Ministry of Science, Technology and Innovation
(MOSTI)

National Blockchain Roadmap 2021-2025

Ministry of Science, Technology and Innovation (MOSTI)

CONTENTS

Executive Summary

The National Blockchain Roadmap is at the helm to steer Malaysia to embrace the Blockchain 2.0, i.e. beyond the crypto-currency, and angle at solution to business issues ranging from fraud management to supply-chain monitoring to identity verification, that can potentially increase efficiency and reduce costs. MOSTI has engaged with various stakeholders, ranging from industry, academy, government agencies and NGOs to develop Malaysia's National Blockchain Roadmap with action plans to embrace the blockchain technology and proliferate its potential in a wide spectrum of industries. Note however **there is no discussion of or advocacy for blockchain crypto-currencies and digital asset**, which we consider beyond the remit and scope of this document.

Blockchains will be a critical drive factor in Malaysia's digital transformation, which can be effectively undertaken and managed through five ecosystem building blocks, in particular Collaboration, Amplifier, Talent, Legal & Governance, and Enablers, abbreviated as CATLE. While acknowledging the advantages of blockchain technologies, several challenges must be addressed to unleash the full potential of blockchain besides leveraging on existing strengths for blockchain. This roadmap outlines 20 initiatives and 10 government-led core programmes for each of the 5 ecosystem building blocks in five years' time span to energise and vitalise the prevalence momentum in Malaysia, and strengthen Malaysia leadership position in Blockchain for Economic Competitiveness & Growth through cohesive strategic collaboration with National Blockchain Roadmap Strategic Framework as guideline (refer Figure 1.1).

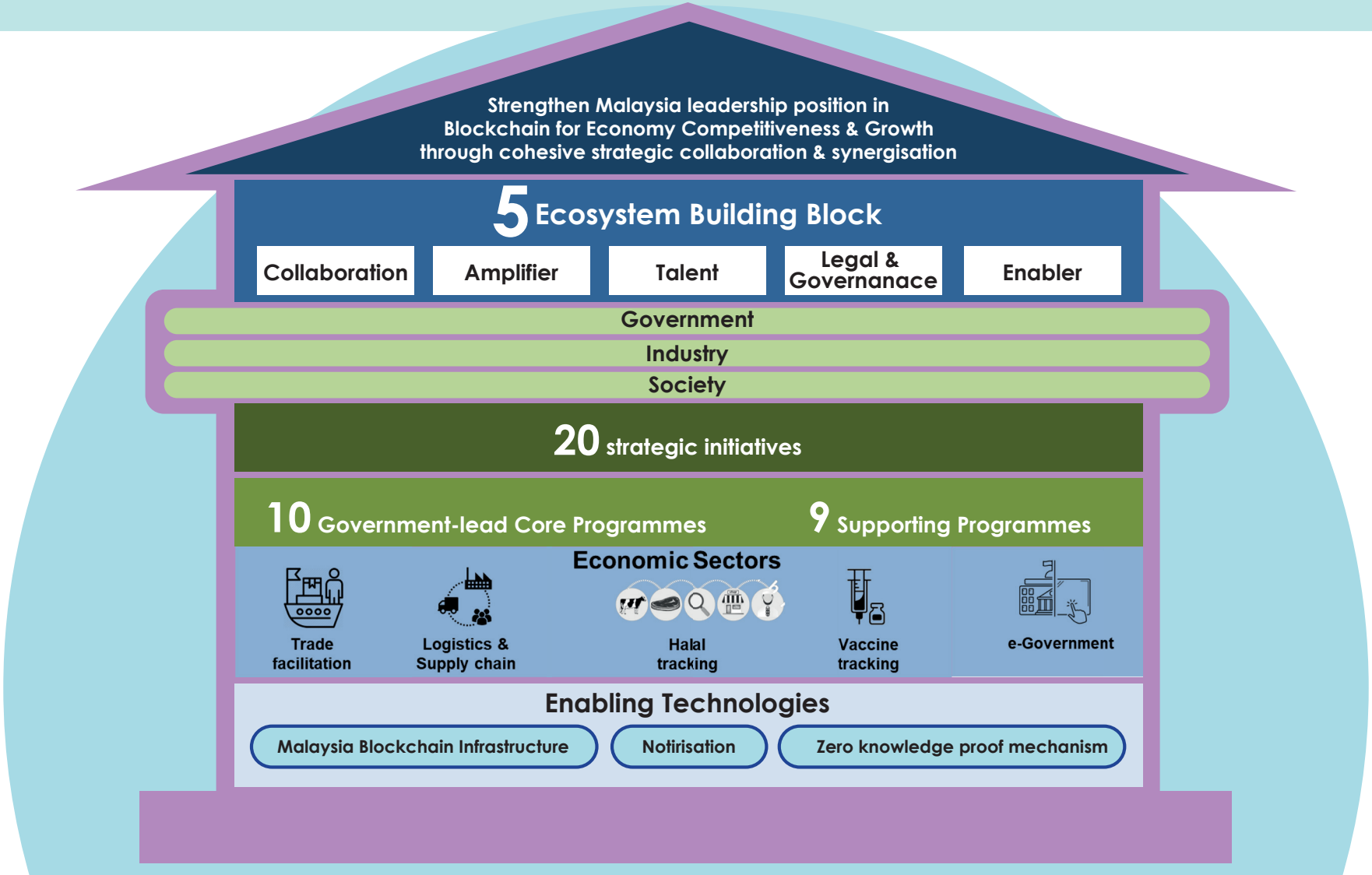


Figure 1.1 : National Blockchain Roadmap Strategy Framework

A core element of our recommendation is the **Malaysia Blockchain Infrastructure (MBI)**. This can be visualised to be similar in concept and objectives as China's Blockchain Service Network (BSN) and the European Blockchain Services Infrastructure (EBSI).

The Malaysia Blockchain Infrastructure will serve as a seeding point for development efforts in support of the roadmap. To this end, work should commence to build common and reusable components useful across problem specifications, use cases and solution architectures; inclusive of data notarisation, zero knowledge commitment and proofing, and middleware interfaces to external systems. The initial development objectives are to protect user privacy and data confidentiality of off-chain information, and also to enable ownership specification and establishment via personalised identity wallets, which would potentially also serve as a national digital identity.

We also recommend that trade facilitation and government services be the strategic focus of any early use case development. The use of blockchains for vaccine tracking, tracing and ultimately administration into particular individuals suggests itself. Likewise, the subsequent certification of such individuals to have undergone a successful vaccination process relating to vaccine allotments traced back to the source data input, with a corresponding zero knowledge query system for privacy protection. The other use cases deemed to be both important and urgent are halal tracking and certification, and customs clearance. It is noteworthy that the addition to also being adjudged the most urgent. The proposed use cases are all of immense public interest, and would presumably have no difficulty attracting private-sector collaborators. al tracking is the single most frequently cited use case, in addition to also being adjudged the most urgent. The proposed use cases are all of immense public interest, and would presumably have no difficulty attracting private-sector collaborators.

While this roadmap covers the years 2021 to 2025, the longer-term view about blockchain's future must be kept in mind. Blockchain today is like the World Wide Web in the early 90s. It will be everywhere and interwoven into our daily lives, but with a potentially faster and broader-based take-up. Malaysia cannot wait, and must launch through this present and pressing window of opportunity, to steer its own future with blockchains.

Chapter 1
Introduction

1.1 Background

Blockchain technology is evolving fast and its applicability has expanded beyond the crypto-currency of Bitcoin in 2008, to more mainstream applications, inclusive of trade facilitation, cross-border logistics and financial services. The local blockchain industry is moving in tandem with global trends. In order to steer and speed up the growth of this local blockchain industry, a National Blockchain Roadmap is necessary. This document focuses on the blockchain applicability of importance and urgency to both government and industry, and provides a generic conceptual schema for technology commonality and reusability. Note however there is no discussion of or advocacy for blockchain crypto-currencies and digital asset, which we consider beyond the remit and scope of this document.

This document seeks to specify the framework and structure of such a roadmap, in terms of constituent programme elements, milestones, owners and outcomes. The governance of this roadmap, as with other national level programmes, is of great importance, but the requirements thereof are perhaps somewhat different from most other programmes. This arises from the need to understand that the motivations for and consequences of blockchain solutions go well beyond purely technological considerations, and is a potential driver for socio-economic transformation.

In technological terms, blockchains are based on well-established cryptographic techniques, and somewhat less well understood econometric game theory, which enable operation of distributed computing systems that dispense with the need for implicit trust in any particular server or operator thereof, as is required for existing ICT services. This notion of systemic trustlessness would drive the process of "trust re-intermediation" from existing systems, resulting in outcomes that exploit the blockchain technical characteristics of information integrity, immutability, transparency and completeness; with the practical outcomes of process rationalisation, acceleration, automation and tamper-proofing.

Chapter 2 Blockchain Technology Overview

2.1 Chapter Objective

The objective of this chapter is to undertake an overview of blockchain technology, from the perspective of providing solutions for real-world problems. This chapter seeks to provide a non-technical description and explanation of blockchain characteristics which are intrinsically technical. It is important to have the perspective that any technology has its own inherently value propositions and limitations, which make them suitable for some use cases but not others.

This chapter is organised as follows: -

- Value propositions: unique to blockchains relative to predecessor technologies, as strong indication of usability;
- Core concepts: deconstructs the basic terminology, in addition to highlighting architectural differences in comparison to client- server systems;
- Theoretical foundations: game theoretic differences in particular resulting in a range of consensus protocols,with consequent securityand performance characteristics; and
- Practical considerations: use of particular blockchain formulations, and operations thereof.

2.2 Value Propositions

Blockchain and distributed ledger systems differ substantively from conventional single source of truth systems, which are generally centred on a single service provider operating a database which contains the state of the system, and presumed beyond contest or dispute. Blockchain systems generally have multiple node servers, which engage in contention on the evolving state of the system, such that a node consensus multiplicity is required to determine each next step of such evolution.

i. Trustlessness

ii. Transparency

iii. Immutability

Use Cases for Blockchain Technology

Chapter 3

iv. Privacy

- **Non-identifiability**
- **Non-traceability**
- **Non-linkability**

v. Security

3.1 Chapter Objective

This chapter will focus on blockchain use cases in a global context, and undertakes exposition and analysis of: -

- Current state of blockchain technologies, unique use cases across various industries, and the corresponding adoption motivation and challenges;
- Current adoption rates of blockchain technologies in various sectors, and projections of new use case possibilities; and
- Landscape of blockchain ecosystems and constituent elements thereof.

3.2 Blockchain Global Trend

Globally, blockchain adoption crosses industry and application boundaries, with the projected economic impact forecasted as follows: -

- Business potential of USD 175 billion by 2025 and in excess of USD 3 trillion by 2030
- Contribution to global gross domestic product (GDP) of USD 1.76 trillion
- Addition of 40 million new jobs to the global workforces; and
- Funding of USD 4.1 billion for blockchain start-ups in 2018 .

This promise to revolutionise the economic and industrial landscape has prompted governments across the world to develop blockchain roadmaps, with key initiatives therein as follows:-

Adoption of Blockchain

The primary market hotspots for blockchain are agriculture, finance services, healthcare, property and public sector . Technology Association of Georgia, Deloitte observes investment on blockchain is varied between industries, and the top 4 industries which have planned to increase their blockchain in the next 12 months are Professional services, Financial services, Energy & resources, Life Science & Health care9 as shown in Figure 3.2.

