data center ecosystem example

INFRASTRUCTURE

- Underlying data center infrastructure serving the public and private sector carried out

DIGITAL ECOSYSTEM

- On top of the DC infrastructure, products and services could have been carried out, e.g. hosting, recovery and data analytics
- Executed by MNCs, such as Amazon, or potential local competitors

DIGITAL CAPABILITIES

- The human capital would have acquired the necessary market skill requirements
- No need for imposed Omanization as the local workforce is competitive and trained

- We do not know what will be technologically en vogue in 5-10 years, e.g. Blockchain only got significant media coverage and hype in the last two years due to cryptocurrency; yet some firms already claim the demise of the technology
- Hence, we refrain from *putting all eggs in one basket*, e.g. "develop data analytics capabilities", "setup Blockchain university", but are focusing on fixing the basics across the three pillars of the sector, i.e. (I) establish a high-performing, future-ready and affordable ICT infrastructure, (II) support the enhancement of the education system in order to foster suitable ICT talent, and (III) nurture a thriving IT sector with private Omani companies and locally operating MNCs
- Enhancements of the three pillars over the next five years will serve as a basis for a future-ready and competitive ICT sector in Oman that is able to deal with the technological endeavors of the future

Source: Arthur D. Little

Sultanate of Oman
Ministry of Transport &
Communications

Appendix

Appendix

A Strategy elements

B Challenges and implications

C Option detailing

D Technology attractiveness

E Initiative budgeting

The strategy consists of different elements progressively going into more detail from Vision to Initiatives

Towards a **GLOBALLY COMPETITIVE ICT SECTOR** &
a **DIGITALLY** empowered **SOCIETY** and **ECONOMY**

INFRASTRUCTURE (2 AMBITIONS, 9 OBJECTIVES)	DIGITAL ECOSYSTEM (2 AMBITIONS, 10 OBJECTIVES)	DIGITAL CAPABILITIES (2 AMBITIONS, 12 OBJECTIVES)
3 SUB PILLARS	4 SUB PILLARS	6 SUB PILLARS
8 INITIATIVES	10 INITIATIVES	14 INITIATIVES

INSTITUTIONAL GOVERNANCE (2 AMBITIONS, 2 OBJECTIVES)

1 SUB PILLAR — 3 INITIATIVES

Source: Arthur D. Little

Pillars

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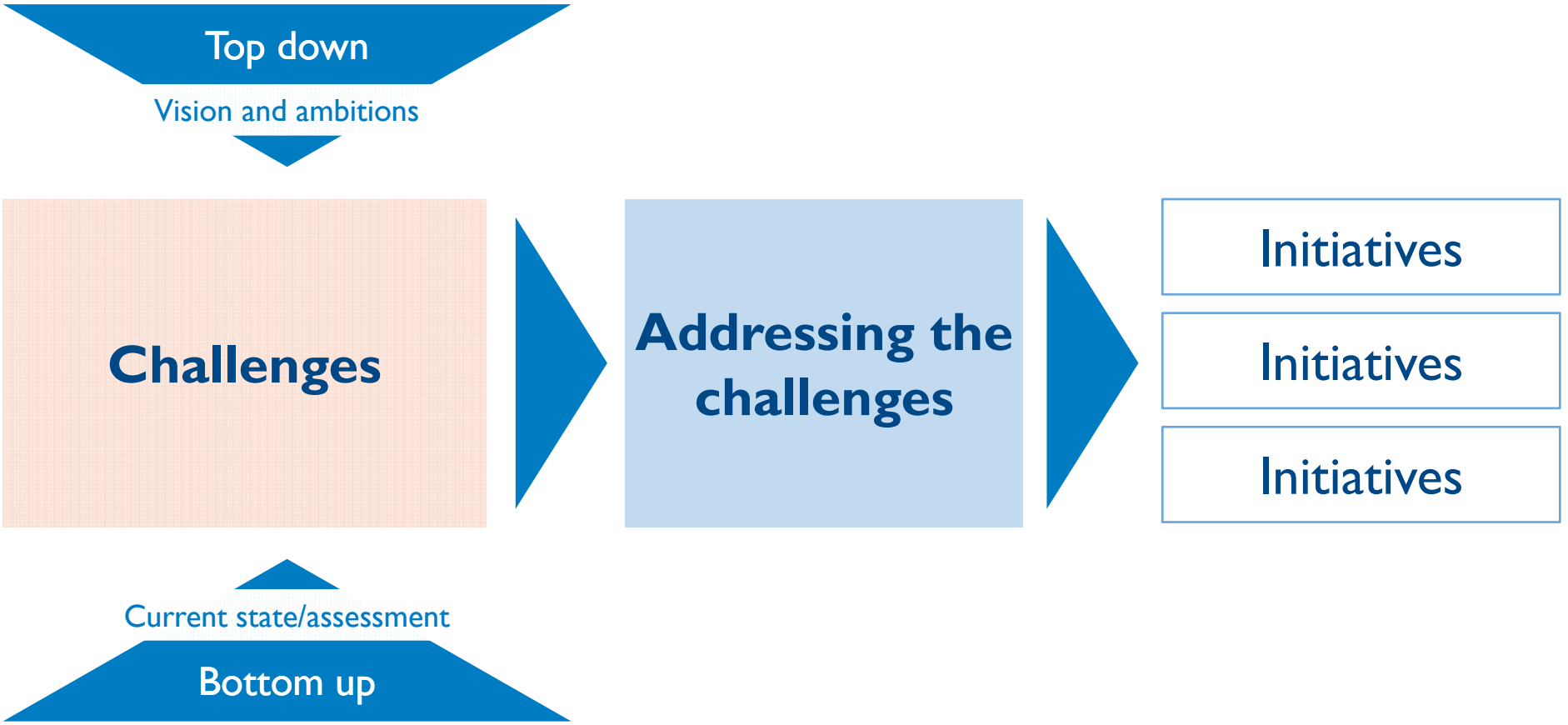
Challenges from top-down and bottom-up input can be resolved through counter measures, which translate to specific initiatives



Infrastructure counter measures are proposed for broadband expansion, emerging infrastructures and regulatory liberalization (1/3)

Broadband expansion

- Lack of a consistent licensing regime inhibits investments in infrastructure by alternate players
- Inhibited private sector funding and initiatives
- Challenges in asset separation, valuation and listing of telecoms in the long term

- Refresh of unified national efforts for fiber rollout
- Clear mandates for public and private stakeholders
- Long-term stakeholder commitment

Unified national broadband infrastructure investment plan update

Broadband implementation supervision (PMO)