Country	Initiatives
Australia	The National Blockchain Roadmap: Progressing towards a Blockchain-empowered future focus areas : * Effective, efficient and appropriate regulation & standards * Skills & capabalities drive innovation * Strong international investment & collaboration
Bangladesh	National Blockchain Strategy guides Bangladesh into a blockchain-enabled nation to create and maintain a resilient and inclusive information infrastructure and to foster innonation
China	Dubai Blockchain Policy's strategc pillars * Government officiency * Industry creation * International leadership
United Arab Emirates	* Blockchain is part of China's Technology Strategy * Blockchain-based Services Network (BSN) provides companies with access to the tools develop blockchain-based applications
Germany	National Blockchain Strategy and focus on finance, crypto assets securities.
India	Blockchain : The India Strategy towards 'Enabling Ease of Business, Ease of Governance, and Ease of Living
Singapore	Singapore Blockchain Innovation Programme (SBIP) with allocation of US$8.9mil
United Arab Emirates	The Emarates Blockchain Strategy 2021 aims to capitalise on the blockchain technology to transform 50% of government transactions into the blockchain in plstform by 2021

Table 3.1 : Blockchain initiative in various counteris

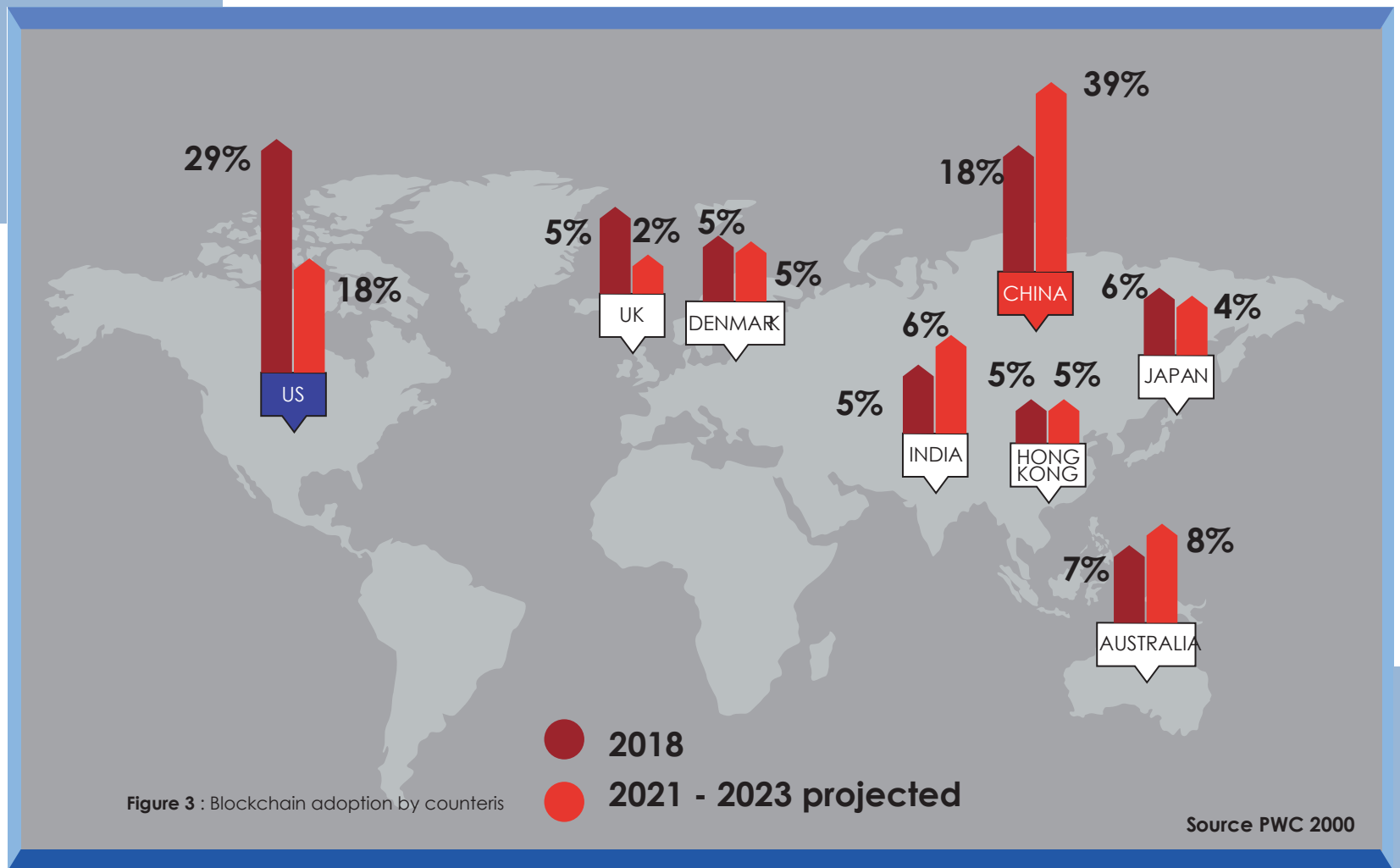


Figure 3 : Blockchain adoption by counteris

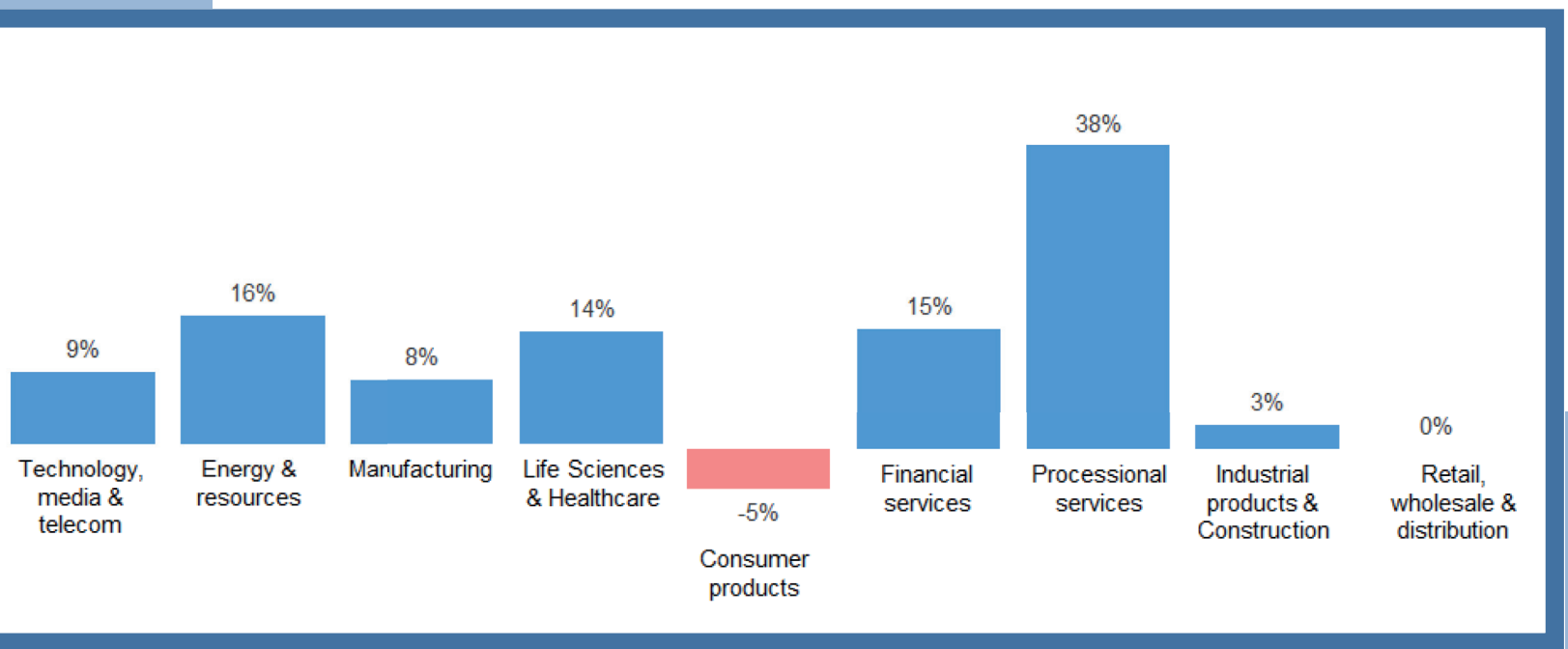


Table 3.2 : Investment intention on blockchain technologies: Difference between current year & next 12 months

Figure 3.3 provides an overview of blockchain technologies that will drive growth and transformation to the market hotspots.

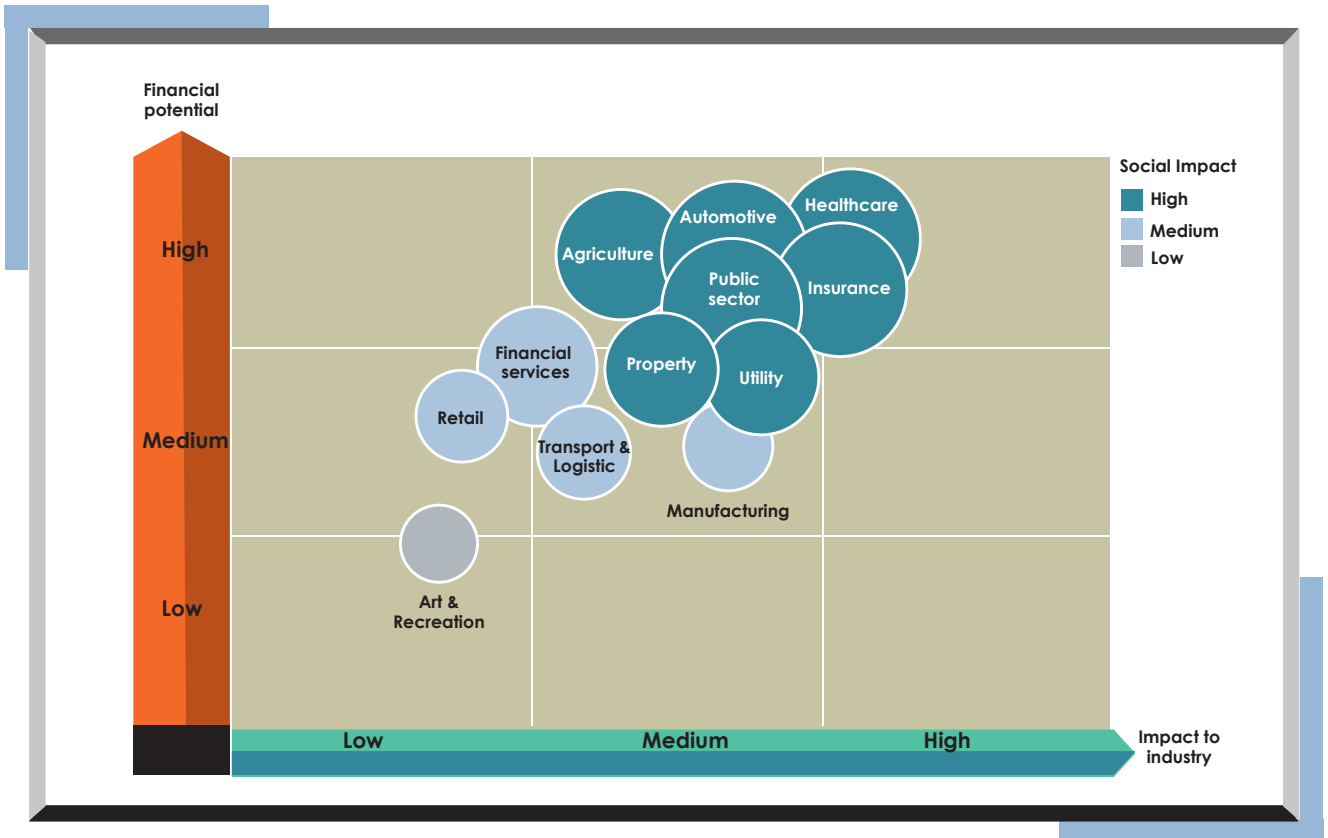


Figure 3.3 : Potential impact of Blockchain

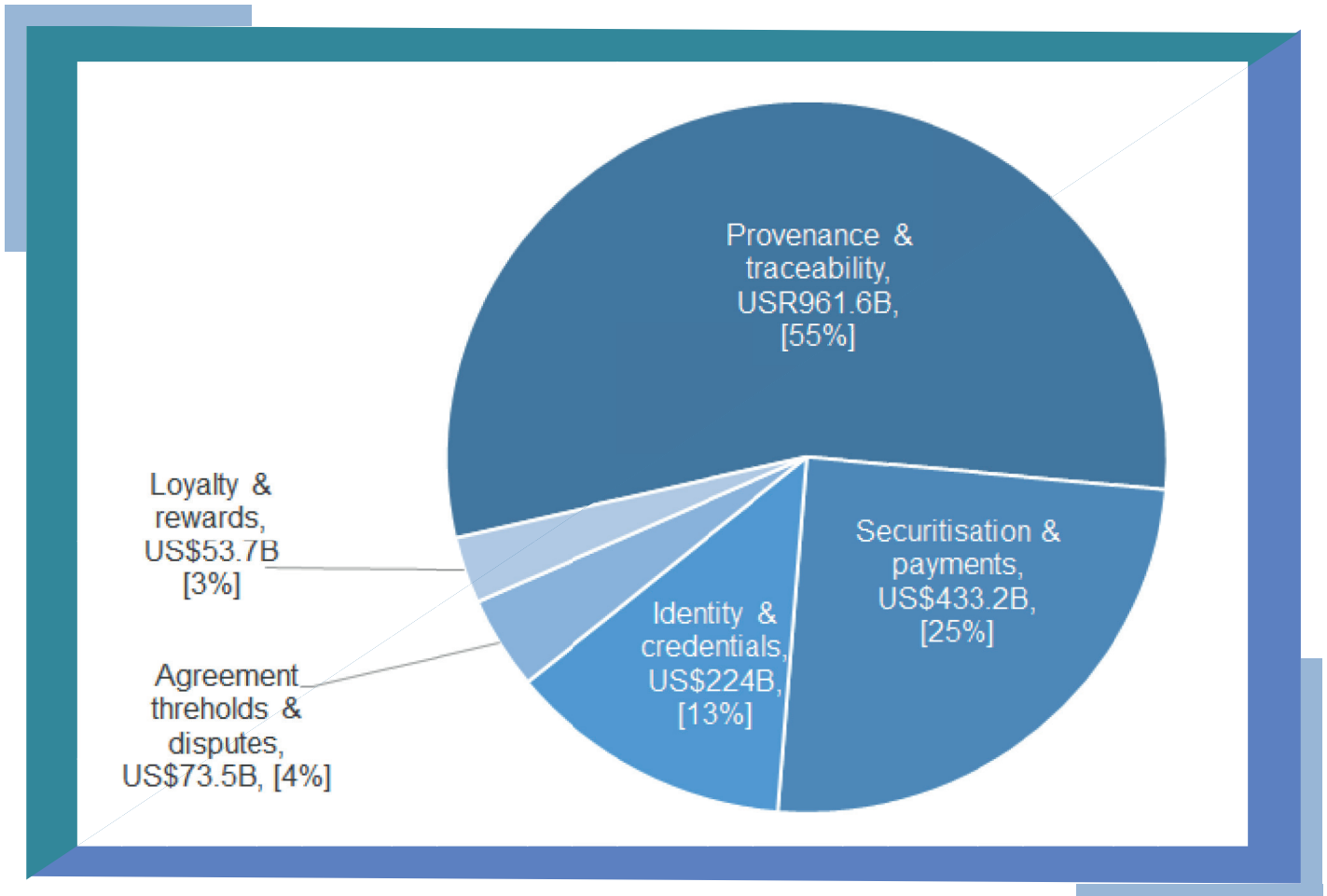


Table 3.4 : Global economic value of blockchain by use cases Blockchain

PWC highlights businesses explore blockchain technologies are premised on the five main reasons in generating global gross domestic products, and blockchain technologies hold the great promises in the realm of traceability and provenance, which has potential economic value of US$961.6B in year 2030 (Refer Figure 3.4).

Blockchain has been adopted and deployed on the premise that blockchain delivers the following six (6) compelling features as illustrated in Figure 3.5, to address critical business challenges across industries.