- Gov't funding the rollout of fiber in large cities
- Gov't owning/renting the land for telecom towers
- OBC operates without a license and is publically funded
- FTTH/B household penetration is 6% at the beginning of 2018

Infrastructure counter measures are proposed for broadband expansion, emerging infrastructures and regulatory liberalization (2/3)

Emerging infrastructure

- Lack in some of the essential requirements for 5G, e.g. forums
- Complex regulatory framework and rollout processes
- Unclarity about 3rd party infrastructure access
- Uncertainty about demand for digitization technologies

- Unified view on emerging tech. infrastructure requirements
- Clear infrastructure sharing rules and regulations for emerging infrastructures
- Data center and cloud infrastructure development

- Emerging tech infrastructure blueprint development
- Active and passive infrastructure sharing
- Data center and cloud infrastructure development

- 3.5 GHz spectrum has been made available for testing 5G technology
- Components of smart city initiatives exist in Oman but are based on a piecemeal approach
- Data center floor space per capita in Oman is the lowest in the GCC

Infrastructure counter measures are proposed for broadband expansion, emerging infrastructures and regulatory liberalization (3/3)

Regulatory liberalization

- Lack of components in the existing telecom regulations, e.g. dominance review for fiber market
- Overregulation, e.g. encryption
- Outdated & conservative licensing and authorization models

- Revision of existing regulatory regime w.r.t to contemporariness:
  - Legacy & future wireless connectivity
  - Emerging technology infrastructures and applications (sandbox approach)

- Regulatory policies and frameworks review and publishing
- Move towards liberalized licensing regime
- Agile regulatory regime establishment

- Comprehensive laws and regulations landscape
- 3 types of licenses defined in licensing framework, each with its own conditions and approval processes
- Revision of infrastructure sharing in process/public consultation
- Universal service as social objective defined

Company incubation and incentivization, combined with low capacity of technology innovation are covered in counter measures (1/3)

Company incubation

- Regulation is considered to be a strong inhibitor to innovation and start-ups
- Lack of organization of in investor ecosystem
- Inflexible public-sector lending
- Low motivation of private-sector lending due to high perceived risk

- Continuous cross-ministerial commitment
- Cohesiveness and professionalization of funding and financing programs
- Private sector capacity building
- Improvements in ease of doing business and incentivization

- Start-up funding & financing programs
- Private sector capacity enhancement to incubate businesses
- Startup promotion and assistance in accessing new markets

- IT contributes 0.3% to Oman's GDP in 2016
- Main activity of IT companies in Oman is reselling
- Most of the value captured in IT sector happens outside the country
- No IT-focused company is listed on MSM, only telco companies

Company incubation and incentivization, combined with low capacity of technology innovation are covered in counter measures (2/3)

Company incentivization

- Underdeveloped market to generate sufficient job opportunities
- IT sector demand is not stimulated, as typically government is the largest spender on IT
- No gov't agreement or coordination
- Slow approval process yields comp. disadvantage for local companies

- Improvements its sector maturity and job opportunities
- Improvements in ease of doing business parameters
- Free zone/ digital corridor setup considerations

Incentive mechanisms applicable to large ICT investors

FDI promotion

- 1% of jobs available are in ICT sector, while 23% of job seekers have an ICT background
- Government setting up its own IT implementation arm
- Though Oman ranks well in EoDB, the operationalization of businesses is complex and the rules are rigid for SMEs and startups

Company incubation and incentivization, combined with low capacity of technology innovation are covered in counter measures (3/3)

Technology innovation

- Low capacity for innovation
- Low level of scientific & technical articles, and low score in H index

- Governmental funds/co-investment schemes and regulations for new technology testbeds
- Regulatory sandbox approach for emerging technologies (see Regulatory liberalization)
- Grant and patent support program

Funding and testbeds for new technologies

Grant and patent support program for research and patent development

Crowdsource technology R&D

- Gov't owned Blockchain Company launched to promote adoption and implementation
- Large interest in AI and active in promoting its uses and benefits
- Committee/project formed to determine 4IR components and impact

Gov't service enhancements are traditionally publically-driven but need increased private sector involvement

Government service enhancement

- Lack of structured and sophisticated methodology towards digitizing the government services
- Retardation in e-gov service implementation and no consistency across all governmental entities, e.g. customer journeys and user interfaces
- Insufficient data coverage in open data platform compared to global benchmarks

- Cohesiveness and unified approach in government service digitization
- Clear open data policies and portal requirements

- Government Transformation plan refresh
- Open data policy and databank road map development

- Oman has implemented e-government initiatives, resulting in a wide array of e-services offered
- Oman provides partial information in 3 of 15 datasets despite an established open data policy, yielding ranking 81 of 94 in Open Data index
- Though some government entities have opened up lot of data, the implementation is not consistent across all entities

Digital inclusion for both people and businesses is a prerequisite for increasing ICT's contribution in Oman (1/2)

Digital people inclusion

- Unattractive value proposition and lack of need for internet for 15% of residents
- Lack of knowledge/skills for almost 10% of residents
- Lack of funding for inclusion efforts

- Ensure funds for digital inclusion initiatives
- Develop curricula to establish relevance for left-out segments
- Bring ICT education and facilities to rural and remote areas

- Digital inclusion fund set-up
- ICT education centers development
- Digital inclusion curriculum and campaigns

- ~30% of the population does not use the internet
- Low online shopping adoption
- Numerous initiatives launched by ITA to close the digital divide, e.g. competence center setup, computer discounts

Digital inclusion for both people and businesses is a prerequisite for increasing ICT's contribution in Oman (2/2)

Digital business inclusion

- Limited support and incentives offered to SME to adopt electronic platforms

- Low online presence of businesses (~19%)
- No policies to promote ICT SMEs in government tenders

- Increase digital service adoption for SMEs through awareness campaigns and subsidies/incentive programs
- Provide advisory services to facilitate digital transformation

SME digital services adoption improvement

Digital Transformation Advisory Services establishment

Digital safety is traditionally publically-driven, but need increased private sector involvement

Digital safety

- Limited private sector activities and maturity

- Increase private sector engagement in cybersecurity through cooperation frameworks/mechanism
- Raise cybersecurity awareness

- Cybersecurity awareness creation
- "National Cyber Security Plan" development
- National Cyber Security Cooperation Framework development

- Oman is among the leading nations in cybersecurity with particular strengths in legal and national capacity building initiatives (GCI)
- Cybersecurity is primarily government-driven through ITA initiatives e.g. Information Security Management Framework, cybercrime law and Oman OCERT
- Personal Information Protection bill drafted

ICT human capital, from school to workforce level requires increased attention to ensure fitness for the local market requirements (1/3)