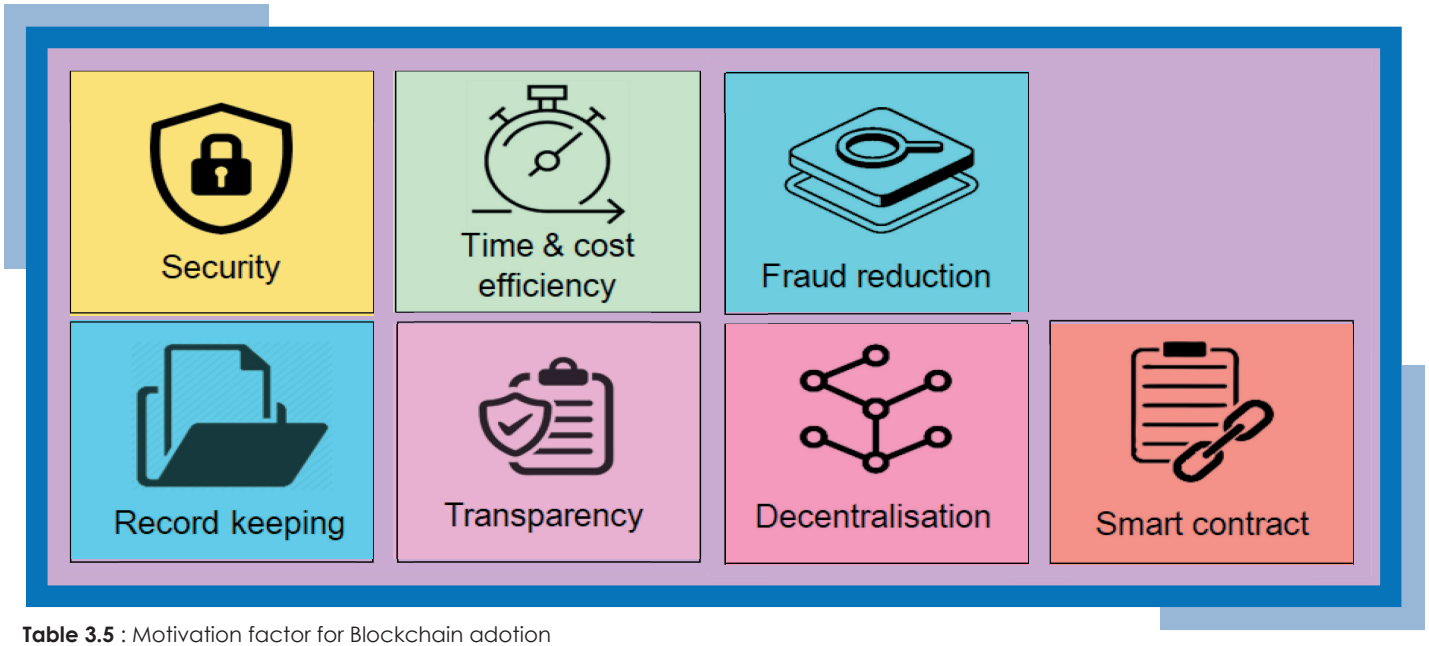


Table 3.5 : Motivation factor for Blockchain adotion

Adoption of Blockchain

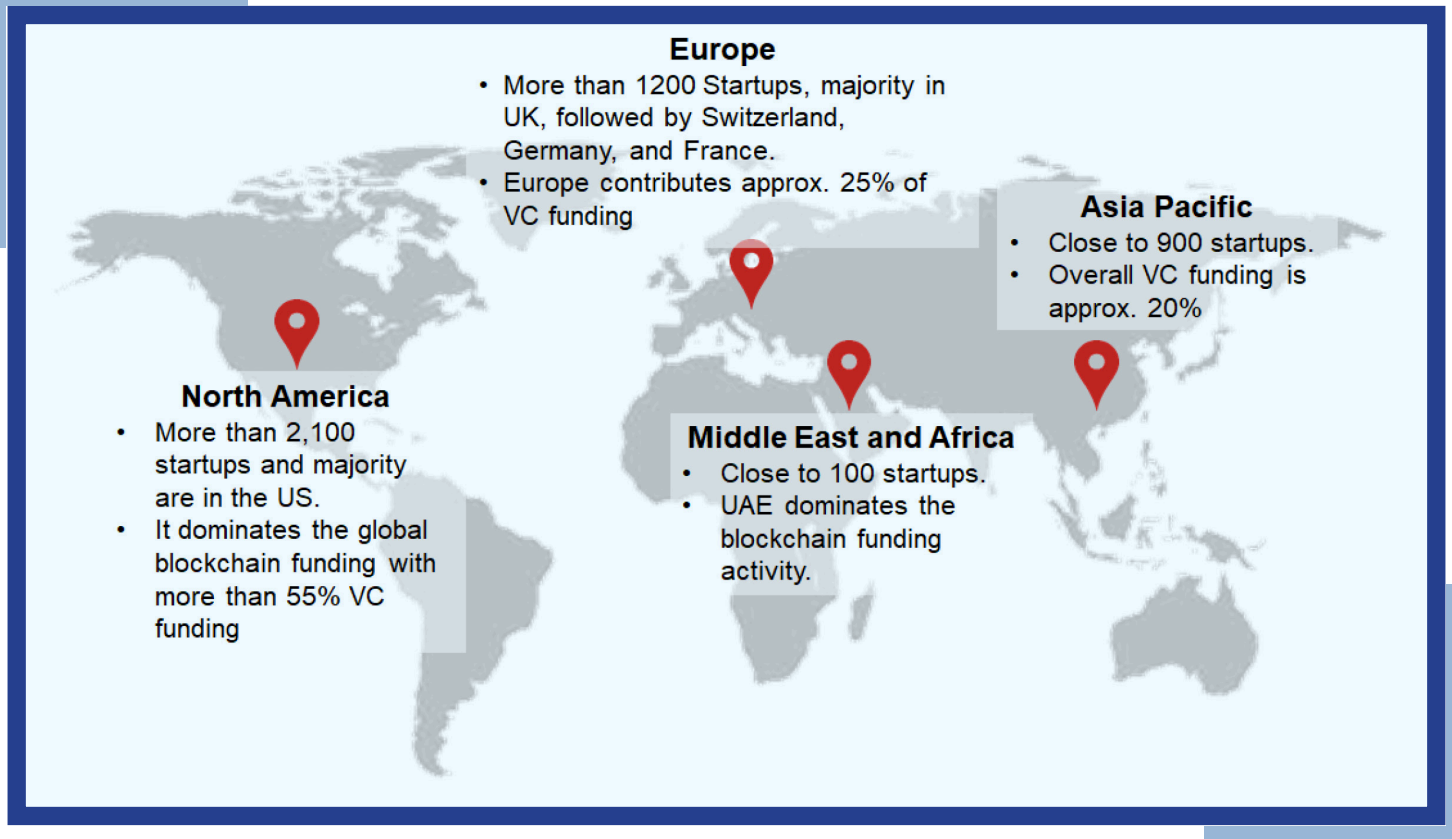


Table 3.7 : Global blockchain investment environment

3.5 Malaysia Blockchain Adoption Scenario

3.5.1 Awareness level

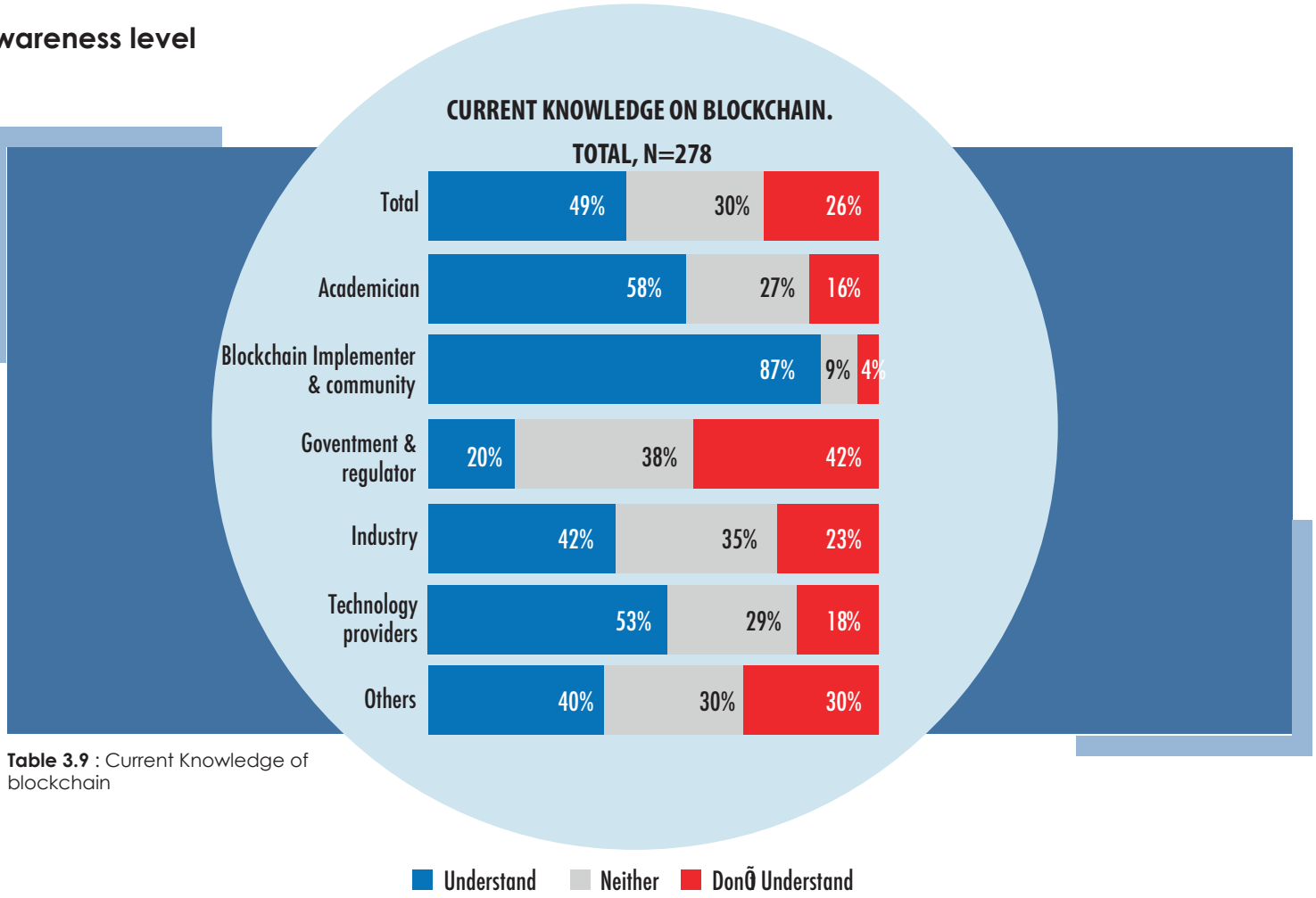


Table 3.9 : Current Knowledge of blockchain

3.5.2 Perception towards Blockchain

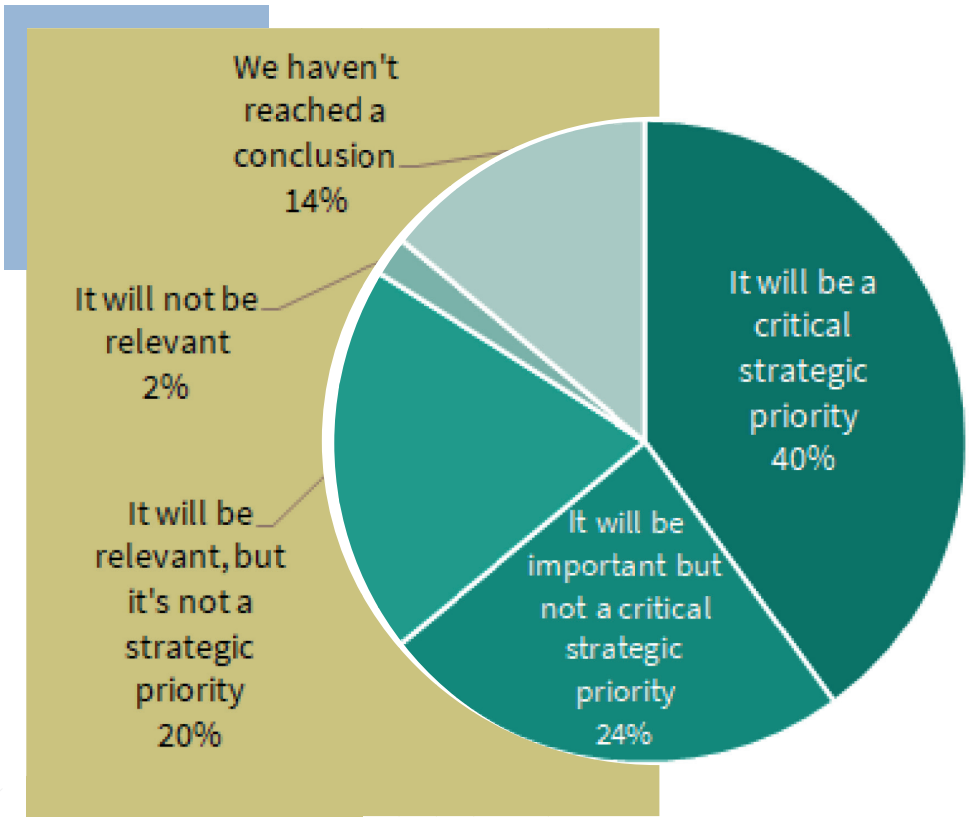


Table 3.10 : Perception towards Blockchain : Malaysia Perspective

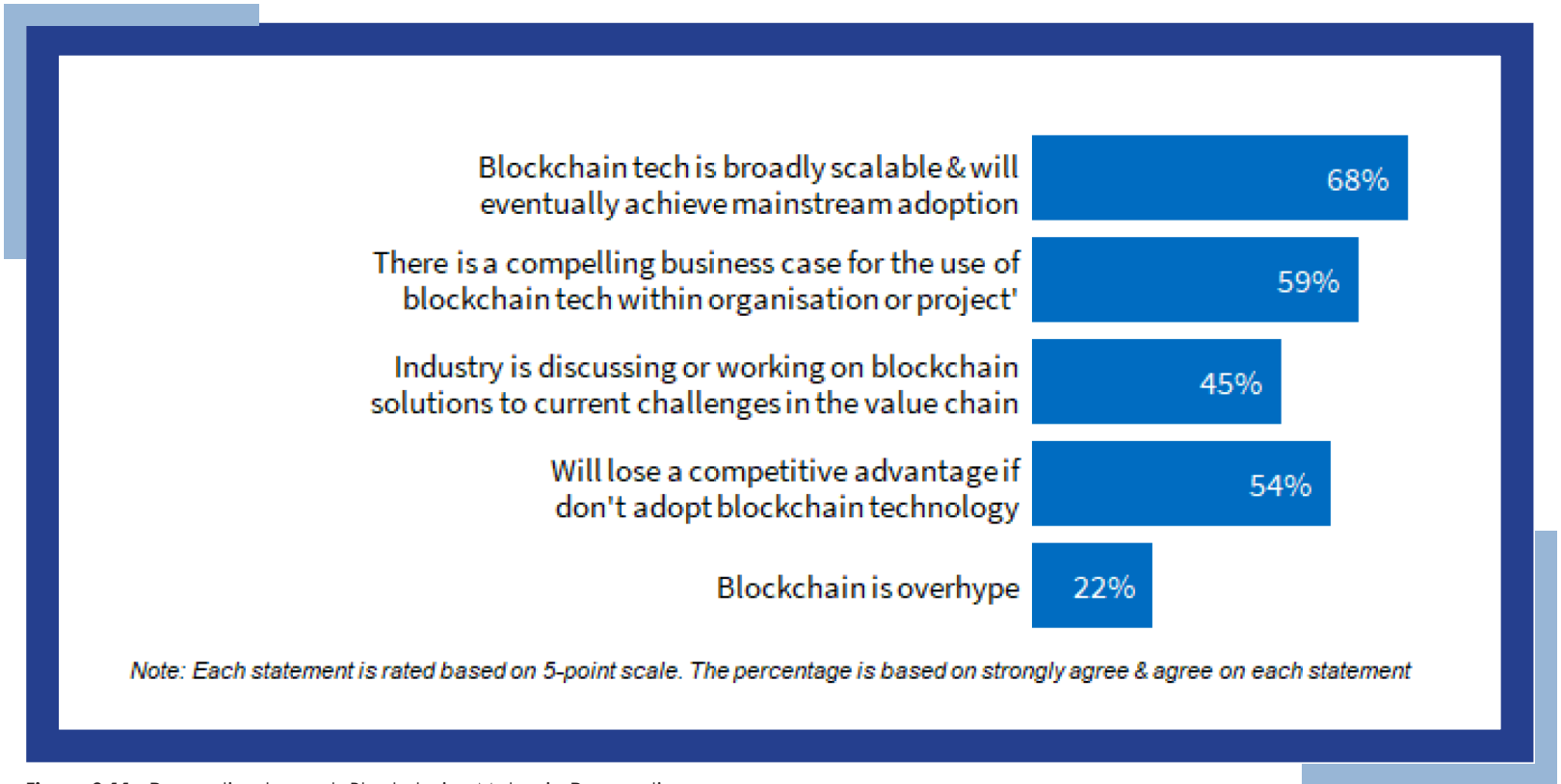


Figure 3.11 : Perception towards Blockchain : Malaysia Perspective

3.5.3 Malaysia Blockchain Activities

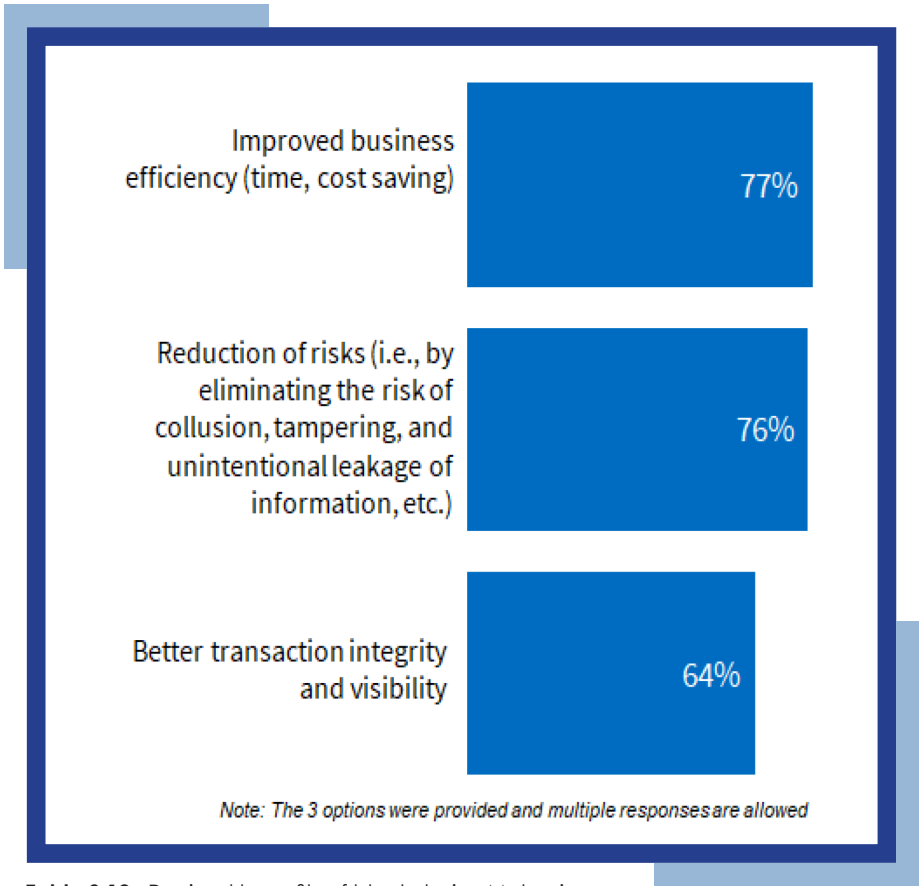


Table 3.12 : Persived benefits of blockchain : Malaysia

3.5.4 Perceived Blockchain Adoption Barriers

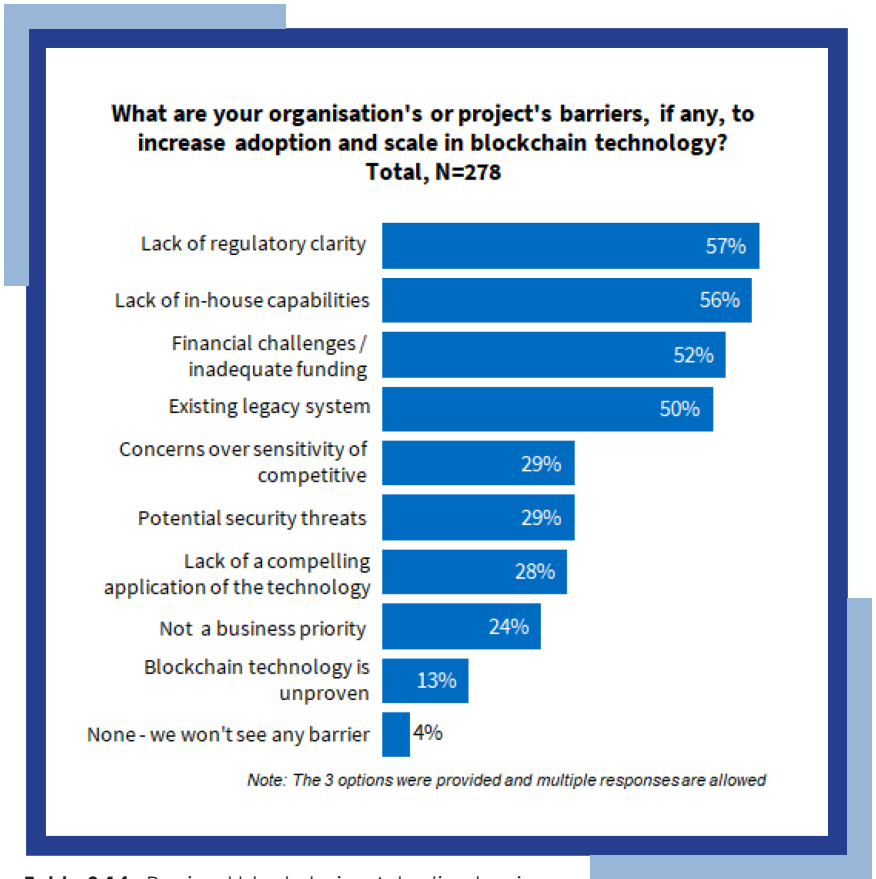


Table 3.14 : Persived blockchain : Adoption barrier

Chapter 4

Strategic Areas for National Blockchain Development

Related Strategic Plans

Roadmap/Policy	Roadmap/policy scope	Blockchain opportunities
National Anti-Corruption Plan 2019-2023 [Malaysian Anti-Corruption Commission, 2019]	The plan outlines Strategy Two to strengthening the effectiveness of public service delivery, particularly to establish a strong and effective mechanism in the issuance of permits and licensing	To explore the opportunities afforded by blockchain technology to develop greater transparency and to address other operational challenges, with aims to ramp up efficiency, speed, and capacity in government service delivery and operation.
Malaysia Cyber Security Strategy 2020-2024 [Ministry of Communications and Multimedia, 2020]	The third pillar focuses catalyse world class innovation, technology, R&D and industry in building and strengthening the cyber security innovation ecosystem in Malaysia as well as raising the ability to deal with cyber security issues effectively through two strategies 1. Spurring National Cybersecurity R&D Programme	Blockchain as a catalyst to generate innovative solutions and creation of new local cybersecurity ventures to prevent cyber threats and risk of de-operationalised of businesses.

Figure 4.1 : National policies, plans and roadmaps: with contributions therein of blockchins

Roadmap/Policy	Roadmap/policy scope	Blockchain opportunities
	2. Promoting a Competitive Local Industry and Technology	
Industry4WRD Policy [Ministry of International Trade and Industries, 2019]	To facilitate the transformation of the manufacturing industry to the next technology frontier and raising their economic well-being.	Blockchain to strengthen digitization, automaton. and transparency of supply chain, and elevate manufacturing capabilities and capacities to the next level. Blockchain improves order accuracy, quality of product, trace operational activities, and track products' journey, which will benefit manufacturers to identify products at any time and increase trust & authenticity of products manufactured.
Pelan strategik pendigitalan sektor awam 2021-25 [Malaysian Administrative Modernisation and Management Planning Unit, 2020]	Modernisation of administration and transformation of public service delivery and pave the way to embrace digitalisation, to improve transparency, integrity and accountability. Under the Strategic Thrust 2 (Integrated and Inclusive digital services), Strategic 4 outlines 2 programmes as follows: 1. To implement emerging technologies related projects. This programme aims to identify suitable pilot projects to leverage on various technologies, namely blockchain, big data analytic (BDA), artificial intelligence/ machine learning (AI/ML) dan Smart Cities IoT 2. To assess the impact and effectiveness of emerging technologies, and subsequently to institutionalise across public	This strategic plan recognises the significant role and impact of blockchain to public sectors. Thus, it indicates the perception and readiness of Malaysian government to adopt blockchain to improve the efficiency of government service delivery.

Roadmap/Policy	Roadmap/policy scope	Blockchain opportunities
Shared Prosperity 2030 [Ministry of Economic Affairs, 2019]	The document highlights effective institutional delivery and Governance & Integrity out of the eight enablers to build capabilities, resources and catalysts to the success of Shared Prosperity 2030	Blockchain possible as innovative digital technologies to be considered under the new paradigm of governmental policy making and service delivery, with main benefits as below: 1. Increased automation, transparency, auditability and accountability of information in governmental registries for the benefit of citizens. 2. Increased trust of citizens and companies in governmental processes and recordkeeping which are no longer under the sole control of government.
Halal Industry Masterplan 2030	The Halal Industry Master Plan 2030 (HIMP 2030) was developed to catalyse Malaysia's strengths towards the development of its Halal industry holistically. The theme 'Prominent, Visible and Globalised Halal Malaysia' depicts Malaysia's goal to achieve socio economic development through leading the global Halal industry.	Halal Traceability Services - IR 4.0, IoT, Blockchain, FinTech and Big Data to ensure Halal products go through an entirely verified supply chain.
National IoT Strategic Roadmap [Ministry of Science, Technology and Innovation, 2015]	Creation of Open Innovation Framework and Open Community Data Framework, Malaysia can reap the future benefits of scientific & technological advances in IoT& compete globally through increased productivity and sustainability, as well as subsequently boosting	To facilitate data exchange & sharing without the need for a third party to arbitrate the trustworthiness of that data, with breadth of impact across a wide spectrum of industries.
	economic growth, and enabling higher income for the nation	

4.3 Strategic Areas

This section takes into consideration blockchain use cases as advocated in the first and second workshops for the National Blockchain Roadmap, as furthermore assessed for:-

- **Suitability**: of blockchain applicability,
- **Impact**: of use case development,
- **Urgency**: in terms of commencement timeframe,and
- **Leadership**: of such development programme, in terms of government or corporate leadership, or combination thereof.

A. Asset tracking,

B. Document management, and

C. Workflow management

4.3.1 Asset tracking

Asset tracking in general refers to use cases in which ledger transactions keep track of movement or ownership of physical assets. This is as opposed to use cases which track pure information assets ie intellectual properties, certificates and crypto-currency units. There is therefore a need to bind the physical asset of interest to the corresponding ledger entry. This can be accomplished via attachment of an IoT device to the asset, with insertion of the unique identifier thereof on the corresponding ledger element.

Information regarding the movement or ownership of assets are recorded in blockchain. Transfer of ownership requires the use of a private key under the control of the owner to complete the transaction. These use cases ensure complete traceability of assets based on the records in the blockchain. Blockchain offers a solution where multiple parties are involved without a trusted authority to maintain the record.

These records can be shared among stakeholders who can react to information updated in the blockchain. As blockchain technology provides record immutability, stakeholders are able to improve process efficiency by cutting down paperwork transfer and increasing level of automation. Cost reduction and competitiveness improvement results in substantial economic and social impact to the industries.

Example of asset tracking are as follows:

- Supply chain traceability on food, medication, manufacturing goods.
- Certification of halal food, cold chain quality, source of origin

- Trade facilitation activities, custom clearance, import permit, insurance, proof of financial documentation

4.3.2 Document management

The basic idea here is to exploit blockchain technical attributes, as previously described, to establish document integrity, ownership and immutability. The need for storage efficiency and data privacy effectively dictates off-chain storage for at least part of the record data, with any on-chain element thereof then bereft of personally identifiable information.

Each ledger element in such a blockchain is essentially a notary entry of the corresponding record, in the form of a zero-knowledge proof of such record ownership and existence. The location of such ledger item within a particular block in the chain then establishes the time of record posting, with equivalent significance to the placement of a notary entry on a particular page in the record book. Users can thereafter use a particular ledger entry to establish provenance and possession of information.

Information that can be handled in this manner are inclusive of:-

- Academic, professional or 'micro' credentials
- Content registration and curation information
- Industrial certificates
- Medical records
- Police reports
- Tender submissions
- Voting confirmations

4..3.3 Workflow management

The broad scope of workflow support can be further categorised in terms of:-

- Process management
- People management, and
- Information service

further details of which are forthcoming in a subsequent section.

This payment use case in particular is likely the one with the greatest visibility and sensitivity, but is also the simplest and best established, considering that Bitcoin was the first blockchain. It is furthermore noteworthy that the crypto-currency use case is by the most significant in terms of popularity and value. The ledger data for a currency chain would simply be the unspent transaction output (UTXO) as designated by the payer to the payee. The use of blockchains in support of

payments in terms of a fiat currency would effectively be a private version of the public currency chain, with node ownership and money supply limited by regulation. Any payment system will need to function in real time at high volume, which is impossible for any blockchain. To this end, the use of blockchains in support of payment would be as a low-level element, in which multiple node operators undertake contention, in pursuit of some block aggregation incentive, and then attain consensus on a periodic basis. The user-facing high-level complement to the payment chain would very likely be exactly the same mechanisms presently in use.