ICT school education

- Gaps in the ICT curriculum used in school
- Limited cross-ministerial collaboration (MOE, MOTC, MOM)
- Lack of funding for digitalization efforts

- Cross-ministerial coordination in curriculum development
- Funding and financing programs, incl. unified national broadband efforts

Compulsory ICT education in schools

ICT exposure programs for school students

- Some schools have limited broadband access
- National ICT curriculum in preparation
- Scattered/piloted roll-out of digitalization initiatives in selected schools

ICT human capital, from school to workforce level requires increased attention to ensure fitness for the local market requirements (2/3)

ICT tertiary education

- Limited involvement in ensuring adequate supply of ICT skilled manpower, i.e. number of candidates, quality
- Limited cross-ministerial collaboration (MOE, MOTC, MOM)
- Lack of funding for digitalization efforts

- Increased public-private collaboration
- ICT scholarships

- ICT curriculum collaboration for tertiary education
- Scholarship programs for gifted ICT students
- Establishment of international ICT college / university

- One of the highest number of IT graduates (~12%) worldwide
- ~60% of universities offer courses related to ICT
- Supply surplus in number of ICT graduates, i.e. market cannot absorb large number of ICT graduates

ICT human capital, from school to workforce level requires increased attention to ensure fitness for the local market requirements (3/3)

ICT workforce

- Cultural inhibitors and lack of incentivization for youth to go to private sector
- Low sector attractiveness due to rigid labor laws and employment quotas discourage
- Perceived difficulty in finding skilled employees

- Certification programs
- Hiring programs and incentivization

National ICT skills action and training program

- SAS and MOM both offer ICT trainings
- Oman does not allow dismissal of redundant workforce
- Omani employment quotas (Omanization)
- ICT job classification framework to achieve administrative development and to optimize service quality

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In order to push broadband expansion, the gov't needs to take a facilitate or drive role, but should not intervene with a gov. owned company

INFRA-STRUCTURE

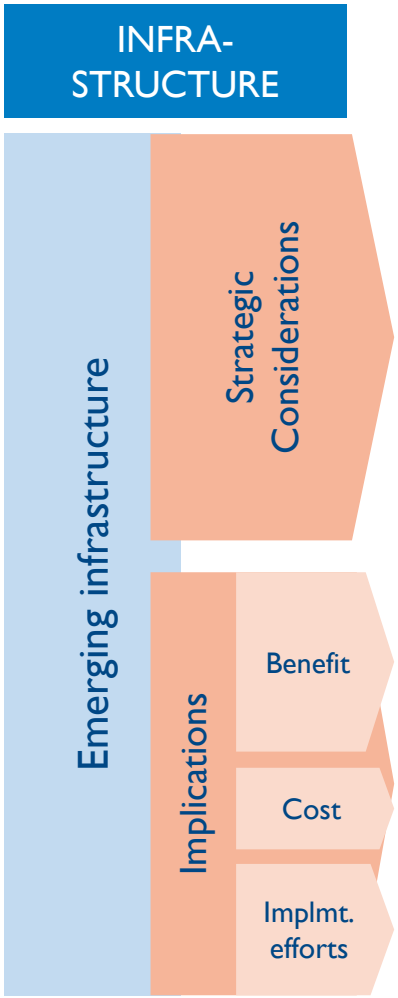
Broadband expansion

		Facilitate	Drive
Strategic Considerations		■ Define clear universal service obligations targets ■ Provide partial government funding from to roll out FTTB/H in economically deprived areas ■ Develop implementation plan, coordinates and align with market players to identify gap areas for funding ■ Encourage nation-wide deployment of public Wi-Fi hotspots in public areas	■ Define clear universal service obligations targets ■ Develop copper phase-out plan ■ Initiate full government funding program to roll out FTTB/H to ensure coverage of majority of areas in Oman ■ Link license renewals to rollout obligations ■ Fund release connected to tightly-managed service level agreements for rural and remote areas
Implications	Benefit	■ Extensive network to facilitate ICT adoption ■ OMR 500 mn benefit to economy due to high speed broadband adoption over 5 years	■ Extensive network to drive ICT adoption ■ OMR 1,270 mn benefit to economy due to high speed broadband adoption over 5 years
	Cost	■ OMR 10 mn for strategy update, implementation monitoring and limited subsidies till 2023	■ OMR 40 mn for strategy update, implementation, larger subsidies and copper phase-out till 2023
	Implmt. efforts	■ Medium – Working with the operators to roll out infra. will be challenging, esp. rural/remote areas there is little private sectors interest in roll out	■ High – Difficulty in obtaining funds for gov't funding programs due to lack of a "commercial case" in rural/ remote areas but the reliance on "social case"

Source: Arthur D. Little

ADL recommendation

Facilitating or driving infrastructure for emerging tech/application fields is recommended to help create a unified understanding among stakeholders

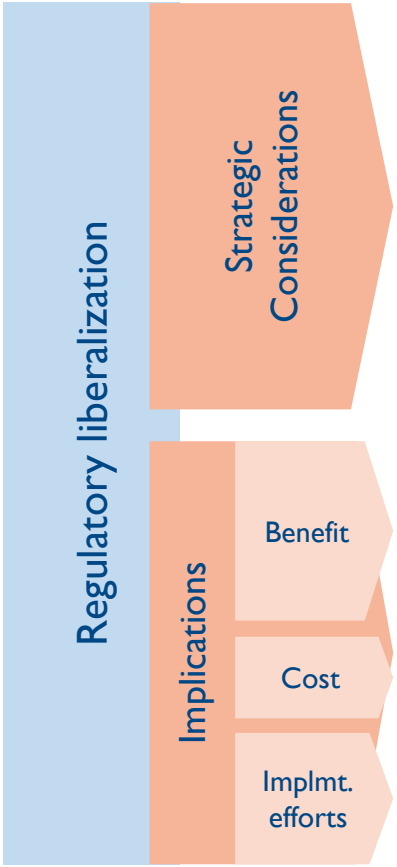


	Facilitate	Drive
Strategic Considerations	■ Develop a 5G/smart city/IoT regulatory framework to facilitate the development of IoT ecosystem in the country ■ Consider pro-active support for 5G, IoT network deployment (including funding of testbeds/ trials) to stimulate IoT ecosystem ■ Facilitate data center connectivity ■ Define effective rollout process ■ Set national emerging infrastructure objectives	■ Create taskforce for emerging infrastructure, e.g. 5G, Smart City, IoT ■ Develop strategic blueprint and detailed implementation roadmap for emerging infrastructure development ■ Mandate mandatory 5G rollout for operators ■ Assess need for public funding and approve the release based on progress in implementation
Implications – Benefit	■ Improved 5G, IoT-technologies and network coverage; Showcase smart cities to improve coverage and adoption ■ OMR 60-90 mn from smart city over 5 years	■ Standard infrastructure for ensuring technical interoperability; Improved 5G, IoT-technologies and cloud network coverage ■ OMR 400 mn from smart city over 5 years
Implications – Cost	■ OMR 66 mn till 2023 for blueprint development, smart city pilot, data center and IXP development	■ OMR 585 mn till 2023 for large scale rollout smart city infrastructure along with other activities
Implications – Implmt. efforts	■ Medium – Developing frameworks for infant infrastructure technologies with uncertain application fields might be challenging	■ High – Requires significant enhancement in existing capabilities to develop relevant policies; High degree of cross-institutional alignment required