This use of blockchains as a low-level complement to a faster user-facing element is in fact reflected in the evolution of the Bitcoin framework, the modern incarnation of which employs its Lightning network for this purpose. Lighting basically allows nodes to undertake off-chain transactions, with only the net difference thereof submitted on-chain, which has the additional benefit of reducing the transaction volume on the underlying Bitcoin network.

4.3.4 Use Case Selection

The inputs collected during the second workshop can be broadly aggregated in terms of the following use case categories: -

A. Asset tracking: inclusive of

- Halal tracking: with the highest citation frequency and urgency,
- Transportation and logistics,
- Supply chain management,
- Vaccine tracking,
- Commodities tracking,
- Land title registration, and
- Asset tracking: encompassing other use cases.

B. Document management: inclusive of

- Document management: encompassing various use cases, as most cited, and
- Document notarisation: with highest urgency.

C. Process management: inclusive of

- Finance and payment: as most cited,
- International trade: with almost equal citation frequency,
- Tendering and procurement: likewise;
- Bursary services: of highest urgency,
- Project management,
- Insurance processing, and
- Customs clearance.

D. People management: inclusive of

- Vaccine certification: as both most cited and of highest urgency,
- Digital identity: of equal urgency,
- Voting and registration thereof: likewise, and
- Travel passes

E. Information services: inclusive of

- Gover nment services: encompassing various use cases, as most cited,
- Report submission and tracking: of highest urgency, and
- Inter-agency synchronisation

Chapter 5

Building Blockchain Ecosystem

Ecosystem Enablers

The power of the ecosystem is the availability of a platform to facilitate interdependent partner networks, in which no single player is required to own or operate all components of the blockchain solution. The multiplier effect and the value in a wide spectrum the ecosystem generates is larger than the combined value each of the players could contribute individually. Therefore, five-dimensional building blocks are proposed to operationalise

the National Blockchain Roadmap. The approach is abbreviated as CATLE approach, which are Collaboration, Amplifier, Talent, Legality and Enablers (Figure 5.1).

Blockchain Acceleration Hub (BAH)

The purpose of establishing is to manage the ecosystem built around blockchain – the players, technologies and the complex process of creating, utilising, sharing and reusing the said technologies and business knowledge. BAH will create a blockchain ecosystem that focuses on the development of the blockchain industry in Malaysia. This set-up will also serve to facilitate collaborations between stakeholders to ensure the continuity of activities within the industry.

5.3.2.2 Malaysia Blockchain Infrastructure (MBI)

Building a blockchain ecosystem requires coordinated effort across multiple fronts to create a conducive environment for the growth of the blockchain community. Each blockchain project can stand on its own by creating a private blockchain. Some blockchain projects may choose to utilise and pay for facilities provided by public or permissioned private blockchains.

Malaysia Blockchain Infrastructure (MBI) provides common blockchain services to applications building on top of the infrastructure. Two services, i.e. notarisation service and zero knowledge proof mechanism will be the initial services provided by Malaysia Blockchain Infrastructure.

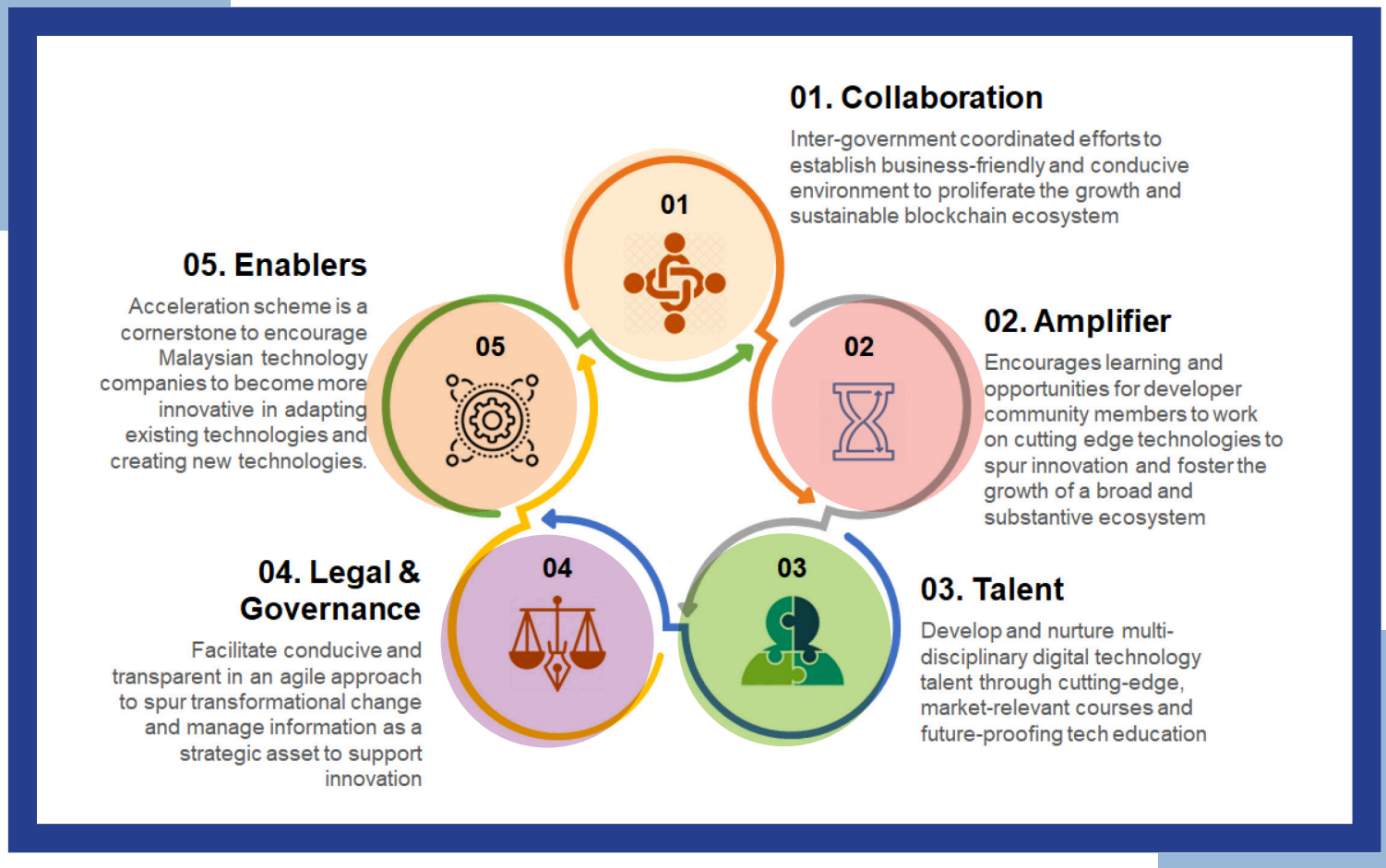


Figure 5.1 : Blockchain ecosystem building blocks

Collaboration

Challenges	1. Lack of blockchain-friendly environment i.e. a. Lengthy approval process b. Require lots of licenses c. Lack of empowerment 2. Readiness of agencies to facilitate blockchain implementation a. Readiness of data sharing: Siloed system prevent data sharing b. Existing personal data sharing regulation c. Fragmented coordination d. Lack of continuity 3. Lack of interoperability of policy & priorities between different agencies, federal-local government and between countries
Key initiatives	1. National Level a. Government-lead blockchain initiatives: National Blockchain Sandbox (NBS) with multi-agency, academia & industry participatory and verification with government data 2. Government-to-government collaboration a. Cross initiative with FTA partners

Amplifier

Challenges	1. Lack of domain industry and technology in-depth knowledge 2. Existing facilities are industry and technology-specific, disconnect and siloed
Key initiatives	1. Malaysia Blockchain Infrastructure 2. Blockchain Acceleration Hub (BAH). 3. Government-led blockchain project implementation

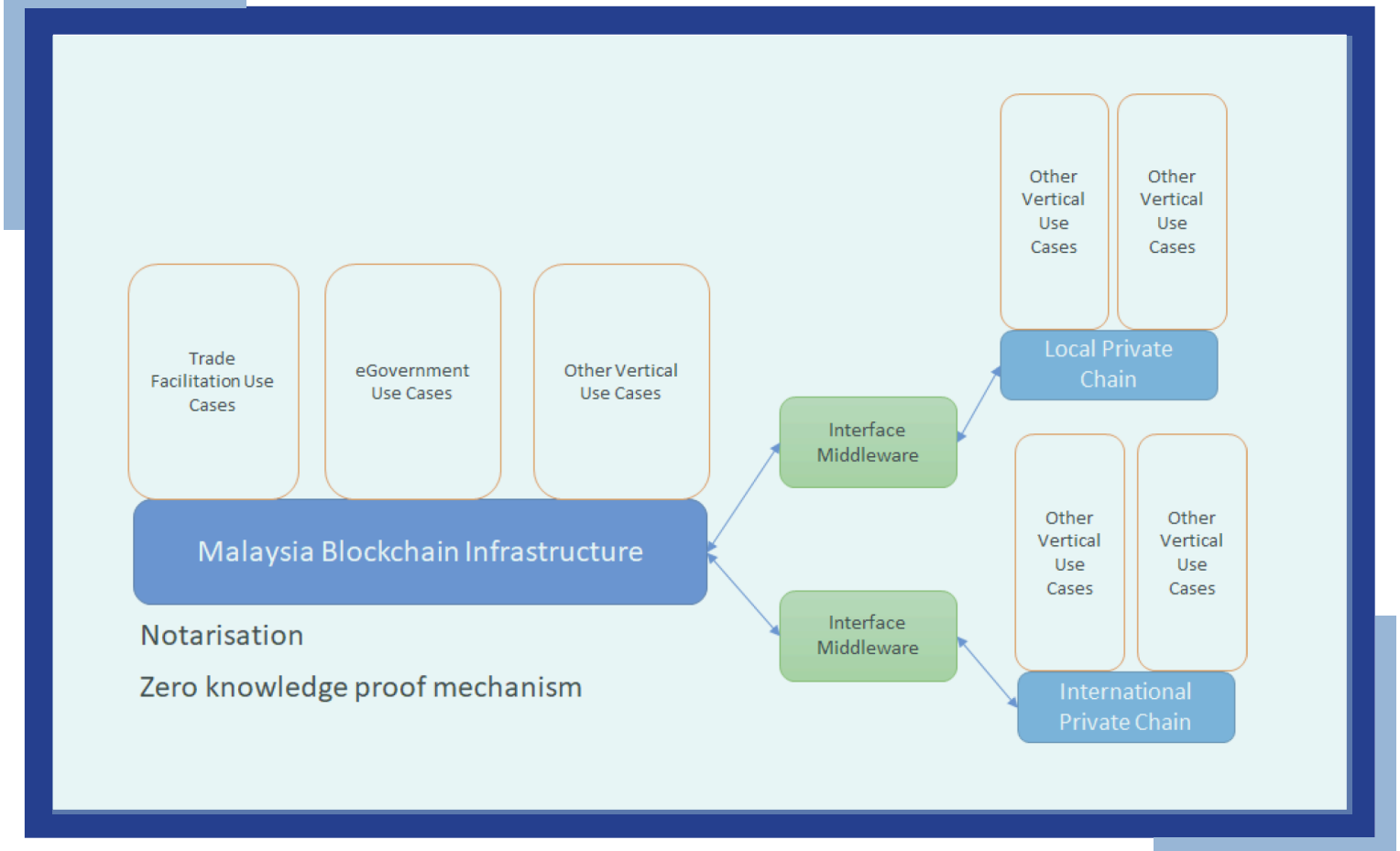


Figure 5.2 : Malaysia blockchin infrastructure interoperability with other blockchain systems

Talent

Challenges	1. Lack of industry related exposure 2. Fragmented talent development 3. Fragmented and distributed support infrastructure and resources 4. Lack of local talent & credentialed, certified Blockchain professionals 5. Lack of focus & priorities in talent development facilities e.g. HRDF 6. Lack & low industry awareness & interest to explore blockchain technologies

Key initiatives	**University** 1. Core technology development nucleus 2. Industry placement 3. Develop Multi-disciplinary Blockchain Standard (MQA)
	Technical and Vocational Education and Training (TVET) 1. Blockchain application development & support infrastructure & infostructure sharing platform
	Professional Course 1. Blockchain Certified Tech Talent: Micro credentials, and Professional Certification 2. Training & retraining
	Inclusive talent policy & system 1. Exert a gravitational pull on skilled workers & brain gain 2. Enable access to global talent that is in-demand 3. Change Management

Legal and Governance

Challenges	1. Regulatory balancing act between innovation and transparency 2. Fragmented and different regulatory framework between industries 3. Stringent regulation will discourage the use of blockchain and stifle innovation 4. Agility of regulatory to response to today's changes
Key initiatives	1. Legal framework on data standardisation and governance 2. Catalyse innovation through regulatory amendments 3. Governance of blockchain a. Data ownership b. Effective governance around transformational business case approvals and support the realisation and prioritisation of blockchain-based transformational projects

Enabler

Challenges	1. High initial cost of investment 2. Lack of reliable & scalable connectivity infrastructure 3. Low awareness of government incentives and facilities 4. Potential high cost of investment for certain use cases
Key initiatives	1. Reliable and accessible internet connectivity 2. Acceleration financial facilities 3. Change management

[19] China: Supreme Court Issues Rules on Internet Courts, Allowing for Blockchain Evidence | Global Legal Monitor https://www.loc.gov/law/foreign-news/article/china-supreme-court-issues-rules-on-internet-courts-allowing-for-blockchain-evidence/

6.1.2 Malaysia's Position in World Trade and Trade Efficiency

Malaysia is ranked 12 in the World Bank's Ease of Doing Business Ranking out of 190 countries as shown in Table 6.124. As more and more countries are adopting Blockchain for trade facilitation, Malaysia will therefore be challenged to maintain its position.

TABLE O.1 Ease of doing business ranking

Rank	Economy	DB score	Rank	Economy	DB score	Rank	Economy	DB score
1	New Zealand	86.8	65	Puerto Rico (U.S.)	70.1	128	Barbados	57.9
2	Singapore	86.2	66	Brunei Darussalam	70.1	129	Ecuador	57.7
3	Hong Kong SAR, China	85.3	67	Colombia	70.1	130	St. Vincent and the Grenadines	57.1
4	Denmark	85.3	68	Oman	70.0	131	Nigeria	56.9
5	Korea, Rep.	84.0	69	Uzbekistan	69.9	132	Niger	56.8
6	United States	84.0	70	Vietnam	69.8	133	Honduras	56.3
7	Georgia	83.7	71	Jamaica	69.7	134	Guyana	55.5
8	United Kingdom	83.5	72	Luxembourg	69.6	135	Belize	55.5
9	Norway	82.6	73	Indonesia	69.6	136	Solomon Islands	55.3
10	Sweden	82.0	74	Costa Rica	69.2	137	Cabo Verde	55.0
11	Lithuania	81.6	75	Jordan	69.0	138	Mozambique	55.0
12	Malaysia	81.5	76	Peru	68.7	139	St. Kitts and Nevis	54.6
13	Mauritius	81.5	77	Qatar	68.7	140	Zimbabwe	54.5
14	Australia	81.2	78	Tunisia	68.7	141	Tanzania	54.5
15	Taiwan, China	80.9	79	Greece	68.4	142	Nicaragua	54.4
16	United Arab Emirates	80.9	80	Kyrgyz Republic	67.8	143	Lebanon	54.3
17	North Macedonia	80.7	81	Mongolia	67.8	144	Cambodia	53.8
18	Estonia	80.6	82	Albania	67.7	145	Palau	53.7
19	Latvia	80.3	83	Kuwait	67.4	146	Grenada	53.4
20	Finland	80.2	84	South Africa	67.0	147	Maldives	53.3
21	Thailand	80.1	85	Zambia	66.9	148	Mali	52.9
22	Germany	79.7	86	Panama	66.6	149	Benin	52.4
23	Canada	79.6	87	Botswana	66.2	150	Bolivia	51.7
24	Ireland	79.6	88	Malta	66.1	151	Burkina Faso	51.4
25	Kazakhstan	79.6	89	Bhutan	66.0	152	Mauritania	51.1
26	Iceland	79.0	90	Bosnia and Herzegovina	65.4	153	Marshall Islands	50.9
27	Austria	78.7	91	El Salvador	65.3	154	Lao PDR	50.8
28	Russian Federation	78.2	92	San Marino	64.2	155	Gambia, The	50.3
29	Japan	78.0	93	St. Lucia	63.7	156	Guinea	49.4
30	Spain	77.9	94	Nepal	63.2	157	Algeria	48.6
31	China	77.9	95	Philippines	62.8	158	Micronesia, Fed. Sts.	48.1
32	France	76.8	96	Guatemala	62.6	159	Ethiopia	48.0
33	Turkey	76.8	97	Togo	62.3	160	Comoros	47.9
34	Azerbaijan	76.7	98	Samoa	62.1	161	Madagascar	47.7
35	Israel	76.7	99	Sri Lanka	61.8	162	Suriname	47.5
36	Switzerland	76.6	100	Seychelles	61.7	163	Sierra Leone	47.5
37	Slovenia	76.5	101	Uruguay	61.5	164	Kiribati	46.9
38	Rwanda	76.5	102	Fiji	61.5	165	Myanmar	46.8
39	Portugal	76.5	103	Tonga	61.4	166	Burundi	46.8
40	Poland	76.4	104	Namibia	61.4	167	Cameroon	46.1
41	Czech Republic	76.3	105	Trinidad and Tobago	61.3	168	Bangladesh	45.0
42	Netherlands	76.1	106	Tajikistan	61.3	169	Gabon	45.0
43	Bahrain	76.0	107	Vanuatu	61.1	170	São Tomé and Príncipe	45.0
44	Serbia	75.7	108	Pakistan	61.0	171	Sudan	44.8
45	Slovak Republic	75.6	109	Malawi	60.9	172	Iraq	44.7
46	Belgium	75.0	110	Côte d'Ivoire	60.7	173	Afghanistan	44.1
47	Armenia	74.5	111	Dominica	60.5	174	Guinea-Bissau	43.2
48	Moldova	74.4	112	Djibouti	60.5	175	Liberia	43.2
49	Belarus	74.3	113	Antigua and Barbuda	60.3	176	Syrian Arab Republic	42.0
50	Montenegro	73.8	114	Egypt, Arab Rep.	60.1	177	Angola	41.3
51	Croatia	73.6	115	Dominican Republic	60.0	178	Equatorial Guinea	41.1
52	Hungary	73.4	116	Uganda	60.0	179	Haiti	40.7
53	Morocco	73.4	117	West Bank and Gaza	60.0	180	Congo, Rep.	39.5
54	Cyprus	73.4	118	Ghana	60.0	181	Timor-Leste	39.4
55	Romania	73.3	119	Bahamas, The	59.9	182	Chad	36.9
56	Kenya	73.2	120	Papua New Guinea	59.8	183	Congo, Dem. Rep.	36.2
57	Kosovo	73.2	121	Eswatini	59.5	184	Central African Republic	35.6
58	Italy	72.9	122	Lesotho	59.4	185	South Sudan	34.6
59	Chile	72.6	123	Senegal	59.3	186	Libya	32.7
60	Mexico	72.4	124	Brazil	59.1	187	Yemen, Rep.	31.8
61	Bulgaria	72.0	125	Paraguay	59.1	188	Venezuela, RB	30.2
62	Saudi Arabia	71.6	126	Argentina	59.0	189	Eritrea	21.6
63	India	71.0	127	Iran, Islamic Rep.	58.5	190	Somalia	20.0
64	Ukraine	70.2						

Table 6.1 : World Bank's ease of doing business 2020 ranking

6.3 Possible Scenarios for Blockchain in Malaysia

The future of Malaysia with Blockchain programs very much depends on what courses of action the government takes following the release of this report and updates to this report. The ecosystem building blocks of Collaboration, Amplifier, Talent, Legal & Governance, and Enablers described earlier will have to be pursued in harmony with each block synergising with the other blocks. Any setback in one or more blocks can impact the synergistic development of the programs in the National Blockchain Roadmap.

a. **Growth** - Blockchain implementation fully supported and synergised by stakeholders to propel Malaysia in a position of strength and leadership in Blockchain and especially in economic competitiveness.

b. **Status Quo** - Blockchain implementation is mediocre whereby Malaysia's competitiveness remains as-is. This competitiveness status quo assumes that other countries remain similarly static in their Blockchain implementation. This situation is unlikely however.

c. **Decline** - Blockchain is not fully driven and supported by one or more stakeholders, impeding development and resulting in a decline in Malaysia's economic competitiveness andleadership in Blockchain.