Source: Arthur D. Little

ADL recommendation

Oman can either stick to the existing regime, or push for liberalization which offers multiple benefits and is line with global best practices



	Do nothing	Own
Strategic Considerations	■ Do not make adjustments to regulatory framework	■ Update and publish the Telecom Act ■ Review market structure and increase competition ■ Move towards a general authorization and/or notification regime for licensing ■ Establish agile regulatory regime ■ Define & implement clear reg. on OTT services, encryption and data classification and hosting ■ Expand interconnection and open access guidelines to cover new types of infrastructure
Implications – Benefit	■ Existing market remains stable	■ Regulatory ecosystem in line with global best practice to foster growth and innovation ■ OMR 200 mn benefit to customers over 5 years due to competitive offerings
Implications – Cost	■ No incremental costs	■ OMR 4 mn till 2023 to updgrade regulatory framework and implement it
Implications – Implmt. efforts	■ Low – No updates required, continue as-is	■ Medium – Multidimensional revamp incl. access to funding and new technologies facilitated with a consultation exercise

Source: Arthur D. Little

ADL recommendation

The gov't needs to take an active role in fostering the local start up ecosystem by providing direct or indirect funding schemes

DIGITAL ECOSYSTEM

Company incubation

		Drive	Own
Strategic Considerations		■ Initiate promotional activities for encouraging and attracting entrepreneurial talent to form start-ups ■ Provide collaboration platform for start-ups, private sector and VCs/ Business Angels ■ Provide financial support (limited) to start-ups ■ Enhance capacity of business incubation, accelerator and growth programs ■ Conduct and publish market studies on hot topics and opportunities	■ Develop a dedicated "organization" to finance and nurture ICT startups by providing – Capital (for seed, early-stage & growth phase) – Leadership & mentoring ■ Entity coordinates the activities with private VC funds in Oman ■ Provide financial incentives to attract local & foreign entrepreneurial talent
Implications	Benefit	■ Increased reputation and sophistication of the local ICT market ■ OMR 260 mn benefit over 5 years	■ Increased reputation due to significant gov't commitment and sophistication of the local ICT market ■ OMR 320 mn over 5 years
	Cost	■ OMR 56 mn till 2023 to support startups and to provide partial funding	■ OMR 250 mn till 2023 to implement drive initiatives + more funding for startups
	Implmt. efforts	■ Medium – Providing coordination role will be less challenging, freeing up budgets without underlying business case	■ High – Establishing and management of a dedicated organization – funding and incubation – will impose challenges

Source: Arthur D. Little

ADL recommendation

Oman offers limited advantages for companies to move-in, hence the government needs to incentivize in order to increase attractiveness

DIGITAL ECOSYSTEM

Company incentivization

Strategic Considerations

Implications

Benefit

Cost

Implmt. efforts

Facilitate

- MOTC works with ICT companies and ministries on improving "ease of doing the business"
- Co-invest for leading global ICT companies to set up research centers
- Promote Oman as attractive destination for FDI, e.g. by quarterly reports on market overview/ statistics

- Increased governmental emphasis on ICT-specific EOBD parameters and increased likelihood of FDI
- OMR 125 mn benefit over 5 years, in terms of ICT investments
- OMR 15 mn till 2023 to facilitate with various agencies for visas, sector promotions, research, etc.
- Medium – working with various ministries to change the "ease of doing business" environment will be challenging due to different priorities

Own

- Create specific purpose entity/ organization
- Develop ICT specific tax regime with MoF
- Establish ICT focused free zones/digital corridors
- Develop and implement incentive mechanisms for large ICT investors
- Establish single window clearance mechanism for ICT companies

- Enhanced EODB parameters and additional vehicles for company incentivization, yielding increased country attractiveness
- OMR 230 mn over 5 years, in ICT investments
- OMR 82 mn till 2023 to establish and operate free zone along with other activities
- High – Establishing and management of a dedicated SPE, funding and mandate for tax and property adjustments will impose significant challenges

Source: Arthur D. Little

ADL recommendation

Oman wants to play a more impactful and value-creating role within the ICT value chain. This push needs to be driven by the government

DIGITAL ECOSYSTEM

Technology innovation

		Drive	Own
Strategic Considerations		■ Provide coordination and limited financial support to carry out R&D activities between public and private R&D institutions ■ Establish regulations for testbeds of new technologies ■ Develop initiatives to crowdsource technology R&D	■ Develop a program to carry out R&D activities in emerging ICT technologies with leading public and private R&D institutions ■ Establish fund to offer testbeds for new technologies ■ Establish hub for cybersecurity research and accreditation labs
Implications	Benefit	■ New ICT patents increase ■ Benefits realized when research is monetized through the industry (combined with sub-pillar on incubation)	■ Increased vertical range of manufacture in the ICT value chain, diversified revenue streams and increased degree of innovativeness
	Cost	■ OMR 40 mn to provide research grants, co-invest in research facilities, patent support, etc.	■ Potentially unlimited
	Implmt. efforts	■ High – Involving and aligning multiple institutions to develop commercially useful patents is arduous	■ High – Involving and aligning multiple institutions to develop commercially useful patents is arduous

Source: Arthur D. Little

ADL recommendation

Existing attempts towards public digitization will be enhanced with a more centralized approach

DIGITAL ECOSYSTEM

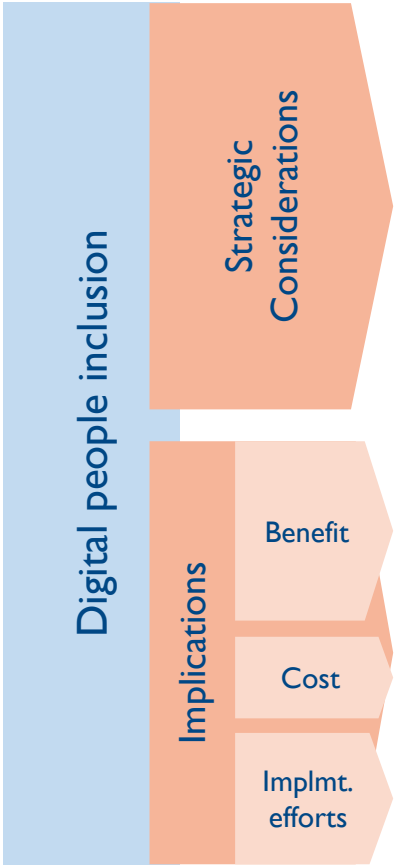
Governmental service enhancement

		Drive	Own
Strategic Considerations		■ Define a digital-first approach to gov't services ■ Refresh and execute existing transformation plan accordingly ■ Develop national Open Data strategy ■ Mandate central transformation budget across ministries ■ Take advisory and PMO role ■ Conduct regular progression audits and release funds accordingly	■ Create specific purpose entity/ organization ■ Develop national Open Data strategy and implement open data platform ■ Define mandatory digital governmental service technical architecture ■ Get mandate for full ownership of transformation across ministries ■ Utilize and coordinate third party service provider for implementation
Implications	Benefit	■ Improvement in existing e-government initiatives ■ OMR 110 mn over 5 years due to high penetration of e-gov services and apps using Open Data	■ Consistent look and feel for citizens utilizing the services facilitates adoption and improves usability ■ OMR 200 mn over 5 years due to higher penetration of e-gov services and Open Data apps
	Cost	■ OMR 6 mn till 2023 to improve e-government and open data services	■ OMR 15 mn till 2023, including operations costs
	Implmt. efforts	■ High – Difficult to get mandate to manage eGov't funds allocated to other ministries	■ High – Difficult to obtain end-to-end implementation responsibilities and take-over/update processes of various governmental agencies

Source: Arthur D. Little

ADL recommendation

Infrastructural, regulatory and service initiatives need to be augmented by inclusion programs for the end user to close the digital divide



Facilitate

- Develop digital inclusion plan to bridge the digital divide
- Create and finance digital inclusion fund
- Encourage private sector contribution to participate in addressing digital divide issues
  - Developing websites for "left-out" segments (i.e. for elderly, women, new learners, etc.)
  - Carry out campaigns and providing ICT technology/ devices

- OMR 670 mn over 5 years for every individual who crosses the digital divide

- OMR 22 mn till 2023, provided partial funding comes from private sector
- Medium – Cooperation and facilitation requires limited enhancement of existing capabilities

Drive

- Implement "digital inclusion" programs and provide funding for devices and broadband connections to bridge income and rural/ urban divide
- Establish educational programs for "left-out" segments (incl. educational centers)
- Operate education centers in low income/rural areas
- Develop eLearning and information portal for "left-out" segments

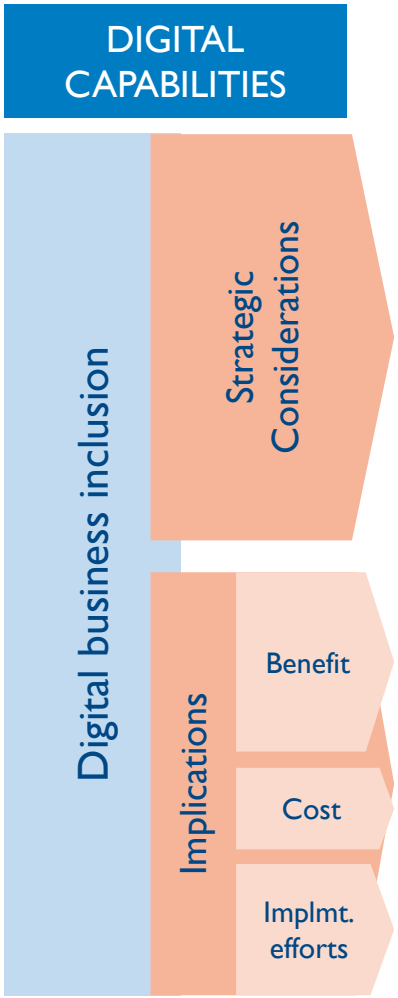
- OMR 650 mn over 5 years for every individual who crosses the digital divide

- OMR 22 mn till 2023 to conduct campaigns and offer training programs
- High – Developing and implementing "digital divide" programs will require significant effort and enhanced capabilities

Source: Arthur D. Little

ADL recommendation

Infrastructural, regulatory and service initiatives need to be augmented by inclusion programs for SMEs to enhance their operations

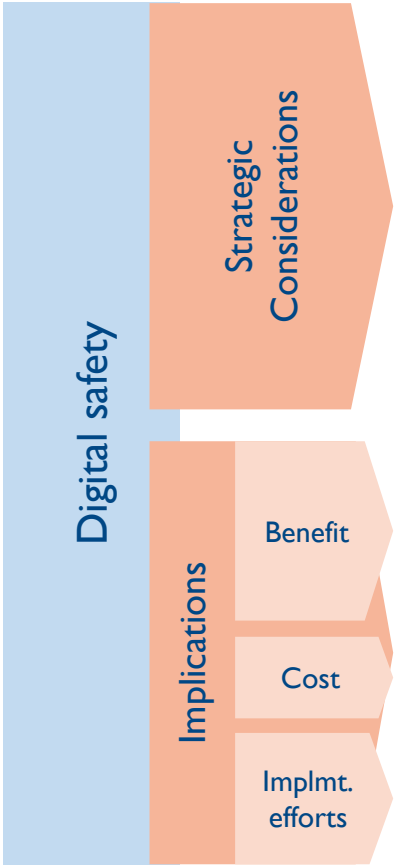


	Promote	Drive
Strategic Considerations	■ Develop and conduct promotional campaigns and training programs for SMEs to move to cloud based solutions ■ Promote benefits of digitalization, such as cloud service adoption, e-Invoicing etc., to SMEs and large companies ■ Encourage SMEs to sell via e-commerce channels	■ Provide/stimulate adoption of cloud-based services at concessional prices ■ Provide resources/ incentives for SME to be online ■ Integrating e-Invoicing with apps made available for SMEs ■ Move all public sector invoicing to e-Invoicing
Implications – Benefit	■ Adoption of digital services will yield new customer acquisition channels and increase company efficiency ■ OMR 15 mn contribution from SMEs over 5 years, as take up is lower than in Drive option	■ Adoption of digital services will yield new customer acquisition channels and increase company efficiency ■ OMR 660 mn over 5 years due to increased contribution of SMEs to the economy
Implications – Cost	■ OMR 600k for promoting adoption through campaigns	■ OMR 2 mn to promote adoption and to subsidize service cost of SMEs
Implications – Implmt. efforts	■ Low – Cooperation and facilitation requires limited enhancement of existing capabilities	■ High – Implementation of IT adoption initiatives across a wide variety of SMEs is challenging

Source: Arthur D. Little

ADL recommendation

Digital safety of residents and businesses is of the highest national importance and thus requires a high degree of gov't involvement



	Drive	Own
Strategic Considerations	■ Develop, adapt and support implementation of national cyber security plan ■ Review and publish personal information protection law ■ Create and support implementation broad-reaching education and awareness efforts ■ Coordinate and redirect research and development efforts	■ Create specific purpose entity/ organization for digital safety and cyber security together with corporate funding sponsors and collaborators (PPP) ■ Develop, adapt and implement national cyber security plan ■ Create and implement broad-reaching education and awareness efforts ■ Coordinate and redirect research and development efforts
Implications – Benefit	■ Web user safety, protected PCs/ devices ■ Privacy violations; Global cybersecurity rank ■ OMR 280 mn benefit over 5 years due to cyber attacks protection and e-commerce take up	■ Web user safety, protected PCs/ devices ■ Privacy violations; Global cybersecurity rank ■ Benefits depend on national level security initiatives in coordination with other government agencies
Implications – Cost	■ OMR 9 mn to develop plans, execute cooperation frameworks and for awareness campaigns	■ Depends on national level security initiatives in coordination with other government agencies
Implications – Implmt. efforts	■ Medium – High cabinet commitment but enhancements in existing capabilities and funding	■ High – Establishing and management of a dedicated SPE, funding and aligning with national security and defense stakeholders imposes significant challenges

Source: Arthur D. Little

ADL recommendation

The sector should play a facilitating role in shaping ICT in primary and secondary schools

DIGITAL CAPABILITIES

ICT school education

		Facilitate	Drive
Strategic Considerations		■ Work closely with Ministry of Education to propose ICT content for school curriculum and enhance ICT skills of teachers ■ Support definition of pilot projects with MoE and provide devices and facilities if required ■ Expose pupils to work on real ICT and technology-related issues	■ Develop ICT curriculum in schools; work closely with Ministry of Education incl. bearing the cost to enhance ICT skills of teachers and salaries ■ Introduce compulsory ICT courses ■ Collaborate with MoE on introducing mandatory English classes and logical reasoning in Mathematics as prerequisite for ICT courses
Implications	Benefit	■ Raise interest and understanding for ICT at an early age ■ OMR 460 mn benefit over 5 years, once the students enter workforce	■ Ability to shape future ICT workforce and raise interest/understanding at an early age ■ OMR 700 mn benefit over 5 years due to a better educated ICT population
	Cost	■ OMR 2-3 mn for developing ICT curriculum and to conduct ICT competitions	■ OMR 165 mn including teacher training and sponsoring their salaries
	Implmt. efforts	■ Medium – Cooperation and facilitation requires enhancements of existing capabilities	■ High – Requires significant enhancement in existing capabilities to develop relevant and suitable content

Source: Arthur D. Little

ADL recommendation

The government can maximum play a facilitating role as universities already offer a wide variety of ICT courses

DIGITAL CAPABILITIES

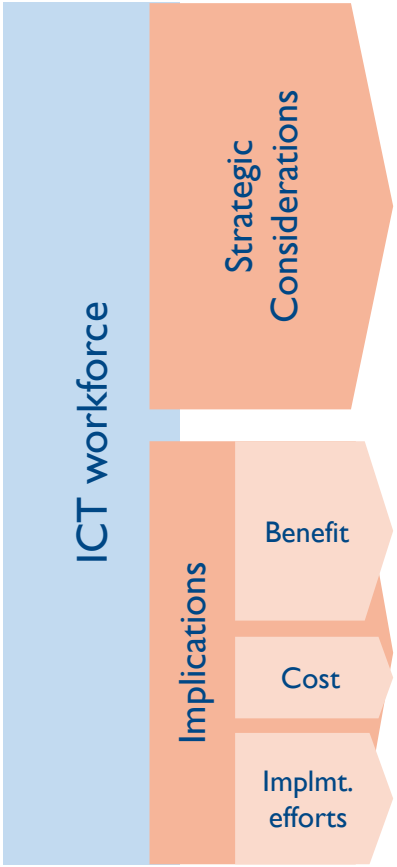
ICT tertiary education

		Facilitate	Drive
Strategic Considerations		■ Establish well-funded scholarship program for students in emerging technologies at university/ vocational level ■ Provide incentives to firms for hiring/ training local ICT graduates ■ Develop R&D platform for collaboration between universities/ research centers with private sector companies	■ Supervise and fund the setup of a international renowned university in Oman ■ Incentives to attract the university to Oman (e.g. land, facilities, research funding, faculty visas, etc.) ■ Examine existing ICT curricula and produce new ICT curricula development guidelines ■ Establish well-funded scholarship program for students in emerging technologies at university/ vocational level
Implications	Benefit	■ Increased awareness and cooperation between universities and the private sector ■ OMR 1 mn benefit over 5 years by guiding students to suitable ICT courses	■ More relevant ICT graduates for businesses that are able to meet market requirements ■ OMR 700 mn benefit over 5 years due to highly qualified ICT graduates entering the market
	Cost	■ OMR 400k to promote ICT careers and coordinate	■ OMR 115 mn including scholarships to deserving graduates and funding a local set-up of int'l univ.
	Implmt. efforts	■ Low – Cooperation and promotion requires limited enhancement of existing capabilities	■ Medium – Requires enhancements in existing capabilities and funding

Source: Arthur D. Little

ADL recommendation

The govt. agencies can play an facilitating or driving role in improving the suitability and relevance of ICT workforce for the local economy



	Facilitate	Drive
Strategic Considerations	■ Provide limited scholarship programs for students enrolled in ICT fields ■ Provide limited incentives for employers to hire and train local ICT talent ■ Provide guidelines to facilitate tele-working	■ Establish a digital careers program and provide financial support and training for career shift towards ICT ■ Provide extensive incentives for employers to hire and train local ICT talent ■ Provide guidelines and necessary regulations to facilitate tele-working (e-signatures, etc.)
Implications – Benefit	■ % of Omanis with ICT jobs in companies (without Omanization requirements) ■ OMR 10 mn benefit over 5 years, due to salaries injected in the economy	■ Enhance ICT capabilities of existing workforce to be prepared for future requirements ■ OMR 100 mn benefit over 5 years, due to higher take up of trainings and salaries injected
Implications – Cost	■ OMR 600k to periodically study supply-demand gaps in the market	■ OMR 800k to develop a digital certification program and to conduct supply-demand studies
Implications – Implmt. efforts	■ Medium – Cooperation and facilitation requires limited enhancement of existing capabilities	■ High – Developing programs will require significant effort and new capabilities

Source: Arthur D. Little

ADL recommendation

Appendix

A Strategy elements

B Challenges and implications

C Option detailing

D Technology attractiveness

E Initiative budgeting

The technologies in the Hype Cycles show a huge global market potential

SELECTION

Selected ICT Hype Cycle key technologies (1/3)

Technology	Description	Global market size ($ bn, year)	CAGR
Smart City Framework*	Decision methodology that enables public and private sector to implement smart city initiatives	n/a	n/a
Blockchain	Distributed electronic ledger that uses software algorithms to record and confirm transactions with reliability and anonymity	23.3 (2023)	80%
Digital Commerce Platforms	Platform that enables the buying and selling of goods and services using the Internet, mobile networks and commerce infrastructure.	14.8 (2024)	15%
Hyperconverged Integrated Systems	Platform offering shared compute and storage resources, based on software-defined storage, software-defined compute, commodity hardware and a unified management interface	6.3 (2019)	50%
Disaster Recovery as a Service	Cloud computing and backup service model that uses cloud resources to protect applications and data from disruption caused by disaster.	12.5 (2022)	42%

Source: Gartner, Arthur D. Little **Bold technologies appear in multiple ICT Hype Cycles**

*) No direct financial impact as it refers only to a methodology, and includes a variety of technologies, e.g. IoT

The technologies in the Hype Cycles show a huge global market potential

SELECTION

Selected ICT Hype Cycle key technologies (2/3)

Technology	Description	Global market size ($ bn, year)	CAGR
Internet of Things	Network of physical objects that contain embedded technology to communicate and sense or interact with their internal states or the external environment	561 (2022)	22%
Machine Learning	Branch of artificial intelligence based on the idea that systems can learn from data, identify patterns and make decisions with minimal human intervention	8.8 (2022)	44%
Virtual Support Agents	Stimulate a human support agent by interacting with users. The VSA draws knowledge from a variety of data sources in order to intelligently respond to the customer	4.2 (2022)	30%
AI for IT Ops. Platforms	Multi-layered technology platforms that automates and enhances IT operations by using analytics and machine learning	11 (2023)	44%

Source: Gartner, Arthur D. Little

Bold technologies appear in multiple ICT Hype Cycles

The technologies in the Hype Cycles show a huge global market potential

SELECTION

Selected ICT Hype Cycle key technologies (3/3)

Technology	Description	Global market size ($ bn, year)	CAGR
Android Instant Apps	Acts like a bridge between web and native applications by enabling users to run specific parts of an app without downloading the entire application but rather tapping a URL	100* (2022)	10%
Edge Computing	Practice of processing data near the edge of your network, where the data is being generated, instead of in a centralized data-processing warehouse	21 (2023)	14%
Software Defined Data Centre	Data center where all infrastructure is virtualized and delivered as a service	83.2 (2021)	27%
Social Analytics	Monitoring, analyzing, measuring and interpreting digital interactions and relationships of people, topics, ideas and content	16.4 (2023)	28%

Source: Gartner, Arthur D. Little

Bold technologies appear in multiple ICT Hype Cycles

*) Total Android apps market

Gartner determines some principle investment rationales, ranging from early an aggressive, to cautious and delayed to minimize risk

BACKUP

Technology priority matrix investment rationale

Benefit \ Mainstream adoption	<2 years	2-5 years	5-10 years	10 years+
Transformational	Invest aggressively if not already adopted	Type C investment profile	Type B investment profile	Type A investment profile
High	Type C investment profile	Type B investment profile	Type A investment profile	Invest with caution
Moderate	Type B investment profile	Type A investment profile	Invest with caution	Invest with extreme caution
Low	Type A investment profile	Invest with caution	Invest with extreme caution	Invest with extreme caution

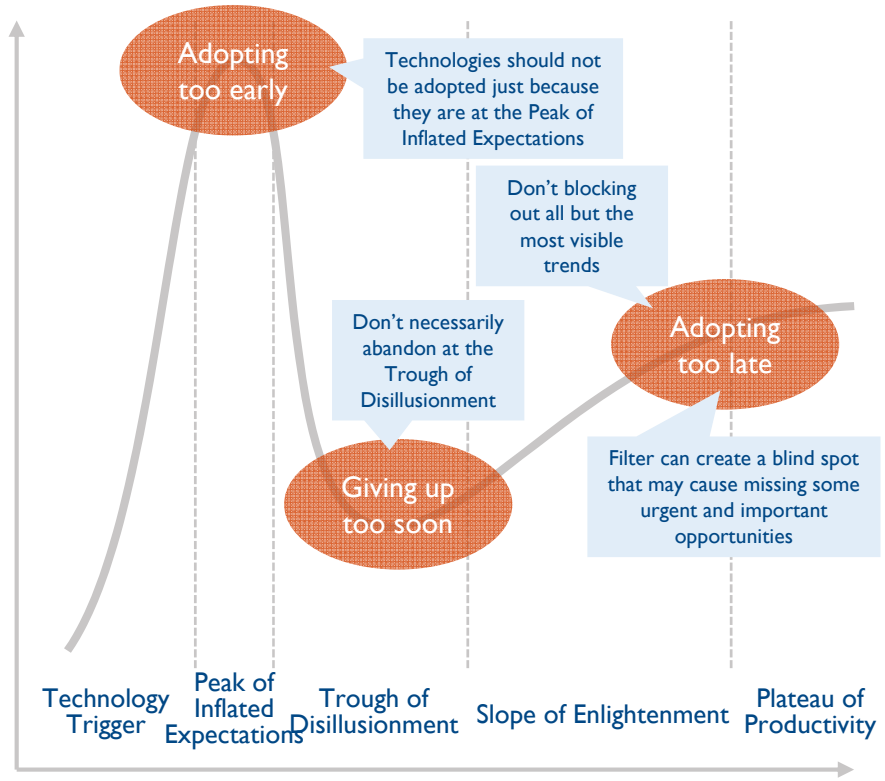
- **Type A**: Deliberately try to **adopt more innovations early** in the Hype Cycle because they are prepared to **brave the risks associated with early adoption in return for the reward**
- **Type B**: Try to hit the middle of the Hype Cycle to **learn from the Type As but not wait so long that they lag behind** their competitors and become Type Cs
- **Type C**: Deliberately try to **minimize risks by adopting late** in the Hype Cycle, once the innovation hits the Plateau of Productivity

Source: Gartner, Arthur D. Little

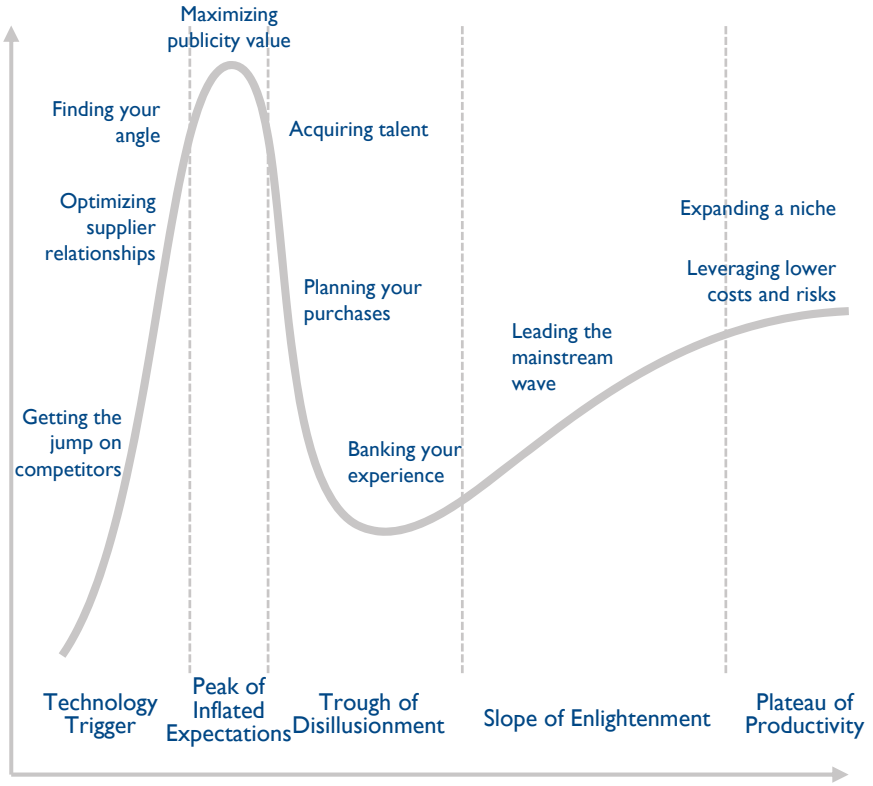
Typical traps along the Hype Cycle include early/late adoption, and giving up too soon, however, opportunities arise along the way

BACKUP

Hype Cycle traps



Hype Cycle opportunities



Source: Gartner, Arthur D. Little

Appendix

A Strategy elements

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D Technology attractiveness

E Initiative budgeting

The initiatives are estimated to cost OMR 498 mn till 2023, and are expected to result in 9-10x benefit over 5 years once implemented

1. Broadband expansion
- BB strategy update
- BB implementation monitoring
- Implementation subsidy

2. Emerging infra
- Infrastructure blueprint development
- Smart city pilot
- Infrastructure sharing + GIS
- Data center development
- IXP costs

3. Regulatory liberalization
- Regulatory costs

4. Company incubation
- Creating startup database, financing products, stock exchange rules
- Government share of VC funding
- Fund provided by other markets for startups to go abroad

5. Company incentivization
- Free zone setup
- ITHRAA support (local)
- Special visa program
- Research co-funding for int'l companies
- International marketing
- ICT report on Oman
- Omanis salary sponsorship

6. Technology innovation
- Research center co-invest + tech testbeds
- Grants and patent support
- Crowdsource technology R&D

7. Gov. service enhancemnt
- e-government
- Open data

8. Digital people inclusion
- Inclusion campaigns
- Training

9. Digital business inclusion
- SME/MSME enrollment
- Digital advisory services

10. Digital safety
- National cybersecurity plan
- National and int'l cooperation framework
- Awareness programs

11. ICT school education
- Teacher training
- Teacher salary costs
- Curriculum updates
- ICT competition
- ICT equipment cost

12. ICT tertiary education
- Scholarship
- ICT curriculum collaboration
- Establishing a new campus (of global institution)

13. ICT workforce
- Certification program
- Studying supply-demand gaps and updating program

14. Institutional governance
- ICT executive league
- ICT GDP contribution mechanism
- ICT sector decision making

Total

44 cost items with a total requirement of ~ OMR 500 mn

We propose a total of 35 initiatives along the three OMN clusters, with the majority targeted towards enhancing the market & removing barriers

Overcome 131

Broad-band exp.	■ Unified NBB infra. investment plan update ■ Broadband implementation supervision	39.3
Emerging infra	■ Active and passive infrastructure sharing	3.5
Regu-lation	■ Regulatory policies and frameworks review and publishing ■ Move towards liberalized licensing regime	3.9
Gov. service	■ Government transformation plan refresh	60
Digital ppl. incl.	■ Digital inclusion fund set-up ■ ICT education centers development ■ Digital inclusion curriculum and campaigns	22
Govern-ance	■ ICT executive league establishment ■ Clear processes for ICT sector decision making	2.2

Modernize 271

Emerging infra	■ Emerging tech. infrastructure blueprint development (incl smart city, IXP) ■ Data center and cloud infrastructure development	11.1
Regu-lation	■ Agile regulatory regime establishment	NA
Comp. incent.	■ Incentive mechanisms for large ICT investors ■ FDI promotion	80
Gov. service	■ Open data policy and roadmap development	3.9
Digital biz. incl.	■ SME digital services adoption improvement ■ Digital transformation advisory services establishment	1.9
Digital safety	■ Cybersecurity awareness creation ■ National cybersecurity plan development ■ National cybersecurity cooperation framework development	8.7
School edu.	■ Compulsory ICT education in schools ■ ICT exposure program for school students	84
Tertiary edu.	■ ICT curriculum collaboration for tertiary education ■ Scholarship program for gifted ICT students ■ Establishment of international ICT college/univ	79
Work-force	■ National digital business certification program	0.8
Gov.-ernanc	■ Measuring ICT contribution to GDP	1.7

Nurture 96

Company incubation	■ Start-up funding and financing programs ■ Private sector incubation capacity enhancement ■ Startup promotion and assistance in accessing new markets	56
Tech. innovation	■ Funding and testbeds for new technologies ■ Grant and patent support program ■ Crowdsourcing technology R&D	40

Strategic pillars

- Infrastructure
- Digital Ecosystem
- Digital Capabilities
- Institutional Governance

… Funding required

Source: Arthur D. Little