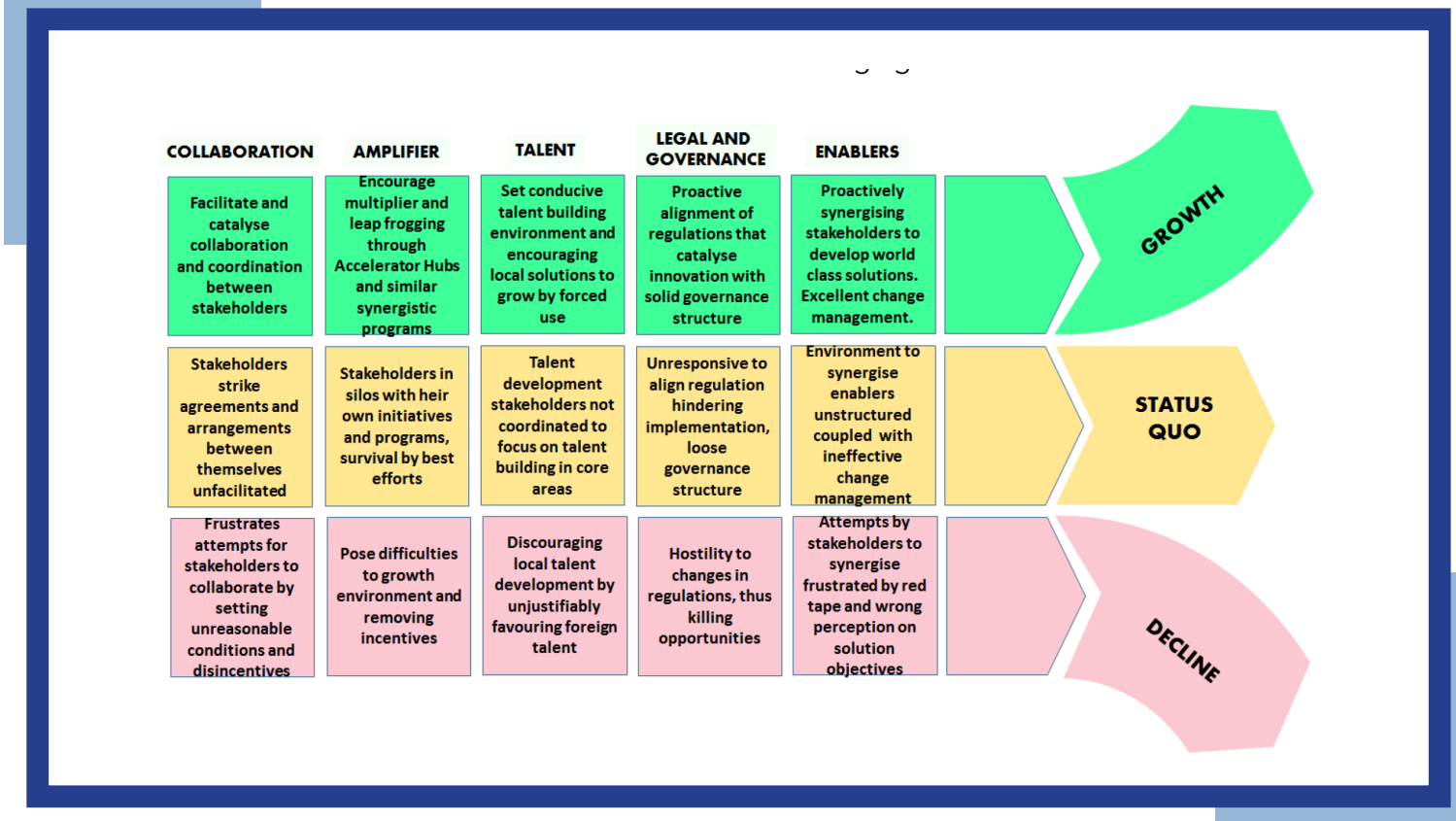


Figure 6.2 : Possible scenarios for blockchain in Malaysia

		Collaboration	Amplify	Talent	Laws and Governance	Enablers
Growth	Proposed Text for paragraph	All actions and plans are guided by a common goal and mission. Government facilitates the collaboration between all stakeholders which involves the target user environment stakeholders (industry and government), solution providers, change management specialists, regulators (local and foreign) and funders. The environment will be one of effective communication to minimise confusion, rework, understanding and accomodating where all work together to resolve problems or issues if they arise.	Government and industry work together to produce innovative and world class solutions. This can be through a combination of setting up Blockchain Accelerator Hubs and other programs that synergise efforts enabling mutliplier effects and leap frogging to higher levels compared to countries that are currently ahead. Program implementation is further enhanced or accelerated by good change management programs that bring all parties to a common understanding on what to expect and what changes to prepare for and when the changes will come into place. Transitioning into the new Blockchain enabled environment will be a smooth program.	Talent development factories (universities and skills certification entities) ensures that their curriculum are current and will remain relevant. Reskilling programs to be provided where necessary. The research and industry environment provides local solutions that local entities (government and private sector stakeholders) will use despite some shortcomings that will be improved over time. The environment also encourages Malaysians employed overseas to come back to enhance local expertise.	Regulators and those entities who have some authority to effect changes through regulation alignment will be aware of the fast changing models brought about by technology that requires traditional processes to change regulations to be overhauled. Such parties keeps abreast with regulatory changes and alignments in other countries and proactively initiate discussion to assess the need and timing etc for local regulatory alignments. Regulations would be innovatively modified to encourage innovation both in technology development as well as realigning traditional processes and workflows in government. A good governance structure exists to ensure the pieces fall into place.	An overall environement exists to enable seamless and frictionless delivery and implementation of solutions, synergising the strengths of all stakeholders and improving the areas of weaknesses. The environment is one where problems are faced squarely and solved, with the common objective of creatng a world class environment of efficient processes supported by effective blockchain solutions and an effective change management program that brings the proper understanding and expectations upfront and throughout the projects.
	Summary	Facilitate and catalyse collaboration and coordination between stakeholders	Encourage multiplier and leap frogging through Accelerator Hubs and similar synergistic programs	Set conducive talent building environment and encouraging local solutions to grow by forced use	Proactive alignment of regulations that catalyse innovation with solid governance structure	Proactively synergising stakeholders to develop world class solutions. Excellent change management.

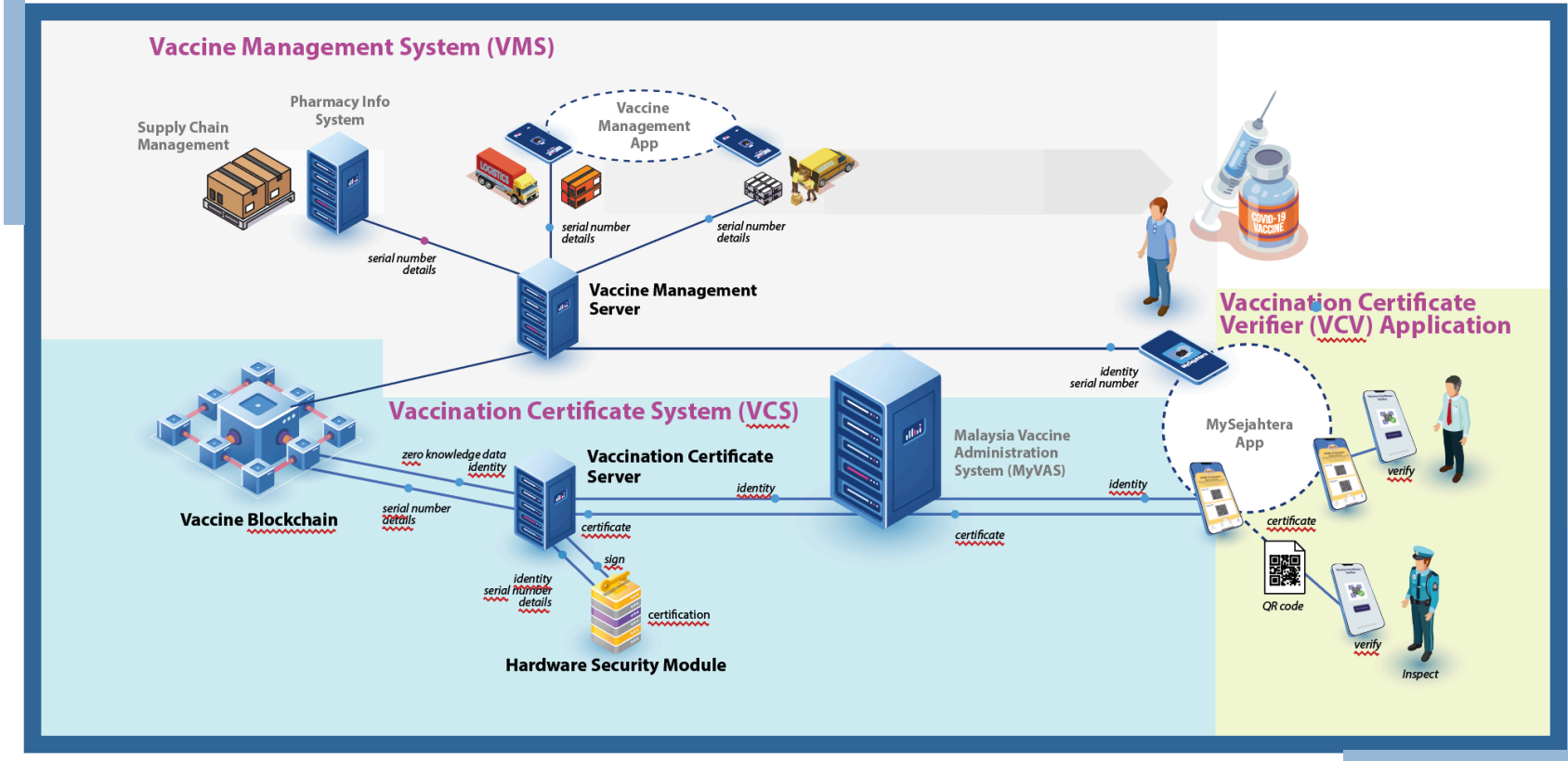
Table 6.4: Growth Scenario

		Collaboration	Amplify	Talent	Laws and Governance	Enablers
Status Quo	Proposed Text for paragraph	Government leaves stakeholders (industry and government) to make their own arrangements according to their own priorities and commitments. He who speaks louder and and/or has the financial muscle to proceed will proceed irrespective whether that is in the best interests of the nation as a whole.	Stakeholders perform their activities business as usual without due regard to synergistic objectives and opportunities with other stakeholdes to maximise or amplify possiible outcomes. Project development does not capitalise on the multiplier benefits effect of Blockchain in enabling transparency, tracebiility and immutability.	Talent development continue to fulfil their role of creating courses, sometimes to follow the tide of seemingly popular interest without specific focus or strategy to build talent or specialisation that helps to grow the industry. Creative and responsive talent development programs are non existent to support the multi disciplined skills requirements and especially in regard to change management skills.	Regulators and those entities that have authority to effect changes through regulation alignment will proceed with their current ways to effect any change in regulation including the long timelines (years) and review cycles. Governance in turn will not be with the holistic perspective of what Blockchain can potentially enable and hence treat changes without the required urgency. Trends in regulatory alignments are not kept in view to prepare for similar alignments locally,	With blockchain seen as no different from other technologies, the traditional methods of incentivising development is used, which do not actually work for Blockchain. No innovative methods to spur industry growth. Blockchain is not seen as a nationwide implemention agenda or infrastructure that requires creative incentive models which may expectedly result in later returns to investment or success stories. Change management as a key area to success is not focused for adequate funding.
	Summary	Stakeholders strike agreements and arrangements between themselves unfacilitated	Stakeholders in silos with heir own initiatives and programs, survival by best efforts	Talent development stakeholders not coordinated to focus on talent building in core areas	Unresponsive to align regulation hindering implementation, loose governance structure	Environment to synergise enablers unstructured coupled with ineffective change management

Table 6.4 : Status quo Scenario

		Collaboration	Amplify	Talent	Laws and Governance	Enablers
Decline	Proposed text for paragraph	Government frustrates all efforts for collaboration between all stakeholders. Additionally unreasonable conditions and disincentives are imposed leaving the stakeholders to protect their turf resulting in finger pointing when issues arise and a waste of efforts and funds	Government hinders the growth of the environment and removes incentives. Additionally industry also are geared towards delivering solutions of poor quality to save costs and to supposedly 'beat the competition'. New ideas are not forthcoming, innovation is non existent and it will be an uncoordinated growth environment.	Talent development factories (universities and skills certification entities) are not keeping their curriculum relevant and continue mismatching industry needs and their products. Reskilling programs are not provided. The research and industry environment are way off target. Local talents seek better oppurtunities elsewhere. Change management skills miss the targets and worsen project completion success.	Regulators and those entities that have some authority to effect changes through regulation alignment are in fact hostile to changes for various reasons. They are not aware of the fast changing models brought about by technology or refuse to take note of such technology developments and stick to their traditional pocessess that require a long time to effect any changes at all. A poor governance structure exists creating disharmony and confusion.	Stakeholders (government and industry) have the wrong perception and expectations on what Blockchain can bring about resulting in disharmony in the solution development process wasting time and resources. Additionally red tapes are imposed that basically stunts the enablers to work together and to synergise, frustrating all efforts. Change management misses the target completely and add to the disharmony in project implementation.
	Summary	Frustrates attempts for stakeholders to collaborate by setting unreasonable conditions and disincentives	Pose difficulties to growth environment and removing incentives	Discouraging local talent development by unjustifiably favouring foreign talent	Hostility to changes in regulations, thus killing opportunities	Attempts by stakeholders to synergise frustrated by red tape and wrong perception on solution objectives

Figure 6.5 : Decline Scenario


Vaccine Management System (VMS)
Supply Chain Management
Pharmacy Info System
Vaccine Management App
serial number details
serial number details
serial number details
Vaccine Management Server
Vaccination Certificate System (VCS)
Vaccine Blockchain
zero knowledge data identity
serial number details
Vaccination Certificate Server
identity
certificate
sign
identity serial number details
certification
Hardware Security Module
Malaysia Vaccine Administration System (MyVAS)
identity
certificate
identity serial number
Vaccination Certificate Verifier (VCV) Application
MySejahtera App
verify
certificate
QR code
verify
Inspect

